

THE COMPETITIVE POSITION OF WOOD PRODUCTS  
IN THE RESIDENTIAL SIDING MARKET

by

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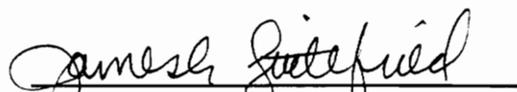
in

Forest Products

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Committee Chairman: Steven A. Sinclair  
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(ABSTRACT)

A nationwide mail survey of professional home builders, remodelers, and siding contractors was undertaken to develop a better understanding of professional end users and the patterns of competition in the residential siding market. Perceptual mapping and determinant attribute analysis are demonstrated to have strategic applications in the forest products industry.

Four-hundred and twelve respondents provided information related to activities involving siding, product use, and distribution. Product-markets were explored using siding preferences, which were measured for single-family homes in six home price categories. Perceptions of siding materials were used to evaluate the threat that non-wood materials pose to solid wood, hardboard, and plywood sidings. Respondents rated seven siding materials on eleven attributes. Perceptual maps were constructed using multiple discriminant analysis, and preferences were used to locate ideal points.

Negative perceptions of all wood products exist in terms of weather resistance and maintenance. Solid wood holds a niche in

appearance/status, and remains competitive against brick because of brick's application cost. While solid wood siding remains relatively free from substitution threats, vinyl's threat would increase if repositioned to enhance its appearance/status. Vinyl poses a considerable threat to hardboard and plywood. Hardboard's lack of competitive advantage and position relative to vinyl makes it particularly vulnerable to vinyl substitution.

Comparisons of users and non-users of each product are made, and general guidelines of using the perceptual map for positioning, promotion, and new product strategies are given.

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- \* Dr. Steve Sinclair, for allowing me the freedom of conceptualizing and developing my own project, and permitting me to pursue some creative avenues which, in forest products research, were basically uncharted.
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- \* Above all, I want to convey a torrent of thanks to my life partner and wife, Laurie, for her constant support and willingness to endure the long hours and low pay associated with this endeavor. This whole undertaking would not have been started, never mind completed, without her.

## PREFACE

This thesis details the findings of a study on the perceptions and attitudes of professional building contractors regarding competing residential siding materials. The purpose of this study is to provide those involved in developing marketing strategies for siding products with an understanding of the basic underlying competitive structure of the market; specifically, to identify those attributes which are most significant in affecting siding material decisions, and to understand contractors' perceptions of the strengths and weakness of competing materials. In addition, this study was designed to demonstrate the applicability of determinant attribute analysis and perceptual mapping--techniques borrowed from consumer and service marketing--to the forest products industry.

The forest products industry faces fierce competition from non-wood materials in the siding market, as well as within the industry as different wood products compete against each other. The focus of this study is on the competition between substitutes rather than within a product class, and therefore concentrates on differences between materials (i.e., hardboard, plywood, vinyl, aluminum, brick, and solid wood siding) rather than different forms of a given material (i.e., lap, panel, bevel, or drop siding).

Further, this study is qualitative in nature rather than quantitative. Market size and market share information are available

from other studies. This study is intended to complement the broad descriptive data from these other studies with qualitative consumer-behavior information; this study explores some of the underlying factors related to WHY the market share figures are what they are.

The first section of the thesis, "Literature Review," is a summary of relevant information uncovered as part of the literature review for this study. Current statistics related to market size and shares in the residential siding market are presented, as are discussions on the two marketing tools used in the study: determinant attribute analysis and perceptual mapping.

The results of the study are broken into the three fundamental areas of the study, each of which is presented in manuscript format. The first manuscript, "Residential Siding: An Assessment of the Product-Markets and a Profile of Professional End-Users," presents a profile of respondents and evaluates product competition within different markets. The basis of this evaluation is product preference, and changes in preferences across different home prices categories.

The second manuscript, "Assessing Buyer Needs in New Markets: Applying Determinant Attribute Analysis to Commodity-Like Products," identifies which product attributes professional's seek when purchasing siding, assesses the relative importance of these attributes, and examines builder type differences.

The third manuscript, "The Competitive Position of Wood as a Residential Siding Material: A Model of Consumer Perceptions," uses consumer perceptions of seven siding products to develop a perceptual map of the siding market. The perceptual map is used to evaluate the competitive positions of the various products. Differences in user groups is also explored.

Finally, the "Summary of Research Findings" chapter reviews the major findings of all three areas of study, while the final section, "Opportunities for Further Research," lists the author's recommendations for future market research in this area.

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## OBJECTIVES

The primary objective of this study was to assess the competitive position of wood products in the residential siding market.

Specific objectives include:

1. To analyze the market characteristics of residential siding in terms of who decides what type of siding to purchase, why customers buy one material as opposed to another, and where siding products are bought.
2. To measure the perceptions and attitudes of professional contractors regarding wood-based siding products compared to alternative materials, and how these influence buying decisions.
3. To examine the relative importance of various siding attributes from the buyer's perspective, and how wood compares against other materials based on these attributes.
4. To identify differences and similarities among types of builders across different geographic regions to facilitate market segmentation.

## LITERATURE REVIEW

### The Siding Market

#### Market Size and Composition

The size of the residential siding market and the market shares of the various products are somewhat elusive and dependant upon the definition of the market. Siding statistics vary depending on whether they include: 1) single or multi-family housing, 2) residential or commercial buildings, 3) new construction and/or 4) remodeling. Often, the statistics are confusing as to what "market" is being considered. Does the remodeling category in a particular statistic include residing? Do the statistics being considered include mobile home construction? For this reason, one needs to be cautious when comparing data from different sources. This section discusses the major published sources of siding market statistics, emphasizing the details of only the more recent information.

Williams (1982) presents a variety of pre-1980 statistics using U.S. Department of Commerce and Bureau of Census data. His tables include: "Dollar Volumes and Physical Quantities of Shipments of Selected Siding Materials"; "Maintenance and Repair and Major Replacement Expenditures for Siding by Residential Property Owners 1976-1980"; and "Types of Exterior Wall Materials Used in Contractor-Built and Owner-Built Houses by Location, 1976-1980."

Market size and market share statistics for 1981 and 1982 were reported by Perry (1983) using Housing Industry Dynamics information for 1981 and National Home Center News information for 1982. These data include information for both the new home and retrofit markets. Perry (1985) reports 1982 new-home siding statistics tracked by the National Association of Homebuilders, and contrasts them to 1978 data.

A 1984 Predicasts study estimated 1983 residential siding consumption to be 4.02 billion square feet of all products, with wood products accounting for almost 37% of the total (Anonymous 1984). The study also predicted 1988 and 1992 consumption for each siding product, with the most striking prediction being vinyl siding's growth from 14% of the market in 1983 to more than 30% in 1992. While they predict vinyl will grow at an annual rate of 7% from 1983 to 1993, hardboard is expected to remain stable, plywood to decline 1% annually, and lumber and shingles to decline 7% annually.

Market statistics for the total siding market do not mean much without breaking them down by segments, because market shares and market size differ substantially between new-home, remodeling, and residing segments. Quantum Enterprise, Inc. (Anonymous 1987a) estimated that 4.7315 billion square feet (surface basis) of siding products (all materials) were sold during 1986. New construction accounted for 66% of the total, which included single-family homes (48%), multi-family (12%), and mobile homes (6%). The remaining 34% was picked up by replacement (23%) and remodeling (11%).

The Crows Weekly Letter reported the results of a recent study

conducted by LSI Systems, Inc., which estimated market shares for siding products in both the new home and repair & remodeling segments (Anonymous 1987b). Wood products control about 50% of siding of the new home segment in the U.S., with brick controlling 17%, aluminum 9%, and vinyl 5%. Of wood products, 25% belonged to hardboard, 8% to bevel siding and boards, 14% to plywood, and 3% to cedar shingles & shakes. Vinyl siding, which accounted for 38% of the remodeling market, had eroded the shares of both aluminum and hardboard in the remodeling segment. Overall, hardboard accounted for 15% of the R & R market while other wood sidings accounted for 14 percent (Anonymous 1987b).

Perhaps the best indication of both the size of the siding market and the major trends in the competition among products is the product shipment figures compiled by the American Hardboard Association (Anonymous 1986a). Data was compiled using figures from the American Plywood Association, the Architectural Aluminum Manufacturers Association, the Western Wood Products Association, and the U.S. Dept. of Commerce Report on Shipment of Brick.

Figure 1 contrasts 1985 product shipments with those from 1977 to highlight the major trends as well as the relative production size of each material. Clearly evident is the growth of vinyl at the expense of aluminum, the reduction in brick and hardboard, the growth in plywood, and the stability of cedar/redwood siding. Those interested in pre-1977 shipments should see William's (1982) siding article.

The intense competition among substitute products in this market, and the resultant "jockeying for position" which takes place, is best

visualized by plotting market shares over time for competing materials. Figures 2 and 3 provide two different perspectives of this competition.

Figure 2 uses the same data set as Figure 1, but shows percent of total shipments for selected products over the past ten years. Total shipments, the basis of these percentages, include cedar/redwood and steel, though these products were intentionally excluded from the graph because of their relatively stable shipments (as indicated in Figure 1). By using "percent of the total" rather than actual shipments, fluctuations due to housing starts are eliminated. While a telephone call to AHA verified that "total shipments" for hardboard included only domestic shipments, they were unsure of the nature of the other products (whether or not they included export shipments). Regardless, Figure 2 clearly indicates substitution trends in this industry.

Figure 3 indicates changes in market shares specifically for the single-family home segment, using "percentage of gross area sided" data from LSI Systems, Inc. (Anonymous 1987c). The products included in Figure 3 are those which experienced the largest change. Especially noteworthy is the 44% increase in hardboard's share from 1981 to 1985, the 50% decrease in lumber's share, and the 133% increase in the "other" category, which includes vinyl.

A study by Quantum Enterprises, Inc. provides not only the most recent market statistics, but also the best breakdown of the siding market into the important segments: Single-Family, Multi-Family,

Mobile Homes, Replacement, and Remodeling (Anonymous 1987a). Quantum's results are summarized in Figures 4, 5, and 6, which portray not only the size of the siding market today, but the substantial differences among market segments. The Mobile Home segment is not shown in Figures 5 or 6. This segment accounts for only 6% of the total. Hardboard accounts for 51% of this segment, vinyl 25%, plywood only 3%, while the "other" category accounts for 20%.

#### Overall & Regional Preferences

The individual regions differ widely in their preferences for the various siding materials. Williams (1982) used Bureau of Census "Characteristics of New Housing" figures to describe these regional differences. The problem in using these figures, however, is that the Bureau of Census breaks siding products into only Brick, Wood or Wood Products, Stucco, Aluminum, and Other. As a result, the data only indicates that "wood or wood products" are dominating in all regions except the South, in which brick is king.

According to LSI Systems, Inc., wood products had their best sales in 1985 in the New England states (74%) and the West North Central region (78%). In New England, the most popular wood siding product was lumber siding (28%), while hardboard was preferred by 56 percent in the West North Central region. Brick was used most often in the West and East South Central regions, 47 percent and 46 percent, respectively. The Pacific region used stucco in 44 percent of the homes in 1985 (Anonymous 1987c).

Another indication of regional preferences is Professional Builder Magazine's annual nationwide survey of consumers and builders. In 1986, 809 households (all of whom planned to buy a home within six months) responded to the question "which exterior finish would you prefer for your new home?" In addition, 475 professional builders responded to the question "which of the following exterior finishes is standard in your best selling model?" (Anonymous 1986b).

The overall results are shown in Table 1. The siding material most preferred in each region by builders and consumers are presented in Table 2. The number of respondents in each category should be noted; breaking the data into the nine census regions diluted the percentage base for many of the regions, though one can still get a feel for the regional differences.

### Distribution

Most residential siding materials are sold through building material wholesalers. According to a report in Housing magazine, 58% of the 474 respondents to a survey conducted in 1977 said they usually purchase their siding from local wholesalers. Retailers were the source of supply for 23 percent, while 13% bought directly from the manufacturer. An unspecified "other" accounted for 7 percent. About 50% of the respondents were engaged in building construction, 25% in planning and design, and 25% in property management (Williams 1982).

A 1987 study by Quantum Enterprises, Inc. explored the differences in distribution between hardboard and vinyl siding (Anonymous 1987a).

Table 3 illustrates this difference. The study also reported that producers of vinyl, hardboard, and aluminum siding have been attempting to penetrate new markets by broadening the scope of their distribution. While vinyl manufacturers have been trying to establish a position in traditional hardboard markets such as new home construction and mobile homes (see Figure 5), hardboard manufacturers have been trying to penetrate the faster growing residing market through alternate distribution.

Though hardboard manufacturers have been working on new products aimed at the residing market, such as a 1/8" die-molded hardboard product laminated with expanded polystyrene backings, Quantum's report suggested that thus far vinyl has been more successful in penetrating the new home, mobile home, and retail lumber dealers than hardboard has been in penetrating the residing market (Anonymous 1987a).

### Attributes

Subscribers to Housing magazine were surveyed in 1977 to determine the roles various factors play in home purchase decisions (Williams 1982). Subscribers (474) responded to the question "How important to you is each of the following factors in your selection of siding by type or brand?" by checking a four-point scale (Very Important, Important, Somewhat Important, and Not Important). Durability, price, weathering properties, and ease of application were rated the most important out of 13 factors, while termite resistance, color, and fire resistance were rated the least important.

A 1982 study conducted by National Family Opinion, Inc. for Professional Builder Magazine's annual consumer/builder survey, asked 527 consumers throughout the nation to rate eight siding materials on the basis of price and maintenance. The two-point scales were "Expensive - Moderate" and "Little Maintenance - Frequent Maintenance" (Anonymous 1982). Tables 4 and 5 present the results of this study.

### Summary

Literature relevant to the siding market was reviewed in this section. Sources for siding market statistics were identified and some of the previous studies reviewed. The objective of this study is to complement these market statistics with in-depth, consumer level information related to preferences and perceptions.

### **Determinant Attributes**

The objectives of this study include statements such as "relative importance of attributes", and determining how these "influence buying decisions." While buyers of siding products consider many attributes, some probably weigh more heavily than others in influencing the purchase decision. This study attempts to identify those attributes which are most significant in affecting which siding material is purchased.

Multi-attribute attitude models (i.e. Fishbein 1967; Rosenberg 1956; Wilkie and Pessemier 1973) are commonly used to measure consumer's attitudes. These models imply that attributes differ in

their contribution to evaluation and choice (Lumpkin et al. 1985). Myers and Alpert (1968) suggest that those attributes which directly influence choice are "determinant." Their notion is that an attribute may be relatively important to a customer when choosing a siding product. On the other hand, if the customer rates all products as being equal with regard to that attribute, then the attribute is not a determinant factor in deciding which product to buy.

Alpert (1971) demonstrates how determinant attributes may be identified for a particular product and compares the three basic methods: (1) direct questioning; (2) indirect questioning, including motivation research and covariate analysis; and (3) observation and experimentation. Direct questioning techniques generally identified determinant attributes more efficiently than indirect methods, with the exception of the regression coefficients determinance technique.

A common form of direct questioning is "duel questioning." This calls for ratings of various product attributes in terms of: (1) how important each is thought to be in determining choice, and (2) how much difference is perceived among competing products in terms of each attribute. Attributes judged high in combined importance and differences are selected as determinant.

The duel-question technique of identifying determinant attributes was labeled "importance-performance analysis" by Martilla and James (1977). They present an example of how the results of this technique can be translated into useful action in a marketing program, and describe the technique as "a low-cost, easily understood technique

that can yield important insights into which aspects of the marketing mix a firm should devote more attention as well as identify areas that may be consuming too many resources."

In this frequently used method, difference is usually measured by directly asking respondents how they perceive the attributes as differing among the various products or brands, with a scaling of "Big Difference", "Small Difference", "No Difference", and "Don't Know" (Myers and Alpert, 1968). Lumpkin, Greenberg, and Goldstucker (1985) measured difference by asking respondents if the retail store they shop at possesses each attribute using a three-point scale from "not at all" to "very much so." The respondents were then asked to apply the same scale to retail stores in general. "Difference" was derived by comparing the two responses.

Both of these methods have some problems in the context of this siding study. The first method only produces information regarding difference, without actually rating each product. For example, we could find that a "big difference" exists among the various siding products with respect to ease of installation, however we wouldn't know how each product rates on this attribute. The second method (as used by Lumpkin et al., 1985) is designed for studies on brand choices or retail store choices. The respondents need to report what brand they presently buy, or store that they shop.

This technique would not be feasible for a study with products as variable as siding. Even if a respondent could state which material he/she usually uses (probably variable from job to job), he/she

certainly couldn't rate each attribute for "siding products in general," at least not meaningfully. Because this siding study is comparing different products that compete with wood siding, and it is important to ask ratings of all the products, rather than just the one the respondent usually uses and siding products "in general."

The problems exist because the notion of determinant attributes is usually used in the context of comparing brands within a product class, not in comparing substitute products as in this study. Myers and Alpert (1968) recognized the difference and mentioned that it might often be more important for manufacturers to pay more attention to determinant attributes among products in addition to among brands:

"The researcher should, therefore, also ask for ratings of different products which might compete with the original product class....there is even the possibility that all brands of an existing product might be rated reasonably high in, for example, "ease of preparation," but some substitute product might rate even higher in this feature and thus would attract consumers on the basis of this greater convenience."

This is the essence of this study.

### **Perceptual Mapping**

Perceptual Mapping is a valuable method of data reduction and is frequently used in consumer-related fields in new product design, advertising, and other applications in which marketing managers want to know (1) the basic cognitive dimensions consumers use to evaluate products and (2) the relative positions of present and potential products with respect to those dimensions. The map can be used to identify opportunities, enhance creativity, and direct marketing

strategies to the area of investigation most likely to appeal to consumers.

Multiple Discriminate Analysis (MDA) was used in this study to generate the perceptual maps. MDA has been widely used in consumer behavior research for this purpose (see Johnson 1971; Dillon et al. 1986; Pessemier 1975 and Churchill 1987). For the reader desiring more information, several authors discuss the technique in terms of product positioning strategies (Hauser et al. 1987; Ray 1982; Busch and Houston 1985), and as a tool to generate new-product ideas (Shocker and Srinivasan 1974; Gavish et al. 1981).

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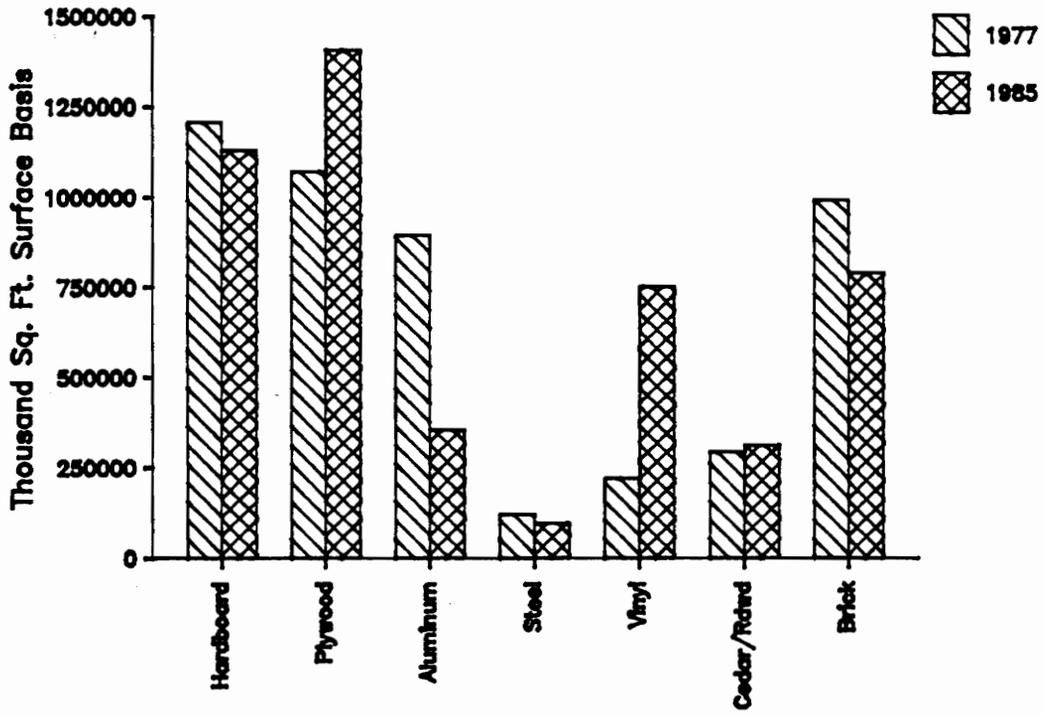


Figure 1. Exterior Wall Siding Product Shipments, 1977 and 1985.  
(Thousand Sq. Ft. Surface Basis)

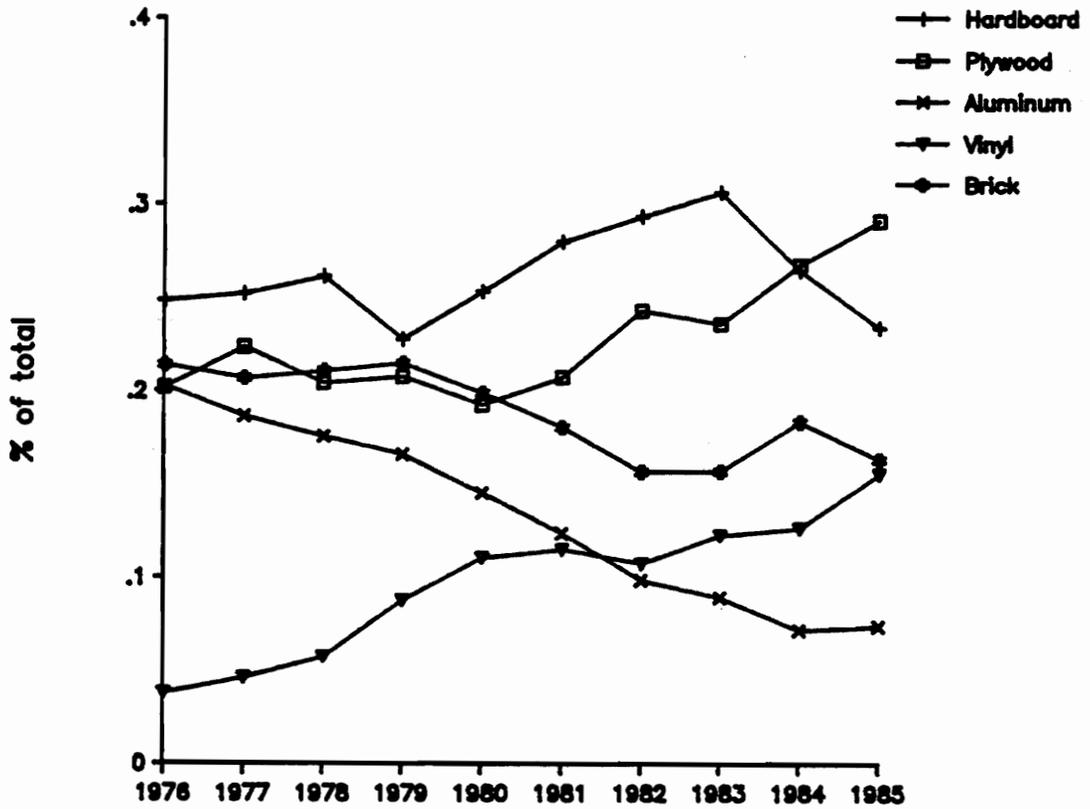


Figure 2. Percentage of Total<sup>1</sup> Shipments for Selected Siding Products, 1976 - 1985.<sup>2</sup>

<sup>1</sup>Total includes steel & cedar/redwood, which remained relatively constant.

<sup>2</sup>Source: Anonymous 1986a.

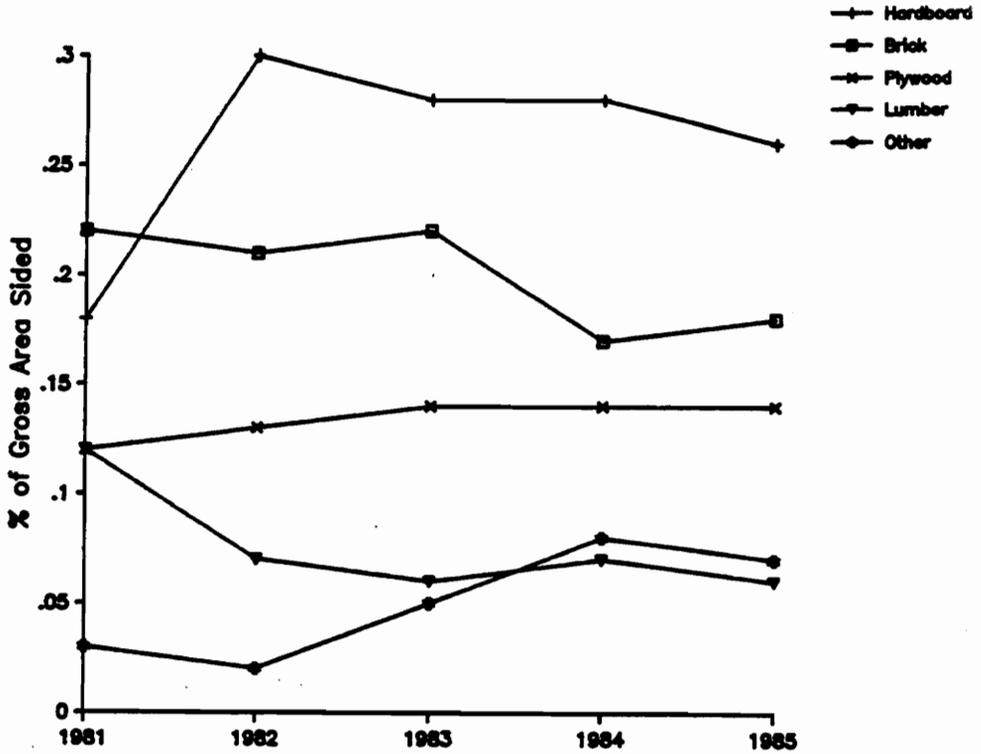


Figure 3. Single-Family Home Market Shares (% of gross area sided) of Selected Siding Products, 1981 to 1985  
(Source: Anonymous 1987c)

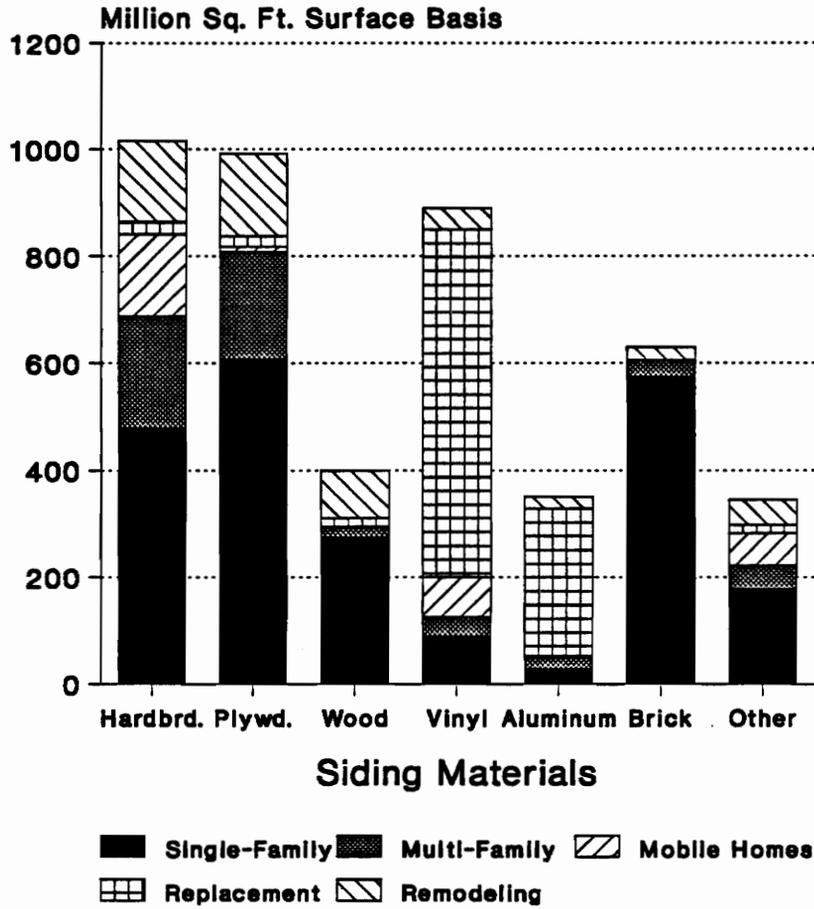
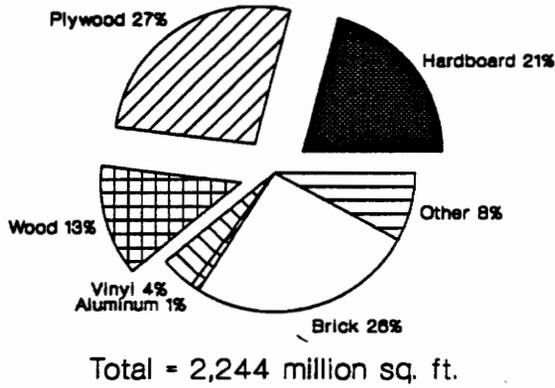


Figure 4. Composition of 1986 Residential Siding Consumption, by Market Segment and Siding Material (Million Square Feet, surface basis) (Source: Anonymous 1987a)

### Single-Family



### Multi-Family

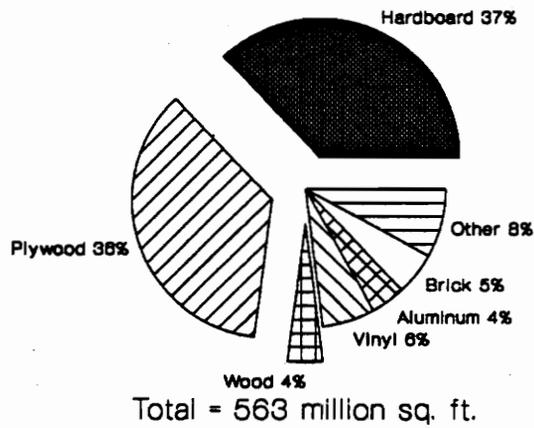
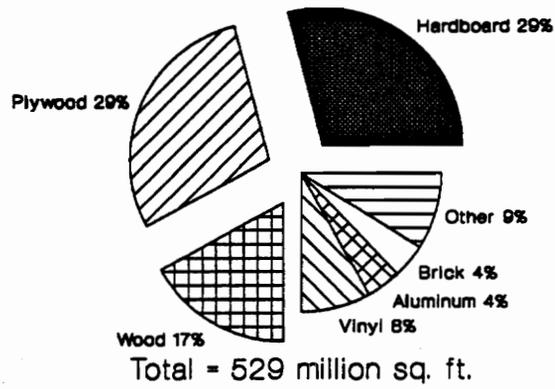


Figure 5. 1986 Siding Market Shares for Single- and Multi-family Segments (Source: Anonymous, 1987a).

### Remodeling



### Replacement

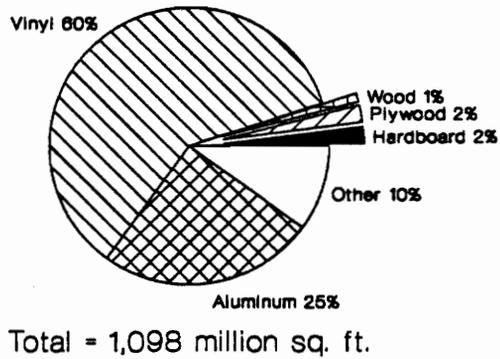


Figure 6. 1986 Siding Market Shares for Remodeling and Replacement Segments (Source: Anonymous 1987a.).

Table 1. 1986 Siding Preferences of Home Buyers and Builders.<sup>1</sup>

<u>Siding Product</u>	<u>Home Buyers</u> <sup>2</sup>	<u>Builders</u> <sup>2</sup>
Brick/Masonry	49.1	33.3
Wood Shakes/Shingles	4.1	4.0
Wood Siding	14.2	27.4
Stucco	9.5	19.2
Aluminum/Metal	9.4	8.6
Vinyl	10.7	11.4
Plywood	1.0	4.2
Hardboard	<u>1.9</u>	<u>9.7</u>
	100 %	117.8% <sup>3</sup>

<sup>1</sup>Source: Professional Builder Magazine (Anonymous 1986a).

<sup>2</sup>Percentage base for Consumers is 809 responses; Builders is 475 responses.

<sup>3</sup>Unlike home buyers, builders were allowed multiple answers, thus percents do not add to 100%

Table 2. Home Buyer and Builder Siding Preferences by Region.<sup>1</sup>

	HOME BUYERS			BUILDERS		
	# of Respondents	Material	%	# of Respondents	Material	%
NEW ENGLAND	(58)	Wood	31	(9)	Wood	78
		Vinyl	16		Shakes/Shingle	44
MID. ATLANTIC	(117)	Brick	40	(41)	Alumin/Metal	34
		Vinyl	27		Vinyl	32
E. NO. CENTRAL	(148)	Brick	60	(29)	Brick	48
W. NO. CENTRAL	(42)	Brick	43	(39)	Hardboard	46
SO. ATLANTIC	(158)	Brick	61	(62)	Stucco	32
		Brick	31			
E. SO. CENTRAL	(29)	Brick	72	(10)	Brick	60
W. SO. CENTRAL	(70)	Brick	80	(32)	Brick	78
MOUNTAIN	(57)	Brick	56	(22)	Wood	36
		Stucco	16		Stucco	27
PACIFIC	(130)	Stucco	34	(36)	Stucco	47
		Wood	29		Wood	41

<sup>1</sup>Source: Anonymous 1982

Table 3. Builders/Contractors Purchase Sources for Hardboard and Vinyl Siding, 1986.<sup>1</sup>

<u>Hardboard Siding</u>	<u>Source</u>	<u>Vinyl Siding</u>
5%	Specialty Siding Distributor	61%
22%	General Line Wholesaler	15%
51%	Lumber Yard	6%
9%	Home Center Chain	6%
13%	Manufacturer's Plant	11%
<u>0%</u>	Other	<u>1%</u>
100%		100%

<sup>1</sup>Source: Quantum Enterprises, Inc. (Anonymous 1987c).

Table 4: Consumer's Rating of Siding Products on Price. <sup>1</sup>

<u>Siding Product</u>	<u>% Rating</u> <u>Expensive</u>	<u>% Rating</u> <u>Moderate</u>	<u># of Responses</u> <u>(Out of 527 Total)</u>
Brick	84%	16%	489
Aluminum/Metal	41%	59%	466
Stucco	27%	73%	455
Wood	35%	65%	466
Shakes/Shingles	59%	41%	459
Vinyl	34%	66%	441
Plywood	10%	90%	445
Hardboard	21%	79%	443

<sup>1</sup>1982 Study by Professional Builder Magazine (Anonymous 1982).

Table 5: Consumer's Rating of Siding Products on Level of Maintenance. <sup>1</sup>

<u>Siding Product</u>	<u>% Rating</u> <u>Little Mtc.</u>	<u>% Rating</u> <u>Frequent Mtc.</u>	<u># of Responses</u> <u>(Out of 527 Total)</u>
Brick	99%	01%	490
Aluminum/Metal	91%	09%	458
Stucco	55%	45%	448
Wood	17%	83%	466
Shakes/Shingles	36%	64%	455
Vinyl	78%	22%	444
Plywood	12%	88%	442
Hardboard	18%	82%	443

<sup>1</sup>1982 Study by Professional Builder Magazine (Anonymous 1982).

**Residential Siding: An Assessment of Product-Markets and a  
Profile of Professional End Users.**

**A Manuscript Prepared for Submission to  
Forest Products Journal**

Residential Siding: An Assessment of Product-Markets  
and a Profile of Professional End Users

Abstract

A nationwide mail survey of professional home builders, remodelers, and siding contractors was undertaken to develop a better understanding of professional end users and the patterns of competition in the highly competitive siding market. Four-hundred and twelve respondents provided information related to activities involving siding, product use, distribution, and who specifies siding materials. Siding preferences were measured for single-family homes in six home price categories. Regional and builder type market segment differences were also evaluated.

Solid wood was used in the highest concentration by single-family home builders and in the Northeast and Western regions. Solid wood competes primarily with brick and stucco in the upper home price market, with preference positively related to home price. Multi-family builders used the heaviest concentration of hardboard, which along with plywood, received the heaviest concentration of use in the West. Both wood composite products compete with aluminum and vinyl in the lower home price markets, and preferences were inversely related to home price for these products.

## Introduction

Residential siding is an important end-use of wood products, in the form of hardboard, plywood, lumber, shingles, and newer products such as oriented strand board. Residential siding consumption in 1986 totalled 4.7 billion square-feet (surface basis). Wood products accounted for 51% of the total, with hardboard and plywood each accounting for 21% and solid wood accounting for almost 9% (Anonymous 1987a).

This is a dynamic market composed of many substitute products, with different forms of wood products competing with each other as well as with non-wood materials like aluminum, vinyl, brick, steel, and stucco. The siding market is characterized by diverse market segments, with dramatic market share shifts occurring between the single-family, multi-family, remodeling, and residing segments, as well as between geographic regions.

The emergence of vinyl as a widely accepted siding material has recently created a rapid shifting of market shares. "Jockeying for position" in the siding market share game has become intensive; some old standbys are losing ground while others are gaining ground, regional products are pushing into new areas, vinyl is increasing its already large remodeling market share, and manufacturers are working feverishly on new products (Green 1986). In recent years, strides have been made in product quality, color, and style options in most siding materials. Wood products manufacturers have introduced plywood

lap siding, hardboard in shorter lengths, and a die-molded hardboard product aimed at the residing market (Anonymous 1987a).

The changes taking place in the siding market and the increasing competition from non-wood materials is a typical example of changes affecting the entire wood products industry, as discussed by Bingham (1986). Bingham states that in times of major transition "the successful competitors will be those who are most aware, most innovative, and most responsive to change." Describing the customers of the forest products industry as "a changing mix of people with more specific desires and needs than those of the past," Bingham challenged forest products researchers to "learn more about the customers of this industry."

Studies on wood as a siding material have primarily concentrated on technical performance; little consumer level research has been done. Siding statistics related to market size and market shares have been collected by several private market research firms (Anonymous 1987a; Anonymous 1987b and 1987c). Product shipment statistics of competing siding products have been compiled by the American Hardboard Association (Anonymous 1986a). Pre-1977 siding statistics are reviewed by Williams (1982).

This paper is part of a larger study designed to provide manufacturers, wholesalers, and retailers with a better understanding of the professional customer of wood and wood-based siding products and the patterns of competition within this market. The purpose of this paper is twofold: (1) to profile the professional siding consumer

in terms of product use and distribution, and (2) to use consumer preferences to identify relevant product-markets for six home price categories. This second objective will provide answers to the following questions:

1. Which products compete within a given home price range?
2. At what home price ranges is a given product competitive, and how does this change as home price changes?

Day et al. (1979) defines a product-market as the set of products judged to be substitutes, within those usage situations in which similar patterns of benefits are sought, and the customers for who such usages are relevant. A lack of understanding of product-market boundaries can result in an inadequate and delayed understanding of emerging threats in the competitive environment.

Ultimately all product-market boundaries are arbitrary. Market and product class definitions appropriate for tactical marketing decisions tend to be narrow, reflecting the short-run concerns of sales and product managers. For example, hardboard manufacturers might tend to limit their view of competitors as other hardboard manufacturers. While appropriate for short-run tactical decisions, manufacturers' perceptions of product-market boundaries should be "stretched" far enough so that significant threats and opportunities are not missed (Day et al. 1979).

## Methodology

### Data Collection

A mail survey was used to collect primary data. This method is the most efficient and cost effective means of securing data from such a dispersed population. While the questionnaire was designed to provide a variety of data which might enhance knowledge of wood-based siding products, the focus of this paper is on product use, distribution, and professional consumer preferences.

The national sample frame of professional home builders, repair and remodeling contractors, and siding contractors was accessed through a standardized marketing firm (Anonymous 1987d) and the Blue Book of Major Homebuilders (Anonymous 1987e). The Blue Book was included to offset small firm bias associated with the yellow page based list provided by the marketing firm. Do-It-Yourself (DIY) consumers were not included in this study; unlike other wood product markets, DIY'ers are not as active in the siding market. A study by the Do-It-Yourself Research Institute estimated that less than 4% of DIY households had installed exterior siding themselves (Green and Farnsworth 1983).

A total of 3271 questionnaires were mailed, 2700 to the yellow page sample and 571 to the Blue Book sample. Both sample sizes were calculated to be sufficiently large to allow approximately a 95% confidence interval with an absolute error of 5% or less in overall survey results. The random sample was drawn systematically to ensure

that geographic regions appeared in the sample proportionately to their occurrence in the sample frame.

Prior to the final mailing, the questionnaire was pretested by mailing it to 114 randomly selected professional builders. Responses from the pretest were used to improve the final questionnaire, which was mailed in October, 1987. A follow-up letter was mailed one week later, followed two weeks later by a randomly selected phone follow up of 300 builders.

### Responses

A total of 412 usable questionnaires were returned. In addition, 441 were returned as undeliverable, a function of the high turnover in the industry, and 25 returned questionnaires were unusable. Because of the anonymity afforded survey respondents, non-response bias could not be assessed by contacting firms that did not return the questionnaire. However, the Chi-square test was used to test for non-response bias by comparing the immediate responses (first 70) to those who responded after the follow-ups (last 70). The assumption in this test is that late respondents tend to be most like non-respondents (Fowler 1984). No significant differences were found at the .05 level in terms of four demographic characteristics: Type of Builder, Revenue, Geographic Region, and Average Home Price. This implies no evidence of non-response bias.

## Respondents

### Demographics

A broad representation was obtained of professionals in terms of builder type, geographic region, and firm size. Most respondents were owners (44%), presidents (29%), or vice presidents (9%). Of the 412 respondents, 31.6% classified themselves as single-family home builders, followed by repair & remodeling contractors (26.5%), siding contractors (20.9%), and multi-family builders (19.7%). Respondents performing any multi-family construction during 1987 were classified as multi-family builders.

Based on U. S. Census regions (Figure 1), the South accounted for 39.2% of the respondents, followed by the North Central (29.0%), West (16.1%), and Northeast (15.8%) regions. Figure 2 depicts total responses by builder type and geographic region. The geographic composition of builder types closely resembled that existing in the sample frame.

Multi-family builders constitute the largest builders in terms of revenue, followed by single-family builders, siding contractors, and repair/remodelers. Eighty-four percent of the multi-family and forty-one percent of the single-family builders reported revenues exceeding \$1 million, while only fourteen and eight percent of siding contractors and remodeling contractors, respectively, reported revenues exceeding \$1 million.

### Construction Activities

The respondents were asked to indicate activities undertaken during the previous year which involved siding (Table 1). Builder type groups were not mutually exclusive in terms of building activities. The most diverse groups were the siding and repair/remodeling contractors; the difference was that 99% of siding contractors reside homes (72% of R&R) while only 37% of the siding contractors build additions (90% R&R).

Similarities between the single and multi-family groups were also evident. Seventy-seven percent of the multi-family builders indicated they were also involved with single-family construction. While 10 (7.9%) of the single-family builders indicated multi-family "activities," they were not included in the multi-family group because they reported "none" when asked how many town houses or multi-family houses were built in 1987. Finally, builders classified as multi-family were more likely to undertake non-residential construction, while those classified as single-family were most likely to undertake construction of additions.

Of the 116 single-family builders who reported number of single-family homes constructed during 1987, 75% built less than 25 homes, 17% built between 25 and 100 homes, and 8% constructed over 100 homes. Of the 56 multi-family respondents reporting single-family construction, half constructed less than 25 homes, while 27% built between 25 and 100 homes and 23% built over 100 homes during 1987.

### Siding Product Use

Respondents were asked to report which products their firm had used in the previous twelve months, and the percentage of the total that each product accounted for (total use = 100%). Product use is measured as a percent of the total rather than volume and therefore should not be mistaken for traditional market share calculations. While a large firm reporting "10% hardboard use" potentially could use more hardboard (volume) than a small firm reporting "100% hardboard use," percentage based results remain useful for identifying fundamental differences between different types of builders and geographic regions.

#### Siding Use by Builder Type

Table 2 reports mean product use percentages for the entire sample as well as for each of the four builder type categories. The biggest differences occur between the home builders (single and multi-family show similar patterns) and the siding contractors. Siding contractors were heavy users of vinyl and aluminum and low on all others, while the home builders were low on vinyl and aluminum and used a higher percentage of hardboard, plywood, and brick. Multi-family builders were the heaviest users of hardboard while single-family builders were the heaviest users of solid wood on a percentage basis. The repair/remodel group fell in between.

Vinyl siding appears to have made inroads into wood's traditional new construction market. Over a third of the respondents in both the

single and multi-family groups reported using some vinyl during the previous year. Vinyl accounted for an average 15% of the total siding use in both of these groups (Table 2). As vinyl use increases in the new home markets, its threat to market shares of wood products increases.

#### Regional Differences in Siding Use

To examine regional differences, mean product use percentages were calculated for all sixteen builder/region combinations. While the results of this breakdown should be interpreted with caution due to the low percentage base resulting from dividing our sample into 16 groups, major patterns are obvious.

Single and Multi-family home builders had the greatest regional differences in product use (Table 3). Westerners used a higher percentage of hardboard, plywood, and stucco than the other regions. Northeast and Western builders used the highest concentration of solid wood siding. Solid wood appears to be the least competitive in the South, where brick dominates. Vinyl percentages were especially high for Northeast home builders, while Western home builders used no vinyl siding.

Regional differences were also evaluated for the siding and repair/remodeling contractor groups. Regional differences for these groups was not as great as for the home builder groups. As in the home builder groups, vinyl was lowest in the West. The "other" category was used often by siding contractors in the North Central and

Western regions. Notes on the surveys indicate that this "other" category was usually steel siding, especially the "seamless" steel products.

#### Solid Wood Siding Use

Of the 412 respondents, 163 (40%) used some solid wood siding during the previous twelve months. Of these solid wood users, over three-quarters had used western redcedar, one-third had used pine/spruce, and one-third reported some use of redwood siding. The species composition of the average wood siding user was 66% redcedar, 16% pine/spruce, 15% redwood, and 3% other species. Only six percent of those using wood siding used the "other species" category. Other species used included Cypress (4 mentions), Fir (2 mentions), Atlantic white cedar (2 mentions), and Douglas-fir and Poplar (each with 1 mention).

To examine differences in species use by home prices, respondents were asked to report the average price of the homes they construct. Figure 3 indicates that the percentage of pine/spruce and redwood generally decrease as home price increases. A higher percentage of western redcedar was used by respondents building higher priced homes.

#### Distribution Channels

Respondents were asked to indicate, for each material, the source of the majority of their purchases. Wood products were primarily purchased at the retail level, while vinyl and aluminum were purchased through

wholesalers (Figure 4). The overall results were broken down into the four builder type categories (Table 4). A higher percentage of multi-family builders purchased wood products from wholesalers and direct from the manufacturer compared to single-family builders.

Not one siding contractor indicated purchasing the majority of their vinyl or aluminum at the retail level, yet over one-third of the single and multi-family home builders purchased their vinyl and aluminum at the retail level. This indicates that vinyl and aluminum have been relatively successful in penetrating wood's traditional distribution channels.

#### Siding Specifiers

Respondents were asked to indicate how often siding material decisions are made by the homeowner (buyer), architect, builder, or developer (Table 5). Only single and multi-family home builders were used in the analysis. Results were extremely variable with no clear patterns emerging. The high standard deviations relative to the means are an indication of the high variability. The range in each category was 0% to 100%. All four categories of decision-makers are important to marketers of siding products.

The least variable was the builder category. Builders make the siding decision about half the time. Over a quarter of the decisions are made by homeowners (buyers), while architects and developers each make the siding decision about ten percent of the time. As expected, developers play a more important role in decisions involving the

larger multi-family category while homeowners are more active in the single-family category. Architects played a minor role in both builder type categories.

### Siding Material Preferences

#### Preferences by Home Price

Respondents were asked which siding materials they would prefer if they were to construct a single-family home in each of six home price categories (from "Under \$70,000" to "Over \$400,000"). Multiple responses were permitted. Because the question referred to new construction, this analysis was limited to single and multi-family builders only.

Figure 5 displays the number of mentions for each product across the six home price categories. Two product groups are apparent. Preferences for hardboard, plywood, vinyl, and aluminum are inversely related to home price (Fig. 5a) while preferences for cedar, brick, stucco, and cedar shingles are positively related to home price (Fig. 5b). Preference for pine/spruce appears to be less sensitive to changes in home price. At the extreme upper end of the range, the products in Figure 5a would pose little threat of substitution to the products in Figure 5b, though products within each group should be considered direct substitutes, characterized by intense competition for market share. In the middle home price range, the product-market structure is less defined with wider preferences and intense

competition among all products.

#### Regional Differences in Preferences

Table 6 indicates regional preference differences. Northeast builders preferred vinyl over the hardboard and plywood for homes under \$100,000. For homes greater than \$100,000, builders in the Northeast prefer solid wood. Another stronghold for solid wood was the Western region. Unlike Northeast builders, Westerners preferred hardboard and plywood over vinyl for lower priced homes. This data indicates that vinyl has yet to reach the acceptance in the West that it has obtained in the rest of the country.

The North Central region was characterized by a strong preference for aluminum on lower priced homes and brick on higher priced homes, though solid wood made a strong showing in the middle of the price range. The South strongly preferred brick for all but the lowest priced homes. Solid wood preference was lower in the South than in any other region.

#### Summary

Residential siding is an important end use for both solid and wood composite products. These products compete in a market characterized by intense competition from non-wood materials and diverse market segments. The professional consumer can be categorized into four builder type segments: single-family builders, multi-family builders, siding contractors, and repair/remodeling contractors. These groups are not

mutually exclusive in terms of construction activities.

New home builders use the highest percentage of wood products. Solid wood siding receives the highest usage in the single-family segment, while hardboard siding is used the heaviest in the multi-family segment. Vinyl siding, traditionally used predominantly in the residing and remodeling markets, appears to have successfully penetrated the new home market, as over a third of the single and multi-family builders surveyed had used some vinyl during 1987. Siding contractors used almost exclusively vinyl and aluminum. Repair/remodeling contractors used predominantly vinyl, however they showed more diversity in product use than siding contractors.

Among single-family home builders, solid wood was used the heaviest in the Northeast and Western regions and was used the least in the South. Hardboard and plywood received their heaviest use in the Western region. Vinyl siding has yet to reach the level of acceptance in the West that it has in the other regions.

Solid wood competes primarily with brick and stucco in the upper home price market (over \$150,000), and preference for these three materials was positively related to home price. Hardboard and plywood compete with each other along with vinyl and aluminum in the lower home price market (under \$70,000), and preference for these materials was inversely related to home price. The product-market in the mid-price range is less defined, with all products competing against each other.

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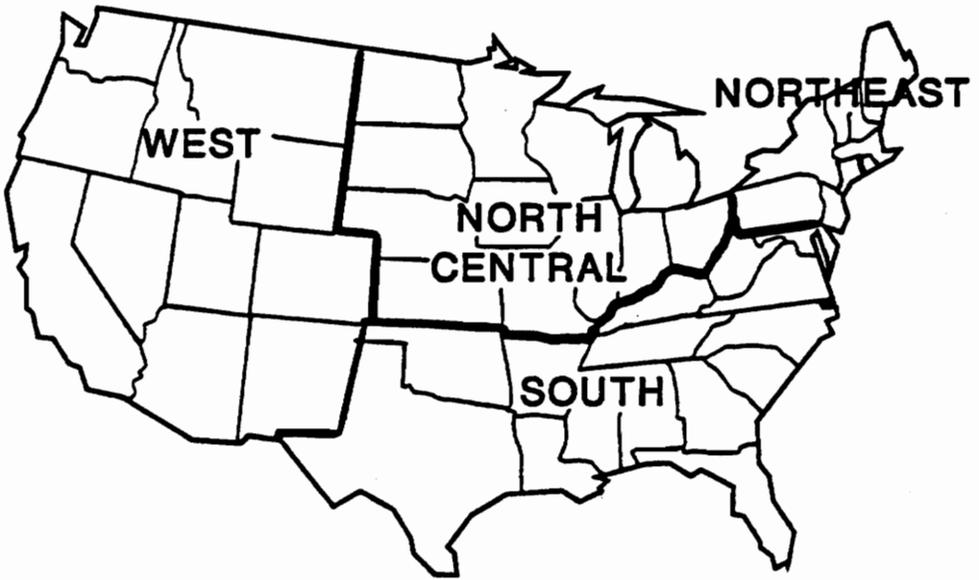
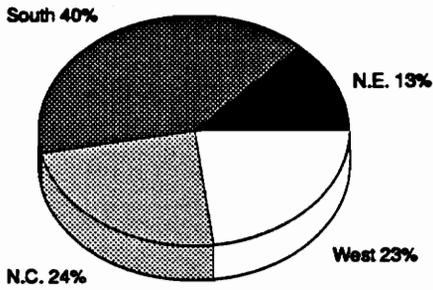
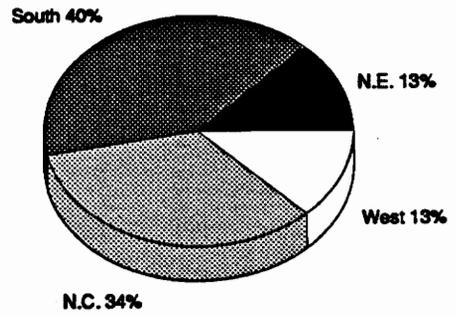


Figure 1. Map of Four U.S. Census Regions.

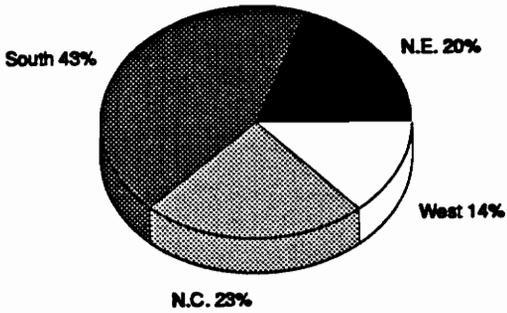
**Single-Family**  
130 Respondents



**Remodeling Contractors**  
109 Respondents



**Multi-Family**  
81 Respondents



**Siding Contractors**  
86 Respondents

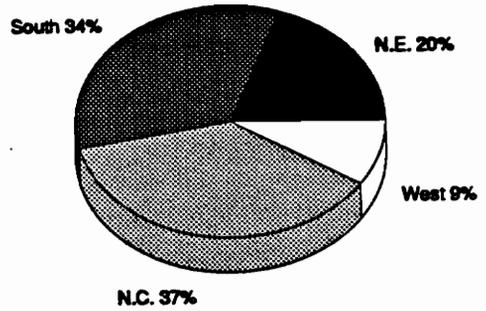


Figure 2. Survey Respondents by Builder Type and Region.

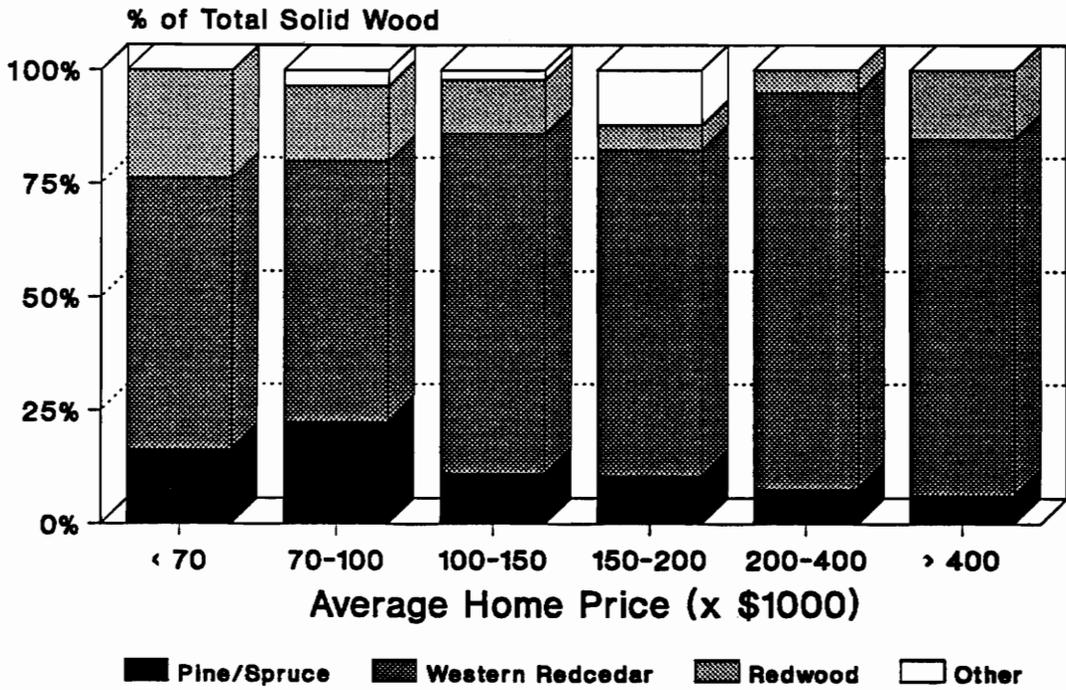


Figure 3. Solid Wood Species Composition as a Function of Respondent's Average New Home Price

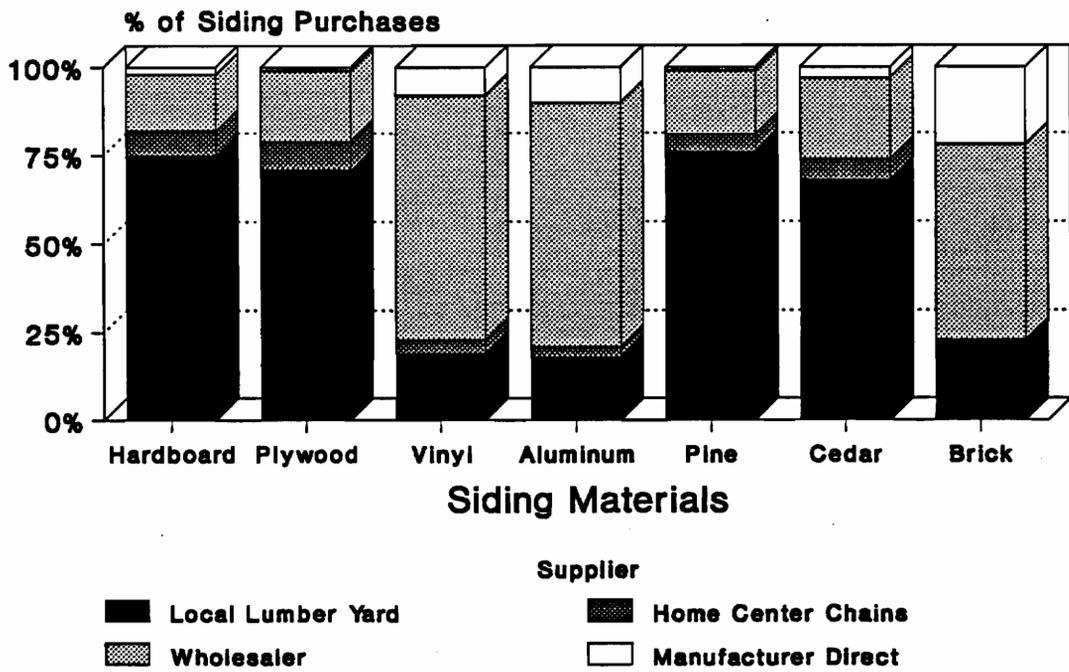
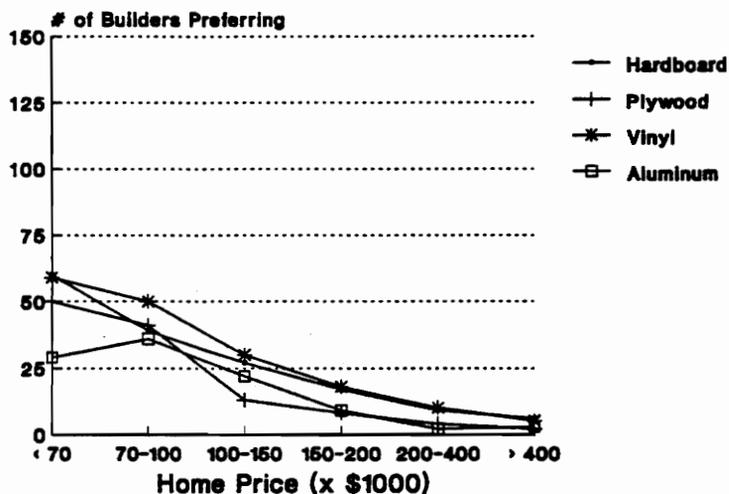


Figure 4. Where Respondents Purchased "The Majority" of Their Siding Products (i.e., 75% of hardboard purchasers reported buying the majority of their hardboard at local retail lumber yards).

## A



## B

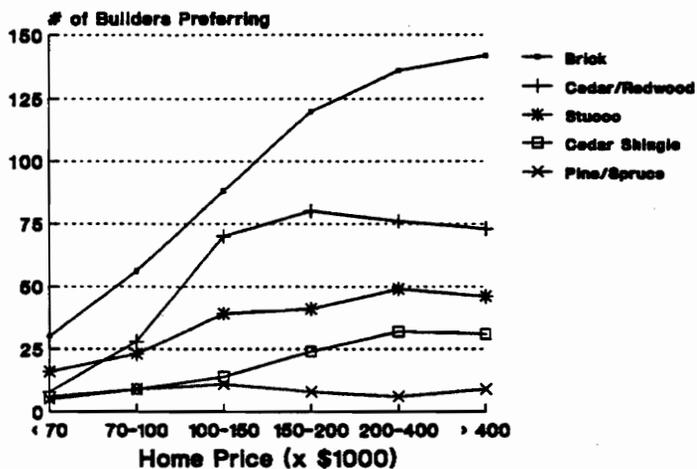


Figure 5. Number of Single and Multi-Family Builders Preferring Each Product For Six Home-Price Categories (respondents were permitted to check as many preferred products as they wished). Products inversely related to home price are included in 5A, while those positively related to home price are shown in 5B.

Table 1. Number of Respondents Performing Various Construction Activities, by Builder Type.

Category	Total # Responses	Single- Family		Multi- Family		Siding Contractor		R & R Contractor	
		(#)	(%)	(#)	(%)	(#)	(%)	(#)	(%)
Single-Family Construction	292	127	(100.0%)	61	( 77.0%)	47	( 54.7%)	57	( 52.8%)
Multi-Family Construction	123	10	( 7.9%) <sup>a/</sup>	79	(100.0%)	25	( 29.1%)	9	( 8.3%)
Non-Residential Construction	80	19	( 15.0%)	30	( 38.0%)	14	( 16.3%)	17	( 15.7%)
Re-Siding Existing Homes	186	16	( 12.6%)	7	( 8.9%)	85	( 98.8%)	78	( 72.2%)
Repair of Existing Homes	161	19	( 15.0%)	6	( 7.6%)	60	( 69.8%)	76	( 70.4%)
Construction of Additions	195	48	( 37.8%)	18	( 22.8%)	32	( 37.2%)	97	( 89.8%)
TOTAL RESPONSES	400	127	b/	79	b/	86	b/	108	b/

<sup>a/</sup> These 10 did not indicate multi-family in Question #13 and thus were not included in the multi-family category.

<sup>b/</sup> Respondents were asked to check all categories that applied. Therefore, percentages do not add to 100%.

Table 2. Average Siding Product Usage (as a percent of total siding use) by Builder Type for the "Last Twelve Months."

"Of the total volume of siding products your firm used in the past twelve months what percent would you estimate consisted of the following materials?"

Products	All Groups	Single-Family	Multi-Family	Siding Contractor	R & R Contractor
Hardboard	10	11	19	*	9
Plywood	8	12	9	*	8
Vinyl	34	15	15	73	41
Aluminum	11	7	10	17	13
Solid Wood	13	23	13	*	13
Cedar Shingles	3	3	3	1	3
Stucco	4	6	7	0	3
Brick	13	22	21	*	8
Other	<u>4</u>	<u>1</u>	<u>3</u>	<u>8</u>	<u>2</u>
TOTAL	100%	100%	100%	100%	100%

\*Indicates between 0 and 1%.

Table 3. Average Siding Product Usage (as a percent of total siding use) by Builder Type and Region.

"Of the total volume of siding products your firm used in the past 12 months, what percent would you estimate came from the following materials?"

	Single-Family				Multi-Family				Siding Contractor				R & R Contractor			
	NE	S	NC	W	NE	S	NC	W	NE	S	NC	W	NE	S	NC	W
Hardboard	4	12	9	16	3	23	20	32	*	*	0	0	1	13	5	14
Plywood	2	10	12	24	8	10	7	3	*	*	0	6	2	12	8	8
Vinyl	33	13	20	0	36	14	8	0	77	88	61	58	54	33	54	18
Aluminum	13	5	7	7	9	3	32	0	17	10	23	16	17	9	16	14
Solid																
Wood	30	19	23	27	27	8	6	23	*	0	0	0	15	13	12	16
Cedar																
Shingles	5	*	3	5	5	2	2	3	2	0	*	4	6	2	3	5
Stucco	2	5	5	12	*	9	1	27	*	0	0	0	2	3	*	8
Brick	9	36	19	7	12	29	21	3	1	*	*	0	1	15	1	10
Other	2	*	2	2	*	2	3	9	3	*	17	16	2	*	3	7
TOTAL	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Number of Respondents:																
	17	48	31	26	16	35	19	10	17	28	31	8	14	43	36	14

\* Indicates between 0 and 1%

Table 4. Siding Suppliers, by Product and Builder Type<sup>a/</sup>

Product	Builder-Type	Local Retail Lumber Yard	Large Home Center Chain	Wholesaler	Direct From Manufacturer	Total <sup>b/</sup> %
Hardboard	Single-Family	80	1	17	1	99
	Multi-Family	70	8	17	6	101
	Siding Contractor	68	4	24	4	100
	R & R Contractor	78	11	11	0	100
Plywood	Single-Family	76	3	21	0	100
	Multi-Family	59	7	29	5	100
	Siding Contractor	73	7	18	2	100
	R & R Contractor	73	14	14	0	101
Vinyl	Single-Family	34	6	57	3	100
	Multi-Family	34	8	43	14	100
	Siding Contractor	0	0	86	14	100
	R & R Contractor	18	3	75	4	100
Aluminum	Single-Family	34	4	57	6	101
	Multi-Family	32	9	50	9	100
	Siding Contractor	0	0	86	14	100
	R & R Contractor	18	4	69	10	101
Pine/Spruce	Single-Family	80	2	18	0	100
	Multi-Family	74	3	21	3	101
	Siding Contractor	68	0	32	0	100
	R & R Contractor	76	10	14	1	101
Cedar/Redwood	Single-Family	70	1	27	2	100
	Multi-Family	60	9	25	6	100
	Siding Contractor	63	0	37	0	100
	R & R Contractor	72	10	15	3	100
Brick	Single-Family	22	1	60	18	101
	Multi-Family	20	2	56	22	100
	Siding Contractor	27	0	50	23	100
	R & R Contractor	24	0	51	26	101

<sup>a/</sup>Question stated "For each material, check the source of the majority of your purchases." This table indicates the percentage of each builder type group which checked each source for each product.

<sup>b/</sup>Totals may not add to 100% due to rounding.

Table 5. Single- and Multi-Family Respondent's Estimates of How Often the Siding Material is Specified By Homeowner, Architect, Builder, or Developer.

Siding Specifier	--Single- and Multi-- Family Combined		Single- Family ONLY	Multi- Family ONLY
	Mean %	Standard Deviation	(Mean) (%)	(Mean) (%)
Homeowner	27.8	31.3	32	20
Architect	11.0	19.3	11	11
Builder	51.1	38.2	50	54
Developer	10.1	25.1	7	15
Total	100.0%		100%	100%

Table 6. Regional Siding Preferences for Single- and Multi-Family Builders.<sup>a/</sup>

Home Price	Region <sup>a/</sup>	---Preferences (% of those in the region mentioning)---			Number of Respondents
		1st	2nd	3rd	
< \$70 K	NE	Vinyl (55%)	Plywood (24%)	Hardboard (17%)	29
	S	Hardboard (36%)	Vinyl (35%)	Brick (28%)	81
	NC	Aluminum (31%)	Vinyl (29%)	Hardboard (27%)	48
	W	Plywood (45%)	Hardboard (34%)	Stucco (24%)	38
\$70-100 K	NE	Vinyl (57%)	Aluminum (23%)	Tie Between Many	30
	S	Brick (46%)	Vinyl (26%)	Hardboard (23%)	80
	NC	Aluminum (32%)	Brick (23%)	& Vinyl (23%)	47
	W	Plywood (44%)	Hardboard (31%)	Stucco (26%)	39
\$100-150 K	NE	Cedar/Redwd (41%)	Brick (28%)	& Vinyl (28%)	29
	S	Brick (68%)	Cedar/Redwd (23%)	Stucco (23%)	80
	NC	Cedar/Redwd (49%)	Brick (42%)	Aluminum (22%)	45
	W	Cedar/Redwd (47%)	Stucco (32%)	Hardboard (21%)	38
\$150-200 K	NE	Cedar/Redwd (50%)	Brick (37%)	Cedar Shing. (23%)	30
	S	Brick (78%)	Cedar/Redwd (27%)	Stucco (19%)	78
	NC	Brick (69%)	Cedar/Redwd (47%)	Tie--Several	45
	W	Cedar/Redwd (61%)	Brick (45%)	Stucco (40%)	38
\$200-400 K	NE	Cedar/Redwd (65%)	Brick (45%)	Cedar Shing. (32%)	31
	S	Brick (88%)	Cedar/Redwd (27%)	Stucco (23%)	77
	NC	Brick (84%)	Cedar/Redwd (37%)	Stucco (16%)	38
	W	Brick (58%)	Cedar/Redwd (55%)	Stucco (47%)	38
> \$400 K	NE	Cedar/Redwd (69%)	Brick (48%)	Cedar Shing. (31%)	29
	S	Brick (86%)	Cedar/Redwd (27%)	Stucco (26%)	77
	NC	Brick (95%)	Cedar/Redwd (30%)	Stucco (14%)	37
	W	Brick (71%)	Cedar/Redwd (55%)	Stucco (40%)	38

<sup>a/</sup> Respondents indicated which materials they preferred for a new single-family home in each price range. Percents will not add to 100% because multiple responses were permitted.

<sup>b/</sup> NE = Northeast; S = South; NC = North Central; W = West

**Assessing Industrial Buyer Needs in New Markets:  
Applying Determinant Attribute Analysis to Commodity-Like Products**

A Manuscript Prepared for Submission to  
Industrial Marketing Management  
or  
Similar Journal

Assessing Buyer Needs in New Markets:  
Applying Determinant Attribute Analysis to Commodity-Like Products

Abstract

Determinant attribute analysis, a technique which isolates critical product attributes, can be a useful managerial tool in old line industries hoping to penetrate new markets with commodity-like products. This paper uses residential siding materials as an example. A nationwide mail survey was used to collect primary data from professional end users of siding products. The dual question method was used to calculate determinance scores for 23 siding attributes and multiple discriminant analysis was used to highlight differences between four builder type market segments.

## Introduction

Many companies in the basic, old line manufacturing industries such as steel, forest products, and metal mining see their future in switching from basic commodities into higher margin, "value-added" specialty products and moving into newer, faster growing and less cyclical market segments (Anonymous 1982). In these basic industries, the key success requirements are usually technological skill, scale economics, and production know-how (Hall 1980, Hayes and Abernathy 1980). But in the new markets, success often depends on creating a package of products and services tailored to new customers.

Levitt (1975), in his classic *Marketing Myopia*, discussed the importance of viewing an industry as a customer satisfying process rather than a goods producing process, and related the failures of many basic industries to their being overly product oriented instead of customer oriented. The concept of learning and catering to customer preferences has more recently become popularized by Peters and Waterman (1982) and Peters and Austin (1985). Product positioning and promotional strategies usually need to be altered when entering new market segments, as the new customers may have different needs and wants. However, skills in analyzing customer desires, market segmentation, and product positioning are rarely present in old line manufacturing industries (Doyle and Saunders 1985).

Determinant attribute analysis is a technique which can aid managers in understanding which product attributes most determine

purchase behavior in different market segments. The technique has been used to identify factors determining consumer store choice (Lumpkin et al. 1985; Bearden 1977) and bank selection (Anderson et al. 1976; Sweitzer 1975). Wilson and Ghingold (1987) present a modification of the technique as a useful tool for linking research and development projects to the marketplace.

Moriarty and Reibstein (1986) used determinant scores as the basis of benefit segmentation to show that it is possible to develop benefit segments for an industrial market and that traditional segmentation methods (SIC codes and Company Size) do not serve as surrogate schemes for benefit segmentation. They also, however, conceded the usefulness of benefit segmentation to practitioners is limited because of problems with identifying and communicating with target customers.

This does not mean that determinant attribute analysis has no use in industrial applications using traditional, a priori segmentation schemes. This paper demonstrates the applicability of determinant attribute analysis to industrial commodity-like products, and the usefulness of using the technique with multiple discriminant analysis to evaluate differences in a priori market segments. The technique is applied to the forest products industry, using residential siding materials as an example.

## Background

### Current Situation

Residential siding is an important product for the forest products industry, in the form of hardboard, plywood, lumber, shingles, and in the newer products such as oriented strand board. The residential siding market is characterized by many substitute products and diverse housing segments. Dramatic market share shifts in siding products occur between the single-family construction, multi-family construction, repair & remodel, and residing segments. Wood products dominate new home construction with a 62% market share, compared to an 8% share for vinyl and aluminum. Conversely, vinyl and aluminum dominate the residing segment with an 84% share compared to a 5% share for all wood products (Quantum Enterprises 1987).

Siding demand, like other industrial goods, is a derived demand. Because siding is a component material for residential homes, demand is derived from demand for housing and remodeling. Siding comprises only a small component of the final product; homebuyers purchase a home, not pieces of cedar siding or hardboard.

Wood-based siding manufacturers, especially producers of plywood and hardboard panels, are characterized by large-scale producers of commodity products and have traditionally relied on a production oriented marketing approach combined with a widely accepted system of voluntary product standards, low degree of product differentiation, and an auction-like manner in which prices are set (Sinclair and

Seward 1988). Most siding materials for use in the residential market are sold through wholesalers of building materials. Contractors solicit bids from dealers on the materials to be used, and price bargaining takes place within these limits (Williams 1982).

The forest products industry is increasingly looking to the repair and remodeling segment for stability and diversification for many product lines (Weyerhaeuser Co. 1984; Georgia-Pacific Corp. 1985). This market segment is also very large and growing, with 1986 repair & remodeling expenditures by residential property owners totaling \$91.3 billion, up 13.6 percent over 1985 (Franta and Johnson 1988). This market is viewed as a haven from the interest rate sensitive new home markets (Anonymous 1984).

In addition to stability, siding manufacturers look to this segment for growth. Most of the growth in the siding market is expected to come from a specific branch of the repair & remodel market--the residing market (Quantum Enterprises 1987). Wood-based siding producers, particularly hardboard manufacturers, hope to penetrate the vinyl and aluminum dominated residing market with alternative distribution and new products designed to appeal to this segment, which is served predominantly by siding contractors (Quantum Enterprises 1987; Masonite Corp. 1980; Masonite Corp. 1979).

Manufacturers attempting to penetrate these new markets must understand the attributes that are most critical in siding material decisions by professionals in the remodeling industry. These are the characteristics around which a sound marketing strategy must be

developed. Determinant attribute analysis is a method which can isolate these critical product characteristics.

#### Determinant Attribute Concept

Multi-attribute attitude models (i.e. Fishbein 1967; Wilkie and Pessemier 1973) are commonly used to measure consumers' attitudes. Underlying these models is the assumption that consumers view products as a bundles of attributes, features, or benefits, and that the attributes differ in their contribution to product evaluation and choice. Myers and Alpert (1968) suggest that those attributes which directly influence choices are "determinant." Their notion is that an attribute may be important to a consumer, but if the consumer feels that alternative products are equal with regard to that attribute, then the attribute is not a determinant factor in purchase decisions. Determinant attributes are those that are important yet also discriminate well among competing products or materials.

#### Methodology

##### Data Collection

Primary data was obtained using a mail survey, the most efficient and cost effective means of securing data from such a dispersed population. Determining which attributes to include on the questionnaire is critical, for if evaluative factors important to the customer are overlooked, the usefulness of the results will be

severely limited. To minimize this limitation, exploratory research was conducted prior to questionnaire development. An open ended questionnaire was sent to 163 professional building contractors during the summer of 1987, the results of which were used to narrow down the list of attributes to the 23 included on the final questionnaire. To ensure the final questionnaire was effective and understandable, it was pretested by mailing it to 114 randomly selected building contractors. Pretest responses were used to improve the final questionnaire.

The sample frame for this study consisted of professional building contractors in every state, advertising in three yellow page categories: (1) Home Builders, (2) Repair and Remodeling Contractors, and (3) Siding Contractors. These categories represent the major market segments for siding products. Contractors were accessed through a standardized mailing list firm (American Business Lists 1987). Because yellow page based lists tend to be biased towards the smaller firms, home builders listed in The Blue Book of Major Homebuilders (Anonymous 1987) were included in the sample frame.

A systematic random sample was used to select 2700 firms from the yellow page list and 571 firms from The Blue Book. Sample sizes were calculated to be sufficiently large to allow a 95% confidence interval with an absolute error of 5% or less in overall survey results. Equal sample sizes were obtained from each of the three yellow page categories (900 each). The systematic procedure ensured that geographic regions appeared in the sample proportionately to their

occurrence in the sample frame. The 3271 questionnaires were mailed in the fall of 1987. A follow-up letter and randomly selected phone follow-ups were used.

### Responses

A total of 412 usable questionnaires were returned. In addition, 441 were returned as undeliverable, a function of the high turnover in the construction industry, and 25 returned questionnaires were unusable. A good cross section of respondents was obtained in terms of builder type and region (Figure 1).

Because late respondents tend to be most like non-respondents (Fowler 1984), non-response bias was studied by comparing the immediate responses (first 70) to those who responded after the follow-ups (last 70). The chi-square test of independence showed no significant differences (at the .05 level) in terms of four demographic characteristics: Type of Builder, Revenue, Geographic Region, and Average Home Price. This implies no evidence of non-response bias.

### Analysis Procedure

While there are several methods of measuring determinant attributes, the dual question method has been found to be efficient and reliable when compared to other methods (Alpert 1971) and therefore was used in this study. This technique calls for rating attributes in terms of: (1) how important each is thought to be in

determining product choice, and (2) how much difference is perceived among the competing products in terms of each attribute.

Each respondent indicated the importance of each attribute along a five place scale ranging from "of no importance" to "critical." Respondents were then asked to indicate, for each attribute, the extent to which competing siding materials differed. These materials included hardboard, plywood, vinyl, aluminum, solid wood, stucco, and brick. Difference was measured along a four place scale ranging from "very similar" to "very different."

Determinance was calculated by weighting the importance of an attribute by the perceived difference. If  $x$  represents the importance rating and  $y$  the difference rating of a particular attribute by an individual respondent, then  $xy$  represents the degree of determinance for the given attribute and respondent. Since importance is measured on a five point scale and difference on a four point scale, determinance scores ranged from 1 to 20. However, what are interesting are those attributes which are both important and discriminating, relative to the other attributes. "Relative to the other attributes" is important, because one respondent may use the scale somewhat different than another.

For example, consider determinance scores for dent resistance from two individuals, respondent A and B. Respondent A has a higher determinance score for dent resistance than respondent B (18 vs. 12). It is possible that dent resistance could be the highest score for respondent B, yet not so for respondent A. Because we are most

interested in an individual's determinance relative to the other attributes instead of the actual score, the scores were standardized (T-scores) by individual (Moriarty and Reibstein 1986). Determinance scores for each individual subsequently have a mean of 50 with a standard deviation of 10.

For example, if respondent A's determinance score for dent resistance is 50, then dent resistance was only average compared to his/her ratings of all 23 attributes. A score of 60 is very high (a full standard deviation above the respondent's average), and likewise a score of 40 is very low. The calculation of determinance scores for each respondent may be depicted algebraically as:

$$D_i = 10((P_i I_i - X) / s) + 50$$

Where:

- $D_i$  = Determinance score for attribute i.
- $P_i$  = Perceived difference between siding materials along attribute i.
- $I_i$  = Importance of attribute i.
- $X$  = Individual's grand determinance mean, or the mean of (P) (I) for all 23 attributes.
- $s$  = Standard deviation of X
- 10 & 50 = Used to convert from Z-score into T-score.

How high does a score have to be in order for an attribute to be considered determinant? The method suggested by Alpert (1971) and used by Lumpkin et al. (1985) is to use a one-tailed Z-test to identify those attributes which are significantly higher than the mean. In this method, the population mean and standard deviation are estimated with the grand mean from the sample. While this method might be biased in that extreme determinance scores would "tend to

pull the grand mean toward their sample means . . . the attributes might at least be chosen systematically . . . rather than through mere eyeballing" (Alpert 1971:188).

While determinant scores will provide a relative ranking of each attribute, it does not provide a test of differences across the four builder type segments. Multiple Discriminant Analysis (MDA) is used for this purpose. The appropriate technique when the dependent variable is categorical and the independent variables are metric (Hair et al. 1987), MDA has been widely used in consumer behavior research to identify differences among market segments (Perreault et al. 1979; Watson 1981; Lumpkin et al. 1985).

MDA finds the weighted combinations of attributes which discriminate among groups, maximizing an F-ratio of between product to within product variance. The varimax rotated loadings, which are analogous to factor loadings, indicate the relative importance of each attribute on each function, with the sign indicating directional relationships. The loadings measure the simple linear correlations between each siding attribute and each function. Group differences can be visualized by portraying the groups on the canonical axes formed by the significant functions. Attribute vectors can be plotted using the rotated loadings to further enhance interpretation of group differences.

## Results

### Attribute Determinance and Importance

Figure 2 profiles mean determinance scores for all respondents with respect to the 23 attributes. Seven attributes are significantly greater than the grand mean and, consequently, should be considered determinant attributes. A one-tailed Z-test was used with a significance level of .05, though at the .10 level results remain the same.

Beautiful appearance, high status image and weather resistance are grouped together as the most determinant attributes--those with the highest combined importance/difference ratings. The four remaining determinant attributes are of lesser determinance yet still significant: low/easy maintenance, dent resistance, competitive price, and structural strength. Those attributes ranking lowest in determinance were manufacturer service, variety attributes (i.e. wide color selection, texture/profile variety, and size variety), and natural material.

As previously discussed, determinance and importance do not always coincide. For comparison, Figure 3 displays mean importance for all respondents, with the attributes arranged in order of determinance. Two attributes--availability and retailer service--rank in the top five for importance yet in the bottom third of determinance. Three others occupied the top ten for importance yet failed to make the top ten for determinance: paint holding ability, dimensional stability,

and service from manufacturer. This comparison demonstrates a problem with simply evaluating "importance." While attributes rating high in importance should not be neglected by marketers, they are not necessarily critical in decisions related to material choice.

Several interesting results were the determinance of competitive price and fast/easy application. Competitive price was only average in importance, yet made it into the determinance category because it had a high rating in terms of difference among products. Fast/easy application ranked third in number of mentions in the exploratory survey used to design the questionnaire, yet ranked only 14th in determinance. It was only average in terms of both importance and difference.

#### Attribute Differences by Builder Type

Multiple Discriminant Analysis (MDA) was used to determine if any of the attributes differed across the four builder type categories. The MDA produced two significant functions which accounted for 91 percent of the explained variance. The varimax rotated loadings, the group means, the significance level of the univariate F-test, and the Newman-Keuls test of group differences are included in Table 1.

A benefit of MDA is that builder type differences can be visually portrayed in a simple diagram, as is done in Figure 4. In Figure 4, group centroids (mean discriminant scores) of each builder type segment have been plotted on the two discriminant functions. Interpretation of group differences is greatly enhanced by including

attribute vectors in Figure 4. These vectors are simply the plotted loadings of each attribute. Rather than plot all 23 attributes, only the most discriminating attributes--those with loadings exceeding .30--are plotted in Figure 4.

This plotting procedure causes the attribute vectors to point towards the builder type segments having the highest mean level on the respective attribute and away from the segments having the lowest mean score (Hair et al. 1987). The greater the distance between segments, the greater the difference in determinance between the segments. These differences can be explained by the attribute vectors.

Interpretation of Figure 4 indicates that the first discriminant function is the primary source of differences between new home builders (single and multi-family) and the groups involved with remodeling and residing (remodelers and siding contractors). The direction of the vectors indicate that this dimension corresponds most closely to competitive price, variety in available sizes, and manufacturer service. Thus competitive price is higher in determinance for the new home groups (especially the multi-family segment), while size variety and manufacturer service are more determinant for the others (especially siding contractors).

Visual inspection of the segment positions on function II indicate that this function is the primary source of differences between the siding contractors and single-family home builders, with the other two segments remaining neutral (close to the middle). The distinguishing characteristics of the siding contractors are a higher determinance

for warranty and ease of repair, while single-family home builders had higher determinance scores for paint holding ability and natural materials.

High status image was highly correlated with both functions and therefore warrants separate consideration. High status image was the primary source of difference between the single-family home builders and siding contractors. High status was high in determinance for the single-family group but low for the siding contractors. Multi-family builders were also positioned high on this attribute (imagine a perpendicular line from this segment to the high status vector), while remodelers remained neutral.

Another difference between siding contractors and single-family builders which is not indicated on Figure 4 was determinance for Beautiful Appearance (Table 1). Appearance was found to be higher in determinance for the single-family builder than siding contractors, though that isn't to say appearance is unimportant to siding contractors--their appearance score was still high relative to other attributes.

Among the attributes labelled "determinant," no significant differences existed between builder types for weather resistance/long life, low/easy maintenance, or structural strength/rigidity (Table 1).

#### Discussion

The analysis thus far has identified 23 attributes which professionals seek when purchasing siding materials, identified seven

of the attributes as being determinant (discriminating attributes high in importance), and further, highlighted the differences in the four builder type segments. Knowing which attributes are most determinant in the target segment, the next step for manufacturers would be to determine how purchasers perceive both their product and key competing products for each determinant attribute. In addition to the determinant attributes, manufacturers should concentrate their market research on those attributes ranking high in determinance for the target segment.

With this information, manufacturers can adjust promotional and product positioning strategies to their new target market. Returning to the example, hardboard manufacturers attempting to penetrate the residing market through siding contractors need to alter promotional messages. Rather than emphasizing price and appearance, attributes such as warranty, ease of repair, and service may need to be emphasized. Hardboard manufacturers need to determine how siding contractors perceive hardboard compared to vinyl and aluminum in terms of warranty, service, and ease of repair. Negative perceptions need to be addressed through promotion and/or new product features. Conversely, vinyl and aluminum manufacturers hoping to penetrate new home construction may need to emphasize home selling attributes (high status image and appearance), as well as price.

Depending on how purchasers perceive the products on the determinant attributes, many alternative promotional strategies exist (for examples see: Ray 1982). However, the basis of creative strategy

planning is knowledge of the target segment's attitude structure, which begins with isolating determinant attributes.

### Conclusions

Determinant attribute analysis, a technique adopted from consumer and service marketing, has been demonstrated to be applicable to an essentially industrial commodity-like product. The technique can be a useful tool to managers in old line, basic manufacturing industries hoping to penetrate new markets. In combination with multiple discriminant analysis, market segment differences can be evaluated and presented to managers in a simple diagram. The technique is a relatively simple method of identifying those product attributes which are both important yet discriminating, and therefore the ones to concentrate on in promotion and positioning strategies as well as future market research.

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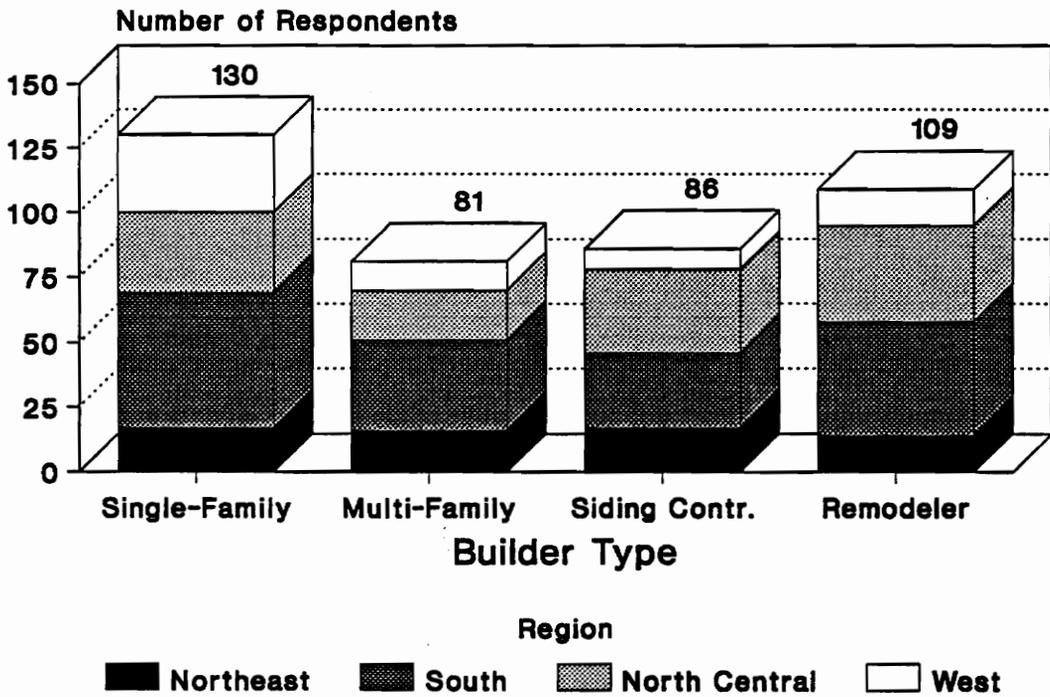


Figure 1. Number of Respondents by Builder Type Segment and Geographic Region (6 of the 412 respondents could not be classified by builder type, resulting in a total of 406 in figure 1).

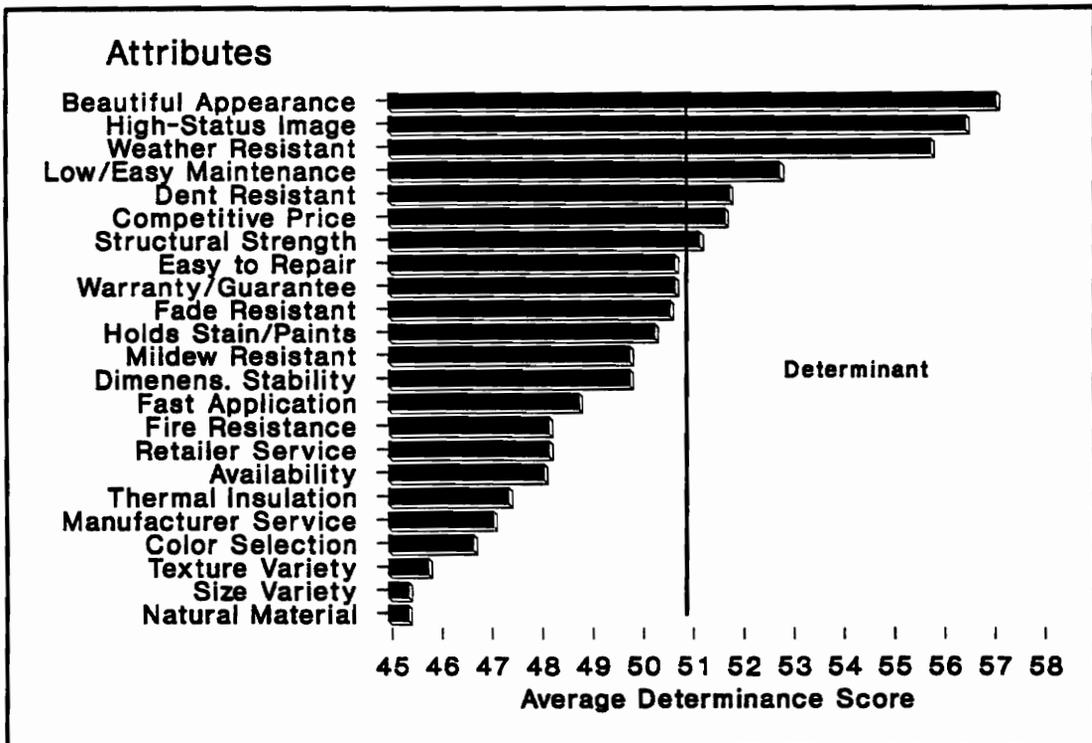


Figure 2. Mean Determinance Score Ratings for 23 Siding Attributes (those labelled "determinant" are significantly greater than the mean score of 50)

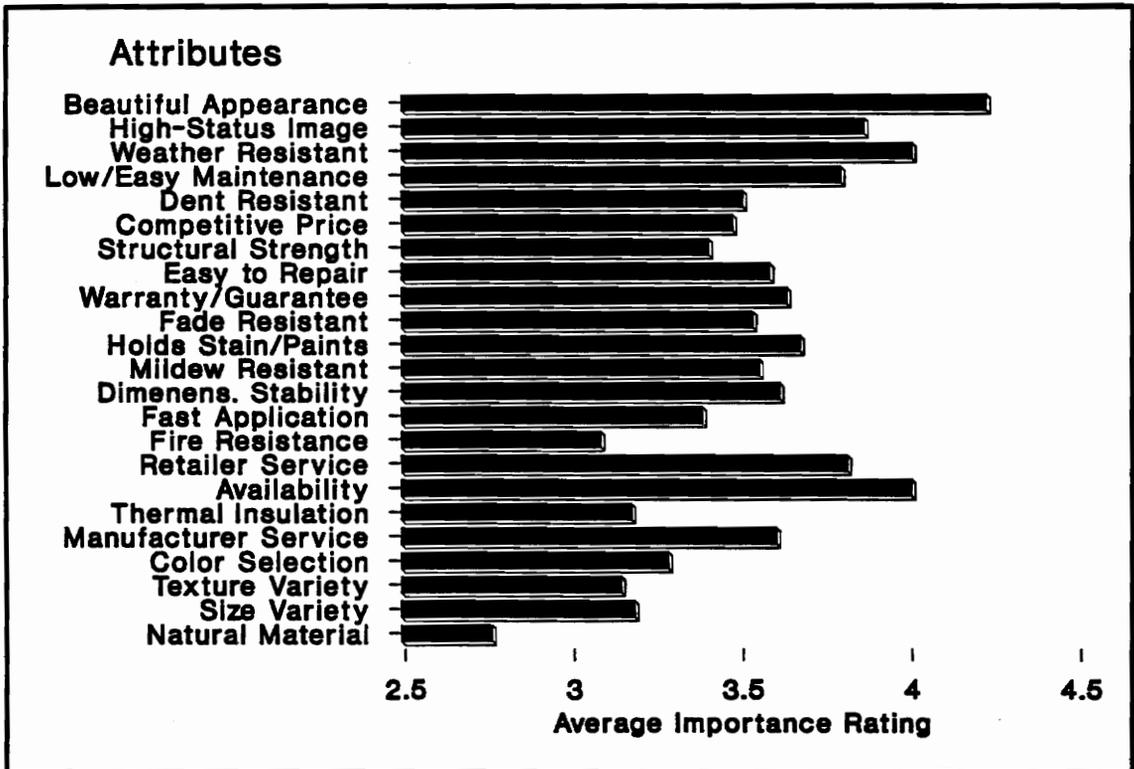


Figure 3. Mean Importance Ratings for 23 Siding Attributes (arranged in order of determinance to facilitate comparison with Figure 2)

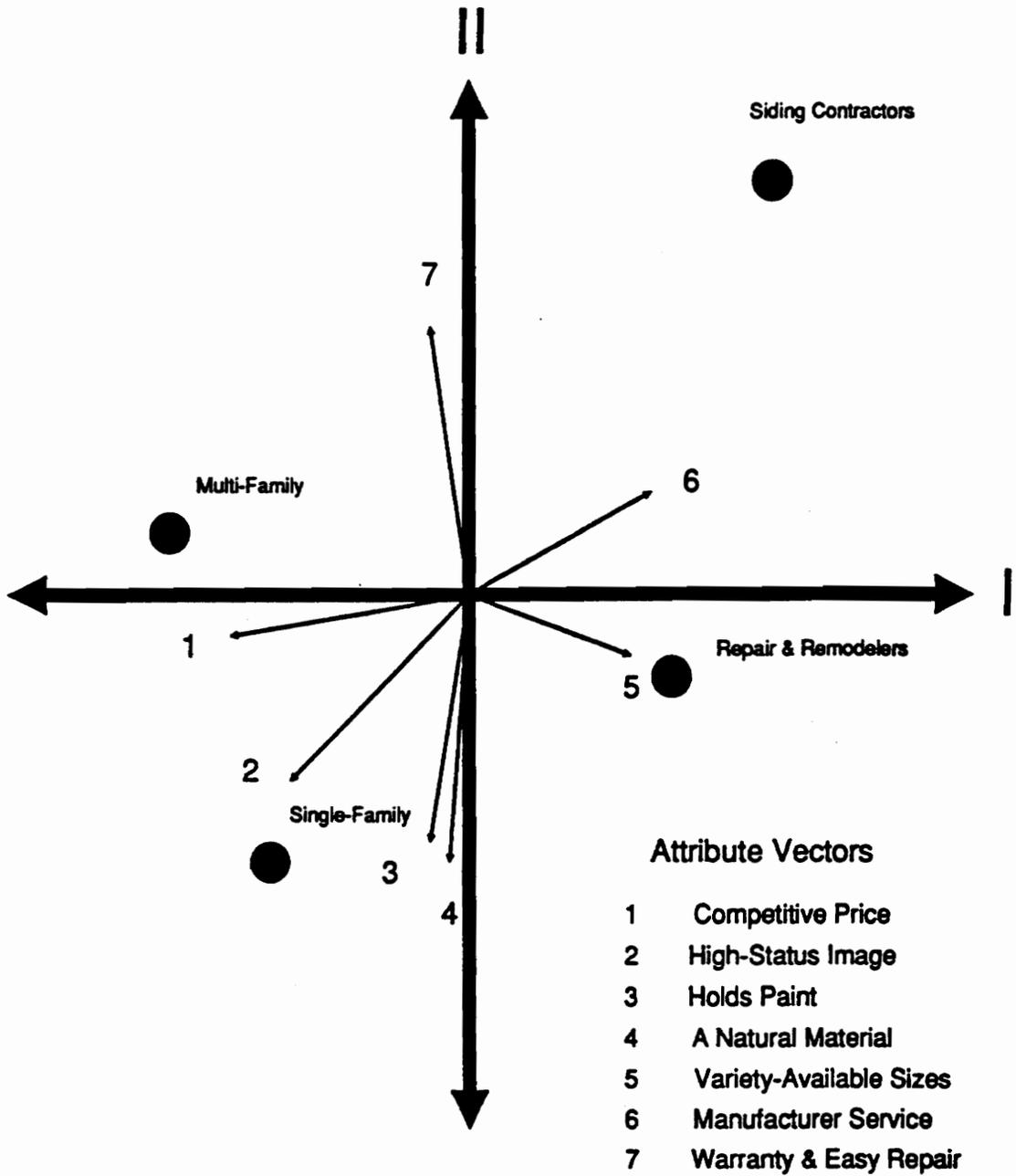


Figure 4. Portrayal of Four Builder Type Segments on Two Discriminate Functions (I and II).

Table 1. MDA Results of Differences in Determinance Scores Across Builder Type Segments

ATTRIBUTES	Mean Determinance Scores By Builder Type Segment						F-Test Prob.	Newman-Keuls: Differing Groups <sup>a/</sup>
	Rotated Canonical Loadings		Single- Family	Multi- Family	Siding Contr.	R & R Contr.		
	I	II	(1)	(2)	(3)	(4)		
<b>DETERMINANT</b>								
High Status/ Quality Image	-.39	-.40	60.3	58.3	51.5	55.4	.000	3 from 1,2,4
Competitive Price	-.51	.07	53.6	55.9	48.6	49.2	.000	1,2 from 3,4
Resistance to Impacts/Dents	.18	.06	50.8	50.7	54.3	52.4	.032	1,2 from 3
Beautiful Appearance	-.12	-.16	58.3	58.3	54.7	57.2	.042	1 from 3
Structural Strength/ Rigidity	.19	-.28	52.1	49.5	50.4	52.0	.159	NS
Low/Easy Maintenance	.00	.10	52.5	53.0	53.9	52.2	.603	NS
Weather Resistant/ Long Life	.13	-.01	55.5	55.7	56.3	55.9	.925	NS
<b>NON-DETERMINANT</b>								
Holds Stains/Paints	-.06	-.46	52.4	51.0	45.1	51.6	.000	3 from 1,2,4
A "Natural" Material	-.07	-.51	48.9	45.1	40.8	46.6	.000	3 from 1,2,4
Manufacturer Service	.34	.22	44.3	46.0	50.2	48.4	.000	3 from 1,2
Warranty/Guarantee	-.02	.49	48.4	51.2	54.0	50.0	.001	3 from 1,2,4
Wholesaler/ Retailer Service	.15	.26	46.4	47.1	51.4	48.2	.003	3 from 1,2,4
Easy to Repair	-.14	.48	48.8	52.3	52.2	50.2	.012	2,3 from 1,4
Variety in Available Sizes	.33	-.10	44.5	43.6	46.0	46.7	.042	2 from 4
Fade Resistance	.19	.14	49.4	49.8	52.3	51.2	.074	NS
Thermal Insulation	.23	-.14	46.7	45.5	47.8	48.7	.094	NS
Wide Color Selection	.10	.04	46.4	45.2	48.3	46.8	.097	NS
Variety in Textures/ Profiles	-.06	-.02	46.7	45.3	46.7	44.7	.162	NS
Fire Resistance	.06	.20	46.7	48.1	48.7	49.0	.290	NS
Fast/Easy Application	-.14	.03	48.7	50.6	48.0	48.4	.298	NS
Resists Mold/Mildew	-.10	.27	49.1	50.3	50.7	49.3	.481	NS
Dimensional/ Shape Stability	-.11	-.11	50.8	49.8	49.1	49.2	.489	NS
Availability	.06	-.01	48.5	47.6	48.5	47.9	.888	NS

<sup>a/</sup> Groups 1,2,3 and 4 represent single-, multi-family, siding contractors, and repair/remodelers, respectively. "NS" represents not significant at the .05 level.

**The Competitive Position of Wood as a Residential Siding Material:  
A Model of Professional Consumer Perceptions**

A Manuscript Prepared for Submission to  
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The Competitive Position of Wood as a Residential Siding Material:  
A Model of Professional Consumer Perceptions

Abstract

Perceptual mapping, a consumer based modeling technique adopted from consumer related fields, is demonstrated to have diagnostic and strategic applications in the forest products industry. The technique is used to evaluate the threat of substitute products -- an important competitive force acting upon all wood products -- and to guide product positioning and new product strategies. Consumer perceptions are used to evaluate the threat that non-wood materials pose to solid wood, hardboard, and plywood sidings. Four-hundred and twelve professionals (home builders, remodelers, and siding contractors) nationwide rated seven siding materials on eleven attributes. A perceptual map was constructed using multiple discriminant analysis, and preferences were used to locate ideal points.

Negative perceptions of all wood products exist in terms of weather resistance and maintenance. Solid wood holds a niche in appearance/status, and remains competitive against brick because of brick's application cost. While solid wood siding remains relatively free from substitution threats, vinyl's threat would increase if repositioned to enhance its appearance/status. Vinyl poses a considerable threat to hardboard and plywood. While plywood has a small perceived advantage in application cost, hardboard's lack of

competitive advantage and position relative to vinyl makes it particularly vulnerable to vinyl substitution.

Comparisons of users and non-users of each product are made, and general guidelines of using the perceptual map for positioning, promotion, and new product strategies are given.

### Introduction

Substitute products are a powerful competitive force acting upon the forest products industry. Engineered polymers compete with pulp products for packaging materials while steel, aluminum, masonry, and plastics compete with wood for building materials (Tillman 1985). The residential siding market is one in which wood particularly faces keen competition from other materials, as well as within the industry as the various wood products compete against themselves.

Wood products accounted for almost 51% of the 4.70 billion square feet (surface basis) of residential siding consumption in 1986 (Anonymous 1987a). Though the siding market as a whole is expected to grow at less than 2% a year or even decline (Anonymous 1984), advancements in plastics technology have recently created a rapid shifting of market shares. The Vinyl Siding Institute calls their industry's dramatic growth "one of the biggest success stories in the history of the building products industry" (Ampolsk 1985), and one study predicts vinyl will increase its market share from 13% in 1983 to more than 30% in the mid-1990's (Anonymous 1984).

While some within the industry believe that vinyl's success has come largely at the expense of aluminum rather than wood, advertisements for vinyl directly attack wood with copy reading "doesn't flake or blister and never needs painting." Forest products manufacturers cannot ignore the threat of substitute products. Porter (1980) includes substitute products as one of the five competitive forces that determine the ultimate profit potential of an industry. Even if not directly stealing market share, they can limit the profit potential of wood products by placing a ceiling on prices.

In order to evaluate the threat that a substitute poses to a given product, it is necessary to understand how consumers perceive a given product vis-a-vis its competitors. Too frequently, assessments of strengths and weaknesses of competing products are limited to tangible characteristics such as price and physical attributes, disregarding the intangibles such as consumer perceptions and attitudes (Dickson 1974). Consumer perceptions do not always correspond to what manufacturers believe about their own products, yet it is the perceptions which determine success in the marketplace. Perceptions result in beliefs about products (or materials), which combine as the basis for an attitude, which directs buying behavior (Busch and Houston 1985).

This paper uses consumer perceptions to evaluate the competitiveness of wood products in the residential siding market. A modeling technique is presented which has received wide use in consumer related fields but has seldom been used in the forest

products industry --perceptual mapping. While the siding market is the focus of this research, the methods presented can be used to evaluate any product or market. The technique has been used in new product design, promotional strategy decisions, and many other marketing applications where the marketing manager wants to know (1) the basic cognitive dimensions consumers use to evaluate the products and (2) the relative positions of present and potential products with respect to these dimensions (Hauser 1979).

#### Methodology

To date, little consumer research has been done related to siding products. Quantitative studies related to market size and shares are conducted by several private market research firms, yet we are aware of none which measure consumer perceptions of competing products. In order to use a consumer based approach to evaluate the competitiveness of wood, primary data had to be collected. To ensure the new construction, remodeling and residing markets were represented, professional consumers were the object of this study rather than Do-It-Yourself consumers.

#### The Questionnaire

Primary data was obtained using a mail survey, the most efficient and cost effective means of securing data from such a dispersed population. The questionnaire was designed to provide a variety of data which might enhance knowledge of the underlying structure of the

siding market.

The focus for this study was on identifying consumers perceptions of seven competing siding products on eleven attributes (Table 1). Respondents were asked to indicate the degree to which each product possessed each attribute. A four-point rating scale suggested by Stern et al. (1975) which asked if the product possesses the attribute to a high degree (4), considerable degree (3), limited degree (2), or not at all (1) was used. Respondents were instructed to assume the wood products had been properly finished.

Determining which attributes to include in the study is critical, for if evaluative factors important to the customer are overlooked, the usefulness of the model will be severely limited. To minimize this limitation, exploratory research was conducted prior to questionnaire development. An open-ended questionnaire was sent to 163 professional builders during the summer of 1987, the results of which were used to narrow down the list of attributes to those in Table 1.

Including too many products on the questionnaire would reduce response quality due to respondent fatigue. The products included were those with significant residential market shares. Solid wood was divided into two categories to reflect the difference in "naturally durable" species. In this paper, cedar and pine will refer to the cedar/redwood and pine/spruce categories, respectively, used in the questionnaire.

Finally, to ensure that the final questionnaire was effective and

understandable, it was pretested by sending it to 114 professional builders and siding marketing executives.

### Sample

The sample frame for this study consists of professional building contractors in every state, advertising in three yellow page categories: (1) Homebuilders, (2) Repair and Remodeling Contractors, and (3) Siding Contractors. These categories represent the major market segments for residential siding. The names were accessed through American Business Lists, Inc. (Anonymous 1987b). Because yellow page based lists tend to be biased towards the smaller firms, home builders listed in The Blue Book of Major Homebuilders (Anonymous 1987c) were also included in the sample frame.

A systematic random sample was used to select 2700 firms from the yellow page list and 571 firms from The Blue Book. Equal sample sizes were obtained from each of the three yellow page categories (900 each). The systematic procedure ensured that geographic regions appeared in the sample proportionately to their occurrence in the sample frame. The 3271 questionnaires were mailed in the fall of 1987. A follow-up letter and randomly selected phone follow-ups were used.

### Responses

A total of 412 usable questionnaires were returned. In addition, 441 were returned as undeliverable, a function of the high turnover in

the industry, and 25 returned questionnaires were unusable. Because late respondents tend to be most like non-respondents, non-response bias was studied by comparing the immediate responses (first 70) to those who responded after the follow-ups (last 70). The chi-square test of independence showed no significant differences (.05) in terms of four demographic characteristics: Type of Builder, Revenue, Geographic Region, and Average Home Price. This implies no evidence of non-response bias.

#### Analysis Techniques

Perceptual mapping results in a geometric representation of how competing products are perceived, and has been used in marketing for product positioning strategies (Hauser et al. 1987; Ray 1982; Busch and Houston 1985), and as a tool to generate new product ideas (Shocker and Srinivasan 1974; Gavish et al. 1981). Day et al. (1979) suggests perceptual mapping as a useful tool in predicting which products customers regard as potential and actual substitutes and why.

Multiple Discriminant Analysis (MDA) was used to generate the perceptual map. This technique has been widely used in consumer behavior research for this purpose (Johnson 1971; Dillon et al. 1986; Pessemier 1975; Churchill 1987) and to identify differences among various marketing segments (Perreault et al. 1979; Watson 1981; Lumpkin et al. 1985).

MDA is the appropriate statistical technique when the dependent variable is categorical and the independent variables are metric (Hair

et al. 1987). In this study, the eleven product ratings are the independent variables, or predictors, while the dependent variable is the seven siding products. MDA finds the weighted combination of attributes which discriminates most among products, maximizing an F-ratio of between product to within product variance. The second and subsequent weighted combinations are then found which discriminate among the products, with the constraint that they all be uncorrelated with each other.

For the perceptual map to be pragmatically useful to management, perceptions must be linked to behavior or intended behavior. This is often accomplished by superimposing onto the model "ideal points," which represent the position on the model that an "ideal" product would occupy, should such a product exist (Hooley 1979). Ideal points serve as a reference point, indicating how much of an attribute is desired, since "more" of an attribute is not necessarily better.

In this study, the product ratings for the respondent's preferred product were used as an indirect measure of the ideal point. When multiple preferences were indicated, the average rating for each attribute was used. The functions derived in the discriminant analysis were then used to fit the ideal points into the same space as the products, as suggested by Johnson (1971). An ideal point was calculated for each respondent for each of four home price ranges.

## Results

### Respondents Profile

A broad representation was obtained of professionals in terms of builder type, geographic region, firm size, and products used. Most respondents were owners (44%), presidents (29%), or vice presidents (9%). Respondents classified themselves as single-family homebuilders (31.6%), followed by repair & remodeling contractors (26.5%), siding contractors (20.9%), and multi-family builders (19.7%). Respondents that performed any multi-family construction during 1987 were classified as multi-family builders.

Using the four U. S. Census regions, more of the respondents were from the South (39.2%), followed by the North Central region (29.0%), the West (16.1%), and the North East (15.8%). Figure 1 depicts total responses by builder type and geographic region. The geographic composition of builder types closely resembled that existing in the sample frame.

Forty-one percent of the single-family builders and 84 percent of the multi-family builders reported revenues exceeding \$1 million, while only 14 and 8 percent of siding contractors and remodeling contractors, respectively, reported revenues exceeding \$1 million. The percentage of respondents using each product during the previous year, by builder type, is shown in Table 2.

## Perceptual Model

Approximately 400 builders rated all seven siding materials on eleven attributes. Multiple Discriminant Analysis (MDA) was used to determine which attributes best discriminate among the materials. The MDA produced five significant functions. Varimax rotation was used to enhance interpretation, as suggested by Perreault et al. (1979) and Hair et al. (1987). In the rotated solution, function I is the most important, and alone it accounts for 34% of the explained variance in product ratings. Function II accounts for 27%, while functions III and IV account for 15% and 13%, respectively. The first four functions therefore account for 89% of the explained variance, and thus will be the only ones considered in the analysis.

The discriminant analysis reduced eleven attributes to four "dimensions", each described by a function. The dimensions represent those attributes in which the products differ the greatest. The functions represent linear combinations, similar to regression, and a discriminant score can be calculated for each respondent on each function. Interpreting and labeling each function is accomplished by examining the attributes having the highest absolute "loadings" on the function, as is done in factor analysis (Watson 1981; Hair et al. 1987).

The rotated loadings are shown in Table 3. The loadings represent the correlations between each attribute and the discriminant score. For example, the correlation between "Low/Easy Maintenance" and

function I is .81. By examining the loading pattern, the functions can be described as:

<u>Function</u>	<u>Label</u>	<u>Attributes Loading on Function</u>
I	Maintenance/Weathering	Easy/Fast Maintenance & Weather Resistance
II	Appearance/Status	Appearance & High Status/Quality Image
III	Dent Resistance	Resistance to Impacts/Dents
IV	Application/Economy	Application Ease, Competitive Price

The group centroids (mean discriminant scores) for each material as well as mean ideal points for four home prices are reported in Table 4. Because discriminant scores are standardized, group centroids are interpreted to be the number of standard deviations for each product from the average of all products on each function (Hair et al. 1987).

The four-dimensional perceptual map was constructed by plotting group centroids and ideal points on the discriminating dimensions (Figure 2). The first two functions (Fig. 2a) account for most (61%) of the variance in product ratings. Functions III and IV (Fig. 2b) account for 28% of the variation. This relationship can be visualized by comparing the difference in product dispersion between Figures 2a and 2b.

The validity of an MDA solution is determined by its predictive capacity. The predictive capacity should be determined using a holdout sample, and Hair et al. (1987) suggests the classification accuracy of the holdout sample should be at least 25% greater than that achieved by chance. The classification accuracy (hit ratio) of this model was 59%, substantially exceeding the maximum chance

criterion of 15%. The discriminant model is therefore valid.

#### Discussion

Figure 2 can be used to evaluate the various products. Distance between two products may be loosely interpreted as measures of perceived substitutability of each product for any other. Though the eventual decision must necessarily be judgemental, the perceptual map facilitates that judgement (Day et al. 1979). Further, the closer a product is to an ideal point, the larger its market share should be.

#### Wood Composites

Hardboard, plywood, vinyl and aluminum occupy the negative half of the appearance/status dimension (Fig. 2a) and the positive half of the application/economy dimension (Fig. 2b). Builders feel these products are economical to apply but lack a status image, and thus are most competitive in the lower home-price ranges.

What is the competitive advantage of the wood composite products? Plywood and hardboard occupy the undesirable negative-negative position in Figure 2a. Vinyl and aluminum both occupy a position much closer to the ideal points, and their mean scores on both dimensions are higher. Vinyl's score in the appearance/status dimension was higher than hardboard and plywood in all four builder categories, and in every region except the West.

The competitive strengths of the wood composites appears to be application economy and dent resistance (Fig. 2b). Hardboard's only

perceived advantage is dent resistance. The location of ideal points indicate this advantage isn't important, at least not to the average respondent. Plywood shares hardboard's dent resistance advantage and is additionally perceived as being faster/easier to apply. This differentiation is minor, though consumers placing a higher value on application/economy than the other dimensions should prefer plywood.

The relative clustering of vinyl, hardboard, plywood, and the lower-range ideal points in Figure 2b indicates these products are undifferentiated in terms of both application/economy and dent resistance. In considering the total model, the closeness of vinyl, hardboard, and plywood indicates they are substitutes. Vinyl's position relative to the ideal points is more favorable than the wood composites (and aluminum), and thus should be considered a serious threat to wood composite's market share. While this is true of both hardboard and plywood, vinyl's position relative to hardboard, and hardboard's lack of competitive advantage, should be particularly alarming to hardboard producers.

#### Solid Wood

The solid wood sidings fell together into their own niche (Fig 2a). Their competitive strength (and only positive score) rests on the most intangible dimension of the four: beautiful appearance and a high-status image. Cedar sidings rated the highest of all seven products in this dimension. Consumers also perceived the cedar sidings to be easier to maintain and more weather resistant than pine,

though perhaps not to the degree expected.

Brick, an important competitor for solid wood sidings in the higher home price ranges, is the lone occupant of the most desirable quadrant (Fig. 2a). Brick is perceived as having a beautiful appearance/high-status image, yet is easy to maintain and weather resistant. Brick's disadvantage is its low position on the application/economy dimension (Fig. 2b).

Marcin (1987) predicted that wood use for exterior siding is expected to increase moderately because of the high labor cost of brickwork and home buyers affection for wood's natural appearance. His prediction is reinforced by our model. Solid wood sidings, particularly cedar, appear to hold a niche for those seeking a high-status, quality image over easy maintenance, and remain competitive against brick because of brick's weak rating on application/economy.

Pine is not as free from competitive forces as cedar. The ideal points for the mid-price homes are located between pine, and vinyl and aluminum. Which product is used is determined by which dimension the individual consumer places a higher value on.

While vinyl's position doesn't indicate much of a threat to solid wood today, the competitive situation is far from stable. As products are repositioned through product changes or promotional campaigns, the threat of substitution changes. Products repositioned towards the upper right quadrant of Figure 2a should enjoy increased competitive advantages and increased market shares. If vinyl manufacturers

successfully repositioned vinyl in the appearance/status dimension, vinyl's threat to solid wood, particularly pine, would increase.

#### User/Non-User Variations

Product positions change not only in time, but among market segments. While the model presented in this paper is based on all regions and types of builders, a separate model could be constructed for specific segments to facilitate market segmentation strategies. Though separate models are beyond the scope of this paper, variations in product positions between users and non-users of each product are explored to enhance interpretation and usefulness of our model.

For each product, respondents were classified as users or non-users (Table 2), and average discriminant scores were calculated for each group for each product. These user group scores, which can be considered a range around the product positions in the model, are displayed in Figure 3. For each product, the "users" are represented by the more favorable location.

The variation between user groups is small for plywood, brick, and solid wood sidings. Solid wood variation was so minute, only means are plotted in Fig. 3b. The position of these products is stable, and thus repositioning could be difficult (i.e. more expensive).

Hardboard and vinyl have unstable positions. Wide discrepancies exist in both the maintenance/weathering and appearance/status dimensions, though the difference was not enough to remove hardboard from the undesirable quadrant (Fig. 3a). While vinyl users and

non-users agreed in terms of vinyl's superior maintenance/weathering characteristics, there was extreme discrepancy in both the appearance/status and dent resistance dimensions. Users placed vinyl alongside the wood composites in Figure 3b and almost into the desirable quadrant in Figure 3a. Aluminum also showed a wide discrepancy in the appearance/status dimension, though its negative dent resistance image remained the same.

These discrepancies between users and non-users might indicate misconceptions exist about these products in these dimensions. Manufacturers attempting to expand their customer base might develop marketing strategies aimed at correcting these imbalances. If user positions represent potential positions, vinyl's potential should again cause concern for manufacturers of all wood sidings, though particularly wood composites.

#### Strategic Alternatives

To this point, the model has been used as a diagnostic tool rather than a strategic one. After diagnosing the competitive position of wood products, perceptual maps can be used to guide new product and promotional strategies. While discussion of all possible repositioning strategies for each product is not possible, general guidelines can be suggested. Manufacturers of wood-based siding products (or industry associations) have several strategies available in terms of promotional message strategy (Ray 1982).

One positioning strategy involves increasing the salience of a

dimension which the firm's product rates well on. This strategy attempts to reposition ideal points instead of products. For the wood composite products, this strategy would involve repositioning the ideal points for the application/economy dimension further away from the center. The message could emphasize the "time is money" theme.

Another strategy involves changing the perception of a product on an attribute to reposition the product itself. The objective is to provide a better "fit" between the ideal point and the product. While marketers should never attempt this strategy if the product does not possess an adequate quantity of the attribute in question, this strategy is ideal when misconceptions about the product may exist, as explored in Figure 3. If the product lacks the attribute, repositioning through new product development might be possible. Wood grained patterns on vinyl and alterations designed to increase application speed are past examples of this strategy.

A third strategy is altering the perceptions of competing products. This technique involves boosting the position of the firm's product while pointing out the fallibility of competitive claims. This technique must be used carefully, as the campaign can often boomerang by giving support to competitive products (Ray 1982).

A final strategy is adding characteristics to those considered in the model. Through marketing communications, a firm can make consumers aware of an attribute that has previously not been considered salient or may not even have existed. This type of strategy is most often attempted when a product is at the mature

stages of its life cycle, and is frequently combined with actual product modifications.

#### Summary/Conclusions

The forest products industry cannot ignore the powerful competitive force of substitute products. The threat of non-wood materials can be evaluated by analyzing consumer perceptions of wood products vis-a-vis competing materials. A graphical representation of consumer perceptions (perceptual map) was used to evaluate the competitiveness of wood products in the residential siding market.

All wood siding products were perceived negatively in the maintenance dimension, which consisted of "low/easy maintenance" and "weather resistant/long life." Solid wood and wood composites were differentiated by the appearance/status dimension, which includes "beautiful appearance" and "high status, quality image." Ideal point locations indicate that solid wood sidings compete with brick in the upper home prices while hardboard and plywood compete with vinyl and aluminum in the lower price market. The mid-price range is less defined, with all products competing with each other.

Considering all four perceptual dimensions, vinyl siding poses a considerable threat to hardboard and plywood sidings. Hardboard in particular appears to be threatened, as its only advantage (dent resistance) doesn't appear to be a determinant factor in consumer's ideal points. Solid wood occupies a special niche in the appearance/status dimension and is competitive with brick because of

brick's low score in the application/economy dimension. However, product positions change over time, and if vinyl siding was successfully repositioned higher on the appearance/status dimension the threat to the solid wood sidings, especially pine and spruce, would become greater.

The perceptions of most products varied little between users and non-users, with the exception of hardboard, vinyl, and aluminum. These three products had wide dispersion in the appearance/status dimension. Users also had more favorable perceptions of hardboard's maintenance and vinyl's dent resistance. Manufactures attempting to open up new markets might concentrate their promotion and new product strategies on these possible non-user misconceptions.

The product map is a valuable tool for diagnosing the underlying factors of the market and formulating positioning strategies as well. A constant decision faced by wood products firms and associations is how to efficiently allocate limited promotional resources. The results of this study provide managers with consumer based information to assist in promotional decisions, as well as decisions related to new product development.

The techniques used in this study can be used to evaluate the threat of substitute materials in other end use markets for wood. Additionally, the techniques can be applied within a product class to evaluate consumer perceptions of competing brands.

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Table 1. Siding Products and Product Attributes Included in the Study.

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<u>Siding Products</u>	<u>Product Attributes</u>
Hardboard	Competitive Price
Plywood	Low/Easy Maintenance
Vinyl	Fast/Easy Application
Aluminum	Resistance to Impacts/Dents
Brick	Beautiful Appearance
Pine/Spruce Solid Wood	Weather Resistant/Long Life
Cedar/Redwood Solid Wood	Wide Color Selection
Variety in Textures/Profiles	
Fade Resistance	
Dimensional/Shape Stability	
High Status/Quality Image	

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Table 2. Percent of respondents using each product in the twelve months preceding the survey. <sup>1</sup>

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-----Percent in "Users" Group-----

Products Used	Single Family	Multi-Family	Siding Contractors	R & Remodel Contractors	Total
Hardboard	32%	51%	4%	42%	32%
Plywood	36%	35%	7%	45%	33%
Vinyl	38%	38%	95%	75%	60%
Aluminum	24%	23%	64%	49%	39%
Brick	56%	59%	6%	39%	41%
All Solid Wood	<u>55%</u>	<u>44%</u>	<u>7%</u>	<u>51%</u>	<u>41%</u>
# Respondents:	122	80	84	107	393
# Blank Responses:	8	1	2	2	13
Total Responses <sup>2</sup>	130	81	86	109	406

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<sup>1</sup> To determine percent of non-users, subtract percentages given in the table from 100%.

<sup>2</sup> Six of the 412 total responses were non-residential contractors.

Table 3. Correlations (loadings) between siding attributes and discriminant dimensions (functions).

Attributes	Rotated Loadings			
	Func. I	Func. II	Func. III	Func. IV
Low Easy Maintenance	.81	.07	.07	.10
Weather Resistant/Long Life	.67	.43	.08	.18
Beautiful Appearance	.02	.83	.04	.02
High Status/Quality Image	.27	.76	.10	-.04
Resistance to Impacts/Dents	.09	.12	.95	.12
Fast/Easy Application	.10	.06	.06	.93
Competitive Price	.19	-.10	.16	.22
Fade Resistance	.27	.08	.24	-.08
Wide Color Selection	.07	.06	-.01	.05
Variety in Textures/Profile	.07	.17	.09	-.02
Dimensional Stability	.08	.14	.04	.10

Table 4. Average Discriminant Scores (Group Centroids) for Siding Products and Ideal Points.

	<u>Discriminant Functions</u>			
	(I) Maintenance/ Weathering	(II) Appearance/ Status Image	(III) Dent Resistance	(IV) Application/ Economy
<u>Siding Products</u>				
Hardboard	-1.1	-1.1	0.3	0.3
Plywood	-1.2	-1.0	0.3	0.8
Vinyl	1.1	-0.5	0.0	0.4
Aluminum	0.9	-0.5	-1.6	0.3
Brick	1.4	1.2	1.0	-1.3
Solid Pine/Spruce	-0.9	0.7	0.0	-0.3
Solid Cedar/Redwood	-0.4	1.4	-0.3	-0.1
-----Ideal Points-----				
<u>Home Price Ranges</u>				
1. Under \$70,000	0.5	-0.3	0.2	0.5
2. \$70,000-100,000	0.7	0.2	0.0	0.2
3. \$100,000-150,000	0.7	0.8	0.3	-0.2
4. Over \$500,000	0.9	1.2	0.6	-0.7

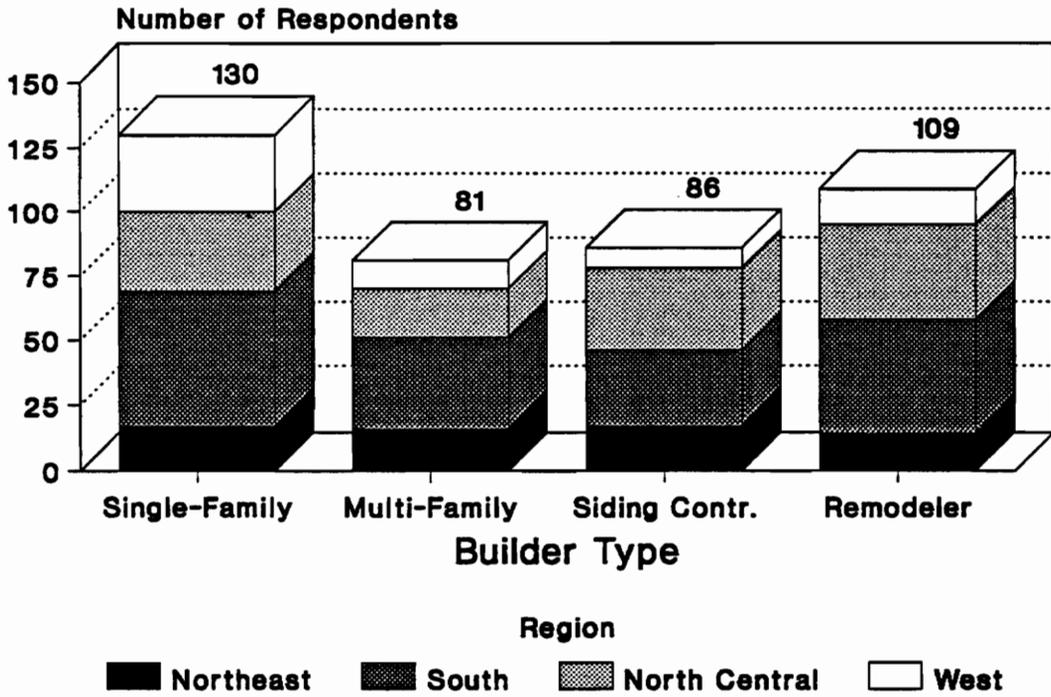


Figure 1. Number of Respondents by Builder Type and Four U.S. Census Regions.

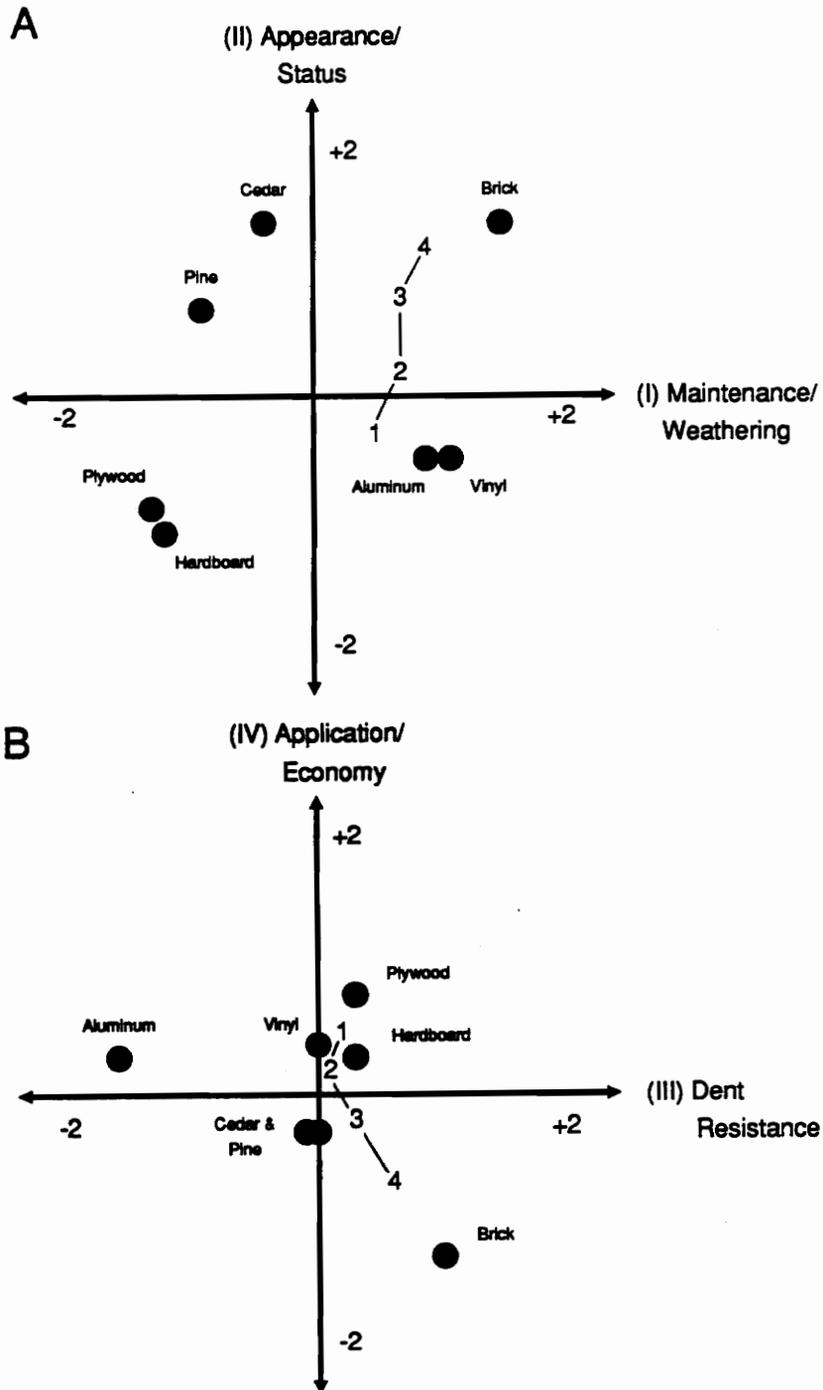


Figure 2. Consumer Perceptions of Siding Products and Ideal Points Portrayed on Four Discriminating Dimensions. Ideal Points are Indicated by the Connected Numbers 1-4 and Relate to Preferences for New Homes Priced (1) < \$70,000; (2) \$70,000-100,000; (3) \$100,000-150,000 and (4) \$150,000-\$200,000.

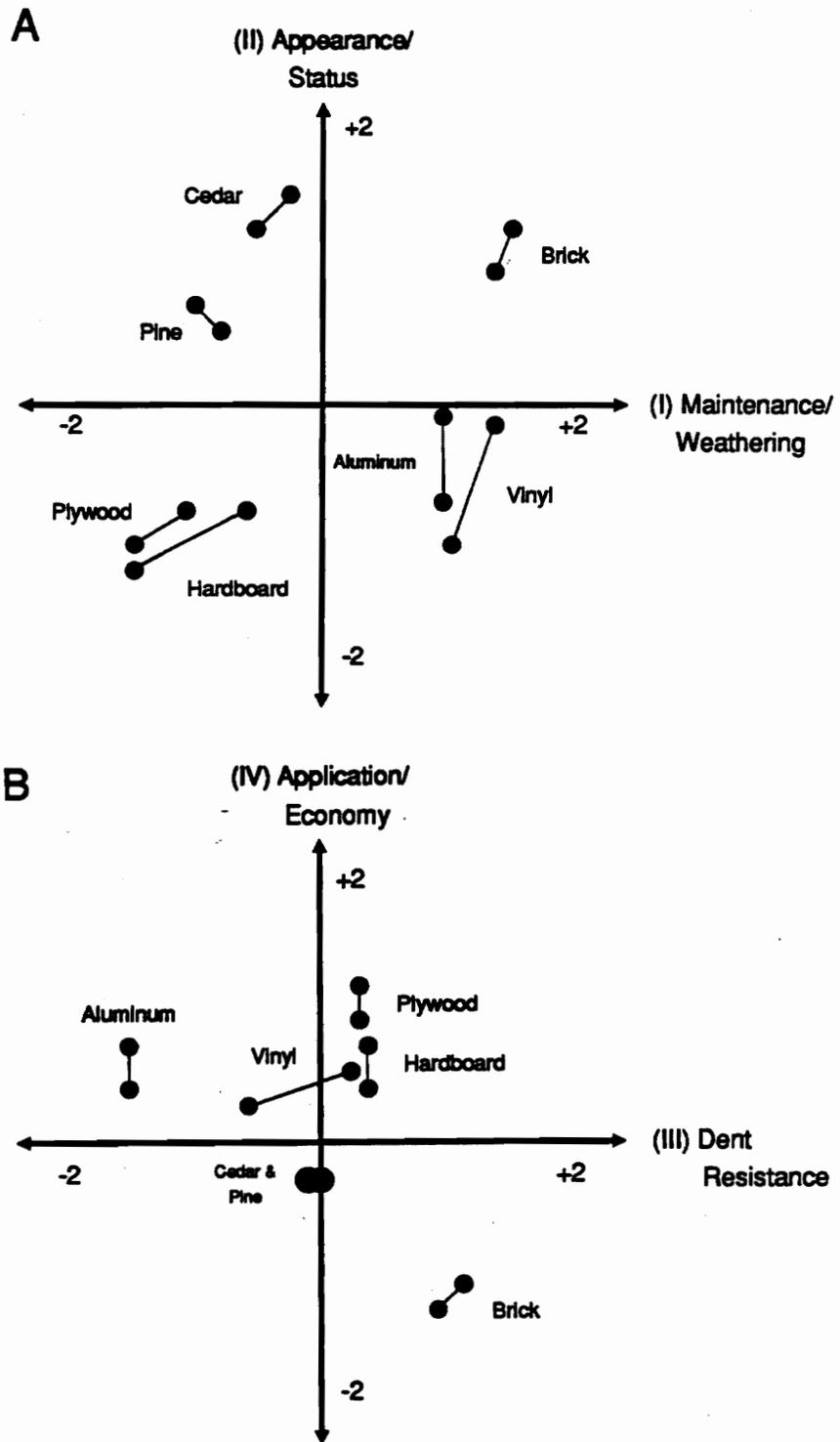


Figure 3. Variations in Product Positions Between Users and Non-Users of Each Product, With Users Represented by the More Favorable Position (only means plotted for pine and cedar in "B" because of small variation).

## SUMMARY OF RESEARCH RESULTS

Professional building contractors throughout the U.S. were surveyed to gain an understanding of the basic competitive structure of the residential siding market. To ensure representation from the various siding markets, contractors surveyed included single and multi-family home builders, siding contractors, and repair and remodeling contractors.

Builders' perceptions were used to evaluate the threat that non-wood products pose to solid wood, hardboard, and plywood sidings. Perceptual mapping, a consumer-based modeling technique borrowed from consumer-related fields, was used to communicate and display product positions. Determinant attribute analysis was used to evaluate the relative importance of various siding attributes to the different types of consumers. Product preference by home price was also measured.

Solid wood competes with brick and stucco in the upper home prices while hardboard, plywood, vinyl, and aluminum compete with each other in the lower home prices. The product-market in the mid-price range is less defined, with all products competing with each other.

Over 400 builders rated seven siding products on eleven attributes. Four characteristics accounted for the major differences among the products. The four fundamental characteristics were labelled: MAINTENANCE/WEATHERING ("low/easy maintenance" and "weather resistant/long life"), APPEARANCE/STATUS ("beautiful appearance" and

"high status/quality image"), DENT RESISTANCE ("Resistance to Impact/Dents"), and APPLICATION/ECONOMY, which includes how easy/fast the product is to apply as well as the material's price competitiveness. The first two were the most important of the four.

Builders had negative perceptions of all the wood-based siding products in terms of maintenance/weathering. Solid wood was differentiated from the wood composites (hardboard and plywood) by appearance/status: solid wood was perceived positively, composites negatively.

Solid wood, particularly cedar/redwood, holds a niche for those seeking a high-status image over easy maintenance, and remains competitive against brick because of brick's weak rating in application/economy. Solid wood is most competitive in the single and multi-family groups and in the Northeast and Western regions. Solid wood was least competitive in the South, where brick's disadvantage was minimal.

Solid wood is relatively free from the threat of substitute products at present, however, if vinyl manufacturers successfully repositioned their product in terms of appearance/status the threat to solid wood, especially pine/spruce, would be much greater. Such repositioning may be feasible, considering both the subjective nature of appearance/status (i.e., vinyl could become more accepted in time) and the variability of vinyl's ratings (vinyl users rated it much more favorably than non-users).

Hardboard and plywood were rated favorably in terms of dent resistance and application/economy. Plywood was perceived as being slightly easier/faster to apply than hardboard. Though the composites were perceived favorably in these two dimensions, this does not represent a competitive advantage -- vinyl was positioned close to the composites. Considering the product positions on all four differentiating characteristics, vinyl occupies the most favorable position and should be considered a serious threat to wood composites.

Wood composites are most competitive among multi-family builders, the group with the highest determinance rating for "competitive price." Though multi-family builders used a higher percent of hardboard than any other group, over a third of the multi-family builders used some vinyl during the year preceeding the survey.

Westerners rated wood composites (particularly hardboard) more favorably and vinyl more negatively than any other region and thus represent wood composite's most competitive region. Wood composites are also competitive in the South, but only in lower priced homes (under \$70,000). The Northeast rated the wood composites negatively, and preference data indicates Northeasterners prefer vinyl over wood composites for lower priced homes.

Determinant attribute analysis was used to evaluate 23 attributes to determine which attributes play the greatest role in determining builder's product choice. A "determinant" attribute is one which is rated high in importance yet also is perceived to differ greatly among the competing products (i.e., an attribute high in importance is not a

determinant factor in buying decisions if competing products are perceived to be equal with regard to the attribute).

Overall, the attributes playing the greatest role in determining product choice were appearance, high status/quality image, and weather resistance. Four other attributes were significantly greater than the average score: low/easy maintenance, dent resistance, competitive price, and structural strength. Attributes low in determinance included manufacturer service, variety attributes (color, texture/profile, and size variety), and a "natural" material.

Significant differences in attributes occurred among the four builder segments. Single and multi-family home builders differed from the siding and remodeling contractors by having higher determinance for price and lower determinance for manufacturer and retailer service. Siding and remodeling contractors were the opposite, having higher determinance for the service attributes and lower determinance for price. The segments differing the most were the single-family builders and siding contractors. High-status image, a "natural" material, and paint-holding ability were all higher in determinance for single-family respondents while warranty, ease of repair, and service were higher for siding contractors.

Regional differences were greatest within the single-family group and lowest within the siding contractors, though overall regional differences in attribute determinance were limited. Significant regional differences within the single-family group were found in dent resistance, natural material, and fade resistance.

**OPPORTUNITIES FOR FURTHER RESEARCH**

The author suggests the following future research projects:

1. This study was essentially exploratory in nature, considering that all regions and builder types were included. Marketers interested in a specific region or builder type could focus a perceptual study on the target segment. By using only the attributes ranking high in determinance in this study, the research instrument could remain one page long, greatly increasing response rates.
2. Manufacturers of a specific product should use the techniques presented in this study to evaluate the market within their product class. In other words, a firm like Masonite should evaluate perceptions of their hardboard products compared to competing manufacturers.
3. While evaluating perceptions of DIY consumers seems like a logical extension of this research, installing siding is not considered a DIY activity. A study on homebuyers could be done, however. A problem with this is that siding is only a small part of the product (home). This presents an interesting question: is the type of siding on a home important to homebuyers?

## APPENDIX A

### Exploratory Survey and Results

#### Objective

The objective of the exploratory survey was to explore which attributes professionals feel are important in order to ensure the attributes chosen for the study are relevant, in addition to ensuring that no important attributes are overlooked.

#### Sample

The one-page exploratory survey was mailed to 163 professional contractors on August 3, 1987. The sample frame consisted of respondents to a previous study conducted by our department. A total of 38 questionnaires were returned. The sample consisted of repair/remodeling contractors (49%), single-family home builders (34%), non-residential building contractors (11%) and multi-family contractors (6%) from all four census regions. The range of products used by respondents was extremely varied, resulting in an excellent cross-section of experienced contractors.

Summary

The attributes with the most total mentions in the exploratory survey's open-ended questions (questions 5-11) should be those the contractors feel are most important and/or different. The list of all attributes mentioned, with the total number of mentions each, is presented below. This list was used to guide development of the study's main questionnaire.

General Appearance	78
Maintenance Level/Ease	72 (59/13)
Application Ease/Speed	64 (54/10)
Price	58
Weather Resistance/Long Life	41
Color Selection	26
Variety Texture/Profile/Size	25
Hardness/Dent Resistance	23 (5/18)
Durability	22
Resistance to Fading	20
Sag/Dimensional Stability	19 (sag/buckle = 10, dim. stab. = 5) (aluminum "noises" =4)
Mystique/Natural/Status	14
Availability	13
Stainable/Paintable	12
Thermal Insulation	11
Structural Strength/Rigidity	9 ("Use as Sheathing")
Warranty/Guarantee	8
Ease of Repair	5
Holds Caulking	4
Mildew/Mold Free	4
Color All Through	4
Insect/Wood Peckers	3
Uniform Quality Within Product	2
Cedar Weathering Nice	2
Poor Trim Materials (Vinyl)	2
Fire Resistance	1
Feel to Touch	1



COLLEGE OF AGRICULTURE AND LIFE SCIENCES

## VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

SCHOOL OF FORESTRY AND WILDLIFE RESOURCES (703) 961-5481  
 DEPARTMENT OF FOREST PRODUCTS, 210 CHEATHAM HALL (703) 961-5330

August 3, 1987

Dear Professional Contractor/Remodeler:

Last spring you completed a survey for a study conducted by this department on CCA Pressure-Treated lumber. We would like to take this time to thank you for your response and let you know that arrangements were made to send you the pressure-treated lumber information you requested. If you don't receive this information in the next several weeks, please don't hesitate to contact us.

Our department is currently involved in another study designed to enable manufacturers of building materials to better meet the needs of professionals like yourself. The focus of this study is residential siding products. We are interested in knowing what characteristics of siding are most important to professionals like yourself. By "characteristics" we mean attributes such as level of maintenance, resistance to fading, price, how easy it is to install, appearance, etc. These are just examples—we want to learn from you what really is important when you decide which siding products to use.

The enclosed questionnaire was designed to be easy and fast to fill out. Unlike other surveys, there are no personal questions related to your revenues or costs—only open questions asking for your opinions and ideas. The questionnaire is only one-page long with two additional questions on the back. We hope you will take a moment to complete and return it in the postage-paid envelope provided. Your opinion, as a professional, is important to us! All answers are strictly confidential.

Thanks once again for your cooperation and help!

Sincerely,

Edward C. Stalling  
 Research Assistant  
 Forest Products Marketing

Steven A. Sinclair  
 Associate Professor  
 Forest Products Marketing

P.S. If you would like information on installing and maintaining siding products sent to you, just check the appropriate space on the back of the questionnaire and write your name and address on the back of the return envelope. We will see that you get it.

Enc.

VIRGINIA POLYTECHNIC INSTITUTE & STATE UNIVERSITY  
 DEPARTMENT OF FOREST PRODUCTS  
 RESIDENTIAL SIDING MATERIALS STUDY

1) Please check the one category which BEST describes your business (check only ONE):

- NEW HOMEBUILDER (SINGLE FAMILY)
- NEW HOMEBUILDER (MULTI-FAMILY)
- SIDING CONTRACTOR
- REPAIR & REMODELING CONTRACTOR
- NON-RESIDENTIAL BUILDING CONTRACTOR

2) Have you bought or used ANY siding products within the past year?

- YES (Please complete the remainder of this survey; your opinion is important to us!)
- NO (If you checked NO, please return this survey in the return envelope provided (NO POSTAGE NECESSARY))

3) Please indicate the types of projects that you undertook in the past year which involved siding. (Check ALL that apply):

- SINGLE FAMILY RESIDENTIAL CONSTRUCTION
- MULTI-FAMILY RESIDENTIAL CONSTRUCTION
- NEW NON-RESIDENTIAL CONSTRUCTION
- RE-SIDING EXISTING HOMES
- REPAIR OF EXISTING SIDING
- CONSTRUCTION OF ADDITIONS
- OTHER: \_\_\_\_\_

4) Of the total volume of siding products your firm used in the past 12 months, what percent would you estimate consisted of the following materials? (Total = 100%):

HARDBOARD SIDING	_____ %
PLYWOOD SIDING	_____ %
VINYL SIDING	_____ %
ALUMINUM SIDING	_____ %
SOLID WOOD SIDING	_____ %
SHAKE/SHINGLES	_____ %
BRICK	_____ %
OTHER MATERIAL	_____ %
TOTAL	= 100 %

**WE ARE INTERESTED IN YOUR OPINION OF THE DIFFERENT SIDING MATERIALS ON THE MARKET. PLEASE ANSWER THE FOLLOWING QUESTIONS IN AS MUCH DETAIL AS YOU WISH, WITH WHATEVER COMES TO MIND. PLEASE ANSWER EACH QUESTION REGARDLESS OF YOUR EXPERIENCE WITH A PARTICULAR PRODUCT. THERE ARE CERTAINLY NO RIGHT OR WRONG ANSWERS.**

- 5) Does vinyl siding have any advantages over plywood or hardboard siding? If so, please list them:
- 6) Why do you think some people prefer solid wood siding over other materials?
- 7) Are there any characteristics which make the performance of aluminum different from vinyl siding? Please explain:
- 8) Is there anything you find people DON'T like about vinyl siding?
- 9) Why do you think hardboard & plywood sidings are so popular in new construction but not in re-siding projects?
- 10) Imagine that you could design a siding product to best meet YOUR NEEDS AS A PROFESSIONAL. Please describe the six characteristics of this material that would make it so outstanding:
  - 1. \_\_\_\_\_
  - 2. \_\_\_\_\_
  - 3. \_\_\_\_\_
  - 4. \_\_\_\_\_
  - 5. \_\_\_\_\_
  - 6. \_\_\_\_\_

OVER 

P A G E T W O

- 11) Imagine you could design a siding product which best meets the needs and requirements of YOUR CUSTOMERS. What six characteristics would this material have that would make it so outstanding:

- |          |          |
|----------|----------|
| 1. _____ | 4. _____ |
| 2. _____ | 5. _____ |
| 3. _____ | 6. _____ |

**THE LAST QUESTION EXPLORES WHO MAKES THE DECISION REGARDING WHAT TYPE OF SIDING PRODUCT YOU USE. AS THIS DEPENDS ON WHAT THE SIDING IS BEING USED FOR, THE QUESTION IS BROKEN INTO THREE END-USES: PLEASE ANSWER FOR THOSE USES YOU ARE FAMILIAR WITH**

- 12) Who normally specifies what type of siding you should use (i.e. architect, homeowner, engineer, myself, etc.) in each of the following situations:

NEW SINGLE-FAMILY HOME CONSTRUCTION: \_\_\_\_\_

NEW MULTI-FAMILY CONSTRUCTION: \_\_\_\_\_

RE-SIDING: \_\_\_\_\_

REMODELING: \_\_\_\_\_

**THANK YOU VERY MUCH FOR YOUR COOPERATION IN FILLING OUT THIS SURVEY.  
PLEASE RETURN IT TO ME IN THE STAMPED/ADDRESSED ENVELOPE PROVIDED**

**☞ If you would like information regarding siding products, please check the space below AND PRINT YOUR NAME ON THE BACK OF THE RETURN ENVELOPE (NOT on this questionnaire). We will see that you get it. All replies are strictly confidential.**

( ) **SIDING INFORMATION (Product Specifications, Installation Guidelines, and Treatment/Maintenance Recommendations)**

APPENDIX B

Final Research Instrument

VIRGINIA POLYTECHNIC INSTITUTE & STATE UNIVERSITY  
RESIDENTIAL SIDING MATERIALS STUDY

- 1) Please check the one category which BEST describes your business (check only ONE):
- ( ) NEW HOMEBUILDER (SINGLE FAMILY)
  - ( ) NEW HOMEBUILDER (MULTI-FAMILY)
  - ( ) SIDING CONTRACTOR
  - ( ) REPAIR & REMODELING CONTRACTOR
  - ( ) NON-RESIDENTIAL BUILDING CONTRACTOR
  - ( ) RETAILER/WHOLESALE
- 2) Please indicate the types of projects that you undertook in the past year which involved siding. (Check All that apply):
- ( ) SINGLE FAMILY RESIDENTIAL CONSTRUCTION
  - ( ) MULTI-FAMILY RESIDENTIAL CONSTRUCTION
  - ( ) NEW NON-RESIDENTIAL CONSTRUCTION
  - ( ) RE-SIDING EXISTING HOMES
  - ( ) REPAIR OF EXISTING SIDING
  - ( ) CONSTRUCTION OF ADDITIONS

IF YOU HAVE NOT BOUGHT OR USED ANY SIDING PRODUCTS WITHIN THE PAST YEAR, PLEASE SKIP TO QUESTION 5

- 3) Of the total volume of siding products your firm used in the past 12 months, what percent would you estimate consisted of the following materials? (Total = 100%):
- |                       |         |
|-----------------------|---------|
| HARDBOARD SIDING      | _____ % |
| PLYWOOD SIDING        | _____ % |
| VINYL SIDING          | _____ % |
| ALUMINUM SIDING       | _____ % |
| SOLID WOOD SIDING     | _____ % |
| CEDAR SHAKES/SHINGLES | _____ % |
| STUCCO                | _____ % |
| BRICK                 | _____ % |
| OTHER MATERIAL        | _____ % |
| <b>TOTAL = 100 %</b>  |         |
- 4) If your firm used any SOLID WOOD SIDING within the past year, what percent would you estimate consisted of the following species? (Total = 100% SOLID WOOD)
- |                          |         |
|--------------------------|---------|
| PINE/SPRUCE SIDING       | _____ % |
| WESTERN RED CEDAR        | _____ % |
| REDWOOD                  | _____ % |
| OTHERS (PLEASE SPECIFY): | _____ % |
| _____                    | _____ % |
| _____                    | _____ % |
| _____                    | _____ % |
| <b>TOTAL = 100 %</b>     |         |

- 5) What is your position (job title) within your firm?  
POSITION: \_\_\_\_\_
- 6) In what state do you conduct the majority of your business? (Please name only one):  
STATE: \_\_\_\_\_

- 7) If you were to construct a single-family home in each of the following price ranges, which siding material(s) would you prefer? Please check the appropriate space(s) for each home price range:

HOME PRICE RANGE	HARDBOARD	PLYWOOD	VINYL	ALUMINUM	SOLID PINE/ SPRUCE	SOLID CEDAR/ REDWOOD	BRICK	STUCCO	CEDAR SHAKES/ SHINGLES
Under \$70K.....	( )	( )	( )	( )	( )	( )	( )	( )	( )
\$70K - 100K.....	( )	( )	( )	( )	( )	( )	( )	( )	( )
\$100K - 150K.....	( )	( )	( )	( )	( )	( )	( )	( )	( )
\$150K - 200K.....	( )	( )	( )	( )	( )	( )	( )	( )	( )
\$200 - 400K.....	( )	( )	( )	( )	( )	( )	( )	( )	( )
OVER \$400K.....	( )	( )	( )	( )	( )	( )	( )	( )	( )

- 8) Where do you purchase your siding materials? For each material, please check the source of the MAJORITY of your purchases. (Please check only ONE; check the last column if your firm never purchases the material):

SIDING MATERIALS	1 LOCAL RETAIL LUMBER YARD	2 LARGE HOME CENTER CHAIN	3 WHOLESALE	4 DIRECT FROM MANUFACTURER	5 NEVER PURCHASE
HARDBOARD.....	( )	( )	( )	( )	( )
PLYWOOD.....	( )	( )	( )	( )	( )
VINYL.....	( )	( )	( )	( )	( )
ALUMINUM.....	( )	( )	( )	( )	( )
SOLID PINE/SPRUCE.....	( )	( )	( )	( )	( )
SOLID CEDAR/REDWOOD.....	( )	( )	( )	( )	( )
BRICK.....	( )	( )	( )	( )	( )

- 9) How do each of the siding products rate in terms of each attribute? For each product, indicate whether the product possesses that attribute to a HIGH DEGREE (4), CONSIDERABLE DEGREE (3), LIMITED DEGREE (2), or NOT AT ALL (1). PLEASE INDICATE HOW YOU FEEL ABOUT EACH SIDING PRODUCT REGARDLESS OF WHETHER YOU HAVE EXPERIENCE WITH THE PRODUCT OR NOT — your opinion is important! NOTE: Assume the WOOD PRODUCTS have been PROPERLY FINISHED.

THE PRODUCT POSSESSES THIS ATTRIBUTE TO A:	NOT AT ALL	LIMITED DEGREE	CONSIDERABLE DEGREE	HIGH DEGREE
<b>▶ COMPETITIVE PRICE:</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
Hardboard Siding.....	( )	( )	( )	( )
Plywood Siding.....	( )	( )	( )	( )
Vinyl Siding.....	( )	( )	( )	( )
Aluminum Siding.....	( )	( )	( )	( )
Brick.....	( )	( )	( )	( )
Solid Pine/Spruce Siding.....	( )	( )	( )	( )
Solid Cedar/Redwood Siding.....	( )	( )	( )	( )
<b>▶ LOW/EASY MAINTENANCE:</b>				
Hardboard .....	( )	( )	( )	( )
Plywood .....	( )	( )	( )	( )
Vinyl .....	( )	( )	( )	( )
Aluminum .....	( )	( )	( )	( )
Brick.....	( )	( )	( )	( )
Solid Pine/Spruce.....	( )	( )	( )	( )
Solid Cedar/Redwood.....	( )	( )	( )	( )
<b>▶ FAST/EASY APPLICATION:</b>				
Hardboard .....	( )	( )	( )	( )
Plywood .....	( )	( )	( )	( )
Vinyl .....	( )	( )	( )	( )
Aluminum .....	( )	( )	( )	( )
Brick.....	( )	( )	( )	( )
Solid Pine/Spruce.....	( )	( )	( )	( )
Solid Cedar/Redwood.....	( )	( )	( )	( )
<b>▶ RESISTANCE TO IMPACTS/DENTS:</b>				
Hardboard .....	( )	( )	( )	( )
Plywood .....	( )	( )	( )	( )
Vinyl .....	( )	( )	( )	( )
Aluminum .....	( )	( )	( )	( )
Brick.....	( )	( )	( )	( )
Solid Pine/Spruce.....	( )	( )	( )	( )
Solid Cedar/Redwood.....	( )	( )	( )	( )
<b>▶ BEAUTIFUL APPEARANCE:</b>				
Hardboard .....	( )	( )	( )	( )
Plywood .....	( )	( )	( )	( )
Vinyl .....	( )	( )	( )	( )
Aluminum .....	( )	( )	( )	( )
Brick.....	( )	( )	( )	( )
Solid Pine/Spruce.....	( )	( )	( )	( )
Solid Cedar/Redwood.....	( )	( )	( )	( )
<b>▶ WEATHER RESISTANT/LONG LIFE:</b>				
Hardboard .....	( )	( )	( )	( )
Plywood .....	( )	( )	( )	( )
Vinyl .....	( )	( )	( )	( )
Aluminum .....	( )	( )	( )	( )
Brick .....	( )	( )	( )	( )
Solid Pine/Spruce.....	( )	( )	( )	( )
Solid Cedar/Redwood.....	( )	( )	( )	( )
<b>▶ WIDE COLOR SELECTION:</b>				
Hardboard .....	( )	( )	( )	( )
Plywood .....	( )	( )	( )	( )
Vinyl .....	( )	( )	( )	( )
Aluminum .....	( )	( )	( )	( )
Brick .....	( )	( )	( )	( )
Solid Pine/Spruce.....	( )	( )	( )	( )
Solid Cedar/Redwood.....	( )	( )	( )	( )

PLEASE CONTINUE RATING THESE PRODUCTS FOR JUST FOUR MORE ATTRIBUTES:

THE PRODUCT POSSESSES THIS ATTRIBUTE TO A:	NOT AT ALL	LIMITED DEGREE	CONSIDERABLE DEGREE	HIGH DEGREE
	1	2	3	4
<b>&gt; VARIETY IN TEXTURES/PROFILE:</b>				
Hardboard .....	( )	( )	( )	( )
Plywood .....	( )	( )	( )	( )
Vinyl .....	( )	( )	( )	( )
Aluminum .....	( )	( )	( )	( )
Brick .....	( )	( )	( )	( )
Solid Pine/Spruce .....	( )	( )	( )	( )
Solid Cedar/Redwood .....	( )	( )	( )	( )
<b>&gt; FADE RESISTANCE:</b>				
Hardboard .....	( )	( )	( )	( )
Plywood .....	( )	( )	( )	( )
Vinyl .....	( )	( )	( )	( )
Aluminum .....	( )	( )	( )	( )
Brick .....	( )	( )	( )	( )
Solid Pine/Spruce .....	( )	( )	( )	( )
Solid Cedar/Redwood .....	( )	( )	( )	( )
<b>&gt; DIMENSIONAL/SHAPE STABILITY:</b>				
Hardboard .....	( )	( )	( )	( )
Plywood .....	( )	( )	( )	( )
Vinyl .....	( )	( )	( )	( )
Aluminum .....	( )	( )	( )	( )
Brick .....	( )	( )	( )	( )
Solid Pine/Spruce .....	( )	( )	( )	( )
Solid Cedar/Redwood .....	( )	( )	( )	( )
<b>&gt; HIGH STATUS/QUALITY IMAGE:</b>				
Hardboard .....	( )	( )	( )	( )
Plywood .....	( )	( )	( )	( )
Vinyl .....	( )	( )	( )	( )
Aluminum .....	( )	( )	( )	( )
Brick .....	( )	( )	( )	( )
Solid Pine/Spruce .....	( )	( )	( )	( )
Solid Cedar/Redwood .....	( )	( )	( )	( )

THANK YOU FOR RATING THESE MATERIALS. NEXT, WE'D LIKE TO ASK YOU HOW IMPORTANT THESE ATTRIBUTES ARE TO YOU

10) When deciding what siding to use, what product attributes do you feel are the most important? (Please rank each characteristic on a scale of 1 = OF NO IMPORTANCE to 5 = CRITICAL by checking the ONE appropriate space):

ATTRIBUTES	OF NO IMPORTANCE	OF LITTLE IMPORTANCE	IMPORTANT	VERY IMPORTANT	CRITICAL
	1	2	3	4	5
COMPETITIVE PRICE.....	( )	( )	( )	( )	( )
LOW/EASY MAINTENANCE.....	( )	( )	( )	( )	( )
FAST/EASY APPLICATION.....	( )	( )	( )	( )	( )
RESISTANCE TO IMPACTS/DENTS.....	( )	( )	( )	( )	( )
BEAUTIFUL APPEARANCE.....	( )	( )	( )	( )	( )
WEATHER RESISTANT/LONG LIFE.....	( )	( )	( )	( )	( )
WIDE COLOR SELECTION.....	( )	( )	( )	( )	( )
VARIETY IN TEXTURES/PROFILES.....	( )	( )	( )	( )	( )
FADE RESISTANCE.....	( )	( )	( )	( )	( )
DIMENSIONAL/SHAPE STABILITY.....	( )	( )	( )	( )	( )
HIGH STATUS/QUALITY IMAGE.....	( )	( )	( )	( )	( )
AVAILABILITY.....	( )	( )	( )	( )	( )
HOLDS STAINS/PAINTS.....	( )	( )	( )	( )	( )
THERMAL INSULATION.....	( )	( )	( )	( )	( )
STRUCTURAL STRENGTH/RIGIDITY.....	( )	( )	( )	( )	( )
WARRANTY/GUARANTEE.....	( )	( )	( )	( )	( )
EASY TO REPAIR.....	( )	( )	( )	( )	( )
MOLD/MILDEW RESISTANCE.....	( )	( )	( )	( )	( )
FIRE RESISTANCE.....	( )	( )	( )	( )	( )
VARIETY IN AVAILABLE SIZES.....	( )	( )	( )	( )	( )
SERVICE FROM MANUFACTURER.....	( )	( )	( )	( )	( )
SERVICE FROM WHOLESALER/RETAILER.....	( )	( )	( )	( )	( )
A "NATURAL" MATERIAL.....	( )	( )	( )	( )	( )
PRODUCT HAS A BRAND NAME.....	( )	( )	( )	( )	( )

11) How much DIFFERENCE do you feel there is AMONG THE SIDING MATERIALS in question 1, in each of these attributes? (Please check the ONE space which best corresponds to your opinion, for EACH attribute):

ATTRIBUTES	VERY	SIMILAR	DIFFERENT	VERY
	SIMILAR			DIFFERENT
	1	2	3	4
COMPETITIVE PRICE.....	( )	( )	( )	( )
LOW/EASY MAINTENANCE.....	( )	( )	( )	( )
FAST/EASY APPLICATION.....	( )	( )	( )	( )
RESISTANCE TO IMPACTS/DENTS.....	( )	( )	( )	( )
BEAUTIFUL APPEARANCE.....	( )	( )	( )	( )
WEATHER RESISTANT/LONG LIFE.....	( )	( )	( )	( )
WIDE COLOR SELECTION.....	( )	( )	( )	( )
VARIETY IN TEXTURES/PROFILES.....	( )	( )	( )	( )
FADE RESISTANCE.....	( )	( )	( )	( )
DIMENSIONAL/SHAPE STABILITY.....	( )	( )	( )	( )
HIGH STATUS/QUALITY IMAGE.....	( )	( )	( )	( )
AVAILABILITY.....	( )	( )	( )	( )
HOLDS STAINS/PAINTS.....	( )	( )	( )	( )
THERMAL INSULATION.....	( )	( )	( )	( )
STRUCTURAL STRENGTH/RIGIDITY.....	( )	( )	( )	( )
WARRANTY/GUARANTEE.....	( )	( )	( )	( )
EASY TO REPAIR.....	( )	( )	( )	( )
MOLD/MILDEW RESISTANCE.....	( )	( )	( )	( )
FIRE RESISTANCE.....	( )	( )	( )	( )
VARIETY IN AVAILABLE SIZES.....	( )	( )	( )	( )
SERVICE FROM MANUFACTURER.....	( )	( )	( )	( )
SERVICE FROM WHOLESALER/RETAILER.....	( )	( )	( )	( )
A "NATURAL" MATERIAL.....	( )	( )	( )	( )

FINALLY, WE WOULD LIKE TO ASK FOUR QUESTIONS ABOUT YOUR FIRM FOR STATISTICAL PURPOSES

12) Please estimate your firm's total revenue for 1987. Please check ONE only.

- ( ) LESS THAN \$100,000
- ( ) \$100,000 TO \$500,000
- ( ) \$500,000 TO \$1 MILLION
- ( ) \$1 MILLION TO \$5 MILLION
- ( ) \$5 MILLION TO \$10 MILLION
- ( ) OVER \$10 MILLION

13) How many dwelling units will your firm build in 1987? Please check ONE for EACH building category:

NUMBER OF UNITS	SINGLE FAMILY DETACHED	TOWN HOUSES	MULTI-FAMILY HOUSES
NONE	( )	( )	( )
1 - 10	( )	( )	( )
11 - 25	( )	( )	( )
26 - 100	( )	( )	( )
101 - 500	( )	( )	( )
OVER 500	( )	( )	( )

14) Who decides which siding material to use in your firm's new residential construction projects? Please estimate how often (%) this decision is made by each of the following persons:

- ( ) I HAVE NO EXPERIENCE IN NEW CONSTRUCTION
- HOME OWNER SPECIFIES \_\_\_\_\_ %
- ARCHITECT SPECIFIES \_\_\_\_\_ %
- BUILDER SPECIFIES \_\_\_\_\_ %
- DEVELOPER SPECIFIES \_\_\_\_\_ %
- TOTAL = 100 %

15) What is the average price of the homes your firm builds? Check only ONE:

- ( ) No Homes Built
- ( ) Under \$70,000
- ( ) \$70,000 TO \$100,000
- ( ) \$100,000 TO \$150,000
- ( ) \$150,000 TO \$200,000
- ( ) \$200,000 TO \$400,000
- ( ) OVER \$400,000

THANK YOU VERY MUCH FOR YOUR COOPERATION IN FILLING OUT THIS SURVEY. PLEASE RETURN IT TO ME IN THE STAMPED/ADDRESSED ENVELOPE PROVIDED

If you would like free information regarding siding products, please check the space below AND PRINT YOUR NAME ON THE BACK OF THE RETURN ENVELOPE (NOT on this questionnaire). We will see that you get it. ALL REPLIES ARE STRICTLY CONFIDENTIAL!

( ) SIDING INFORMATION (Product Specifications, Installation Guidelines, and Treatment/Maintenance Recommendations)

APPENDIX C  
Cover Letters Used  
(Pre-test Cover Letter)



COLLEGE OF AGRICULTURE AND LIFE SCIENCES

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

DEPARTMENT OF FOREST PRODUCTS

Thomas M. Brooks Forest Products Center—William H. Sardo Jr. Pallet & Container Research Laboratory

September 2, 1987

Dear Professional Homebuilder/Remodeler:

Will you do us a favor?

We are conducting a nationwide survey among professionals in the homebuilding/remodeling industries. The purpose of this research is to find out the opinions and needs of professionals like yourself on the advantages and disadvantages of using various siding materials in residential construction. Your answers will enable manufacturers to better meet the needs that you, the professional, require in siding products.

Your firm appeared in a scientifically selected random sample. Therefore, your response to the enclosed survey is of key importance to the accuracy and success of our research, whether or not your firm is a user of one or more of the materials described.

We ask that the survey be completed by a person in your firm that is the most involved in decisions related to siding. It will take only a short time to answer the simple questions on the enclosed survey and to return it in the postage-paid return envelope. Of course all answers are confidential and will only be used in combination with those of other professionals from all over the U.S.

If you are interested in receiving information on installing and maintaining various siding materials, simply check the appropriate space on the back of the survey and write your name & address on the back of the return envelope, or if you prefer, request the information in a separate letter.

Your answers are crucial, as we need a high response rate for the survey results to be reliable. Please return the completed survey at your earliest convenience.

Thank you for your cooperation and help!

Sincerely,

*Edward C. Stalling*  
Edward C. Stalling  
Research Assistant

*Steven A. Sinclair*  
Steven A. Sinclair  
Associate Professor

(Pre-Notification to Blue Book Sample)



COLLEGE OF AGRICULTURE AND LIFE SCIENCES

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

DEPARTMENT OF FOREST PRODUCTS

*Thomas M. Brooks Forest Products Center*

October 15, 1987

Thad Montgomery  
King Builders  
Box 5306  
Lafayette, LA 70505

Dear Mr. Montgomery:

I am asking your help in a nationwide research project. The purpose of this project, which I am conducting as part of my graduate studies, is to find out the opinions of professionals like yourself on the advantages and disadvantages of using various siding materials in residential construction. The study results will help siding manufacturers better meet your needs.

In about a week you will receive my simple questionnaire. I ask that the survey be completed by the person in your firm that is most involved in decisions relating to siding products. It will take but a short time to fill out—and your answers will be of the greatest importance to the success and accuracy of my research.

I need your help to complete my graduate research project. I hope you can spare 10 minutes. Thanks!

Sincerely,

*Edward C. Stalling*

Edward C. Stalling  
Graduate Student  
Forest Products Marketing

(Survey Cover Letter to Blue Book Sample)



COLLEGE OF AGRICULTURE AND LIFE SCIENCES

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

DEPARTMENT OF FOREST PRODUCTS

*Thomas M. Brooks Forest Products Center*

October 22, 1987

Dear Homebuilder:

Last week I sent you a letter requesting your company's participation in a nationwide research project I am conducting as part of my studies here at Virginia Tech.

The purpose of this research is to find out the opinions of professionals like yourself on the advantages and disadvantages of using various siding materials in residential construction. The study results will help siding manufacturers better meet your needs.

I hope you can spare 10 minutes to help me with this project by filling out the enclosed questionnaire. I ask that the survey be completed by the person in your firm that is most involved in decisions related to siding products. Of course all answers are confidential and will only be used in combination with those of other professionals from all over the U.S.

If you are interested in receiving information on installing and maintaining various siding materials, simply check the appropriate space on the back of the survey and write your name and address on the back of the return envelope, or if you prefer, request the information in a separate letter.

Your answers are crucial, as we need a high response rate for the survey results to be reliable. Please return the survey at your earliest convenience.

Thank you for your cooperation and help!

Sincerely,

*Edward C. Stalling*  
 Edward C. Stalling  
 Graduate Student  
 Forest Products Marketing

*Steven A. Sinclair*  
 Steven A. Sinclair  
 Associate Professor  
 Forest Products Marketing

Enc.

(Survey Cover Letter to Yellow-Page Sample)



COLLEGE OF AGRICULTURE AND LIFE SCIENCES

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

DEPARTMENT OF FOREST PRODUCTS

*Thomas M. Brooks Forest Products Center*

October 22, 1987

Dear Professional Homebuilder/Remodeler:

Will you do us a favor?

We are conducting a nationwide survey among professionals in the homebuilding/remodeling industries. The purpose of this research is to find out the opinions and needs of professionals like yourself on the advantages and disadvantages of using various siding materials in residential construction. Your answers will enable manufacturers to better meet the needs that you, the professional, require in siding products.

Your firm appeared in a scientifically selected random sample. Therefore, your response to the enclosed survey is of key importance to the accuracy and success of our research, whether or not your firm is a user of one or more of the materials described.

We ask that the survey be completed by a person in your firm that is the most involved in decisions related to siding. It will take only a short time to answer the simple questions on the enclosed survey and to return it in the postage-paid return envelope. Of course all answers are confidential and will only be used in combination with those of other professionals from all over the U.S.

If you are interested in receiving information on installing and maintaining various siding materials, simply check the appropriate space on the back of the survey and write your name and address on the back of the return envelope, or if you prefer, request the information in a separate letter.

Your answers are crucial, as we need a high response rate for the survey results to be reliable. Please return the completed survey at your earliest convenience.

Thank you for your cooperation and help!

Sincerely,

*Edward C. Stalling*

Edward C. Stalling  
Research Assistant  
Forest Products Marketing

*Steven A. Sinclair*

Steven A. Sinclair  
Associate Professor  
Forest Products Marketing

Enc.

(Follow-Up Letter to Total Sample)



COLLEGE OF AGRICULTURE AND LIFE SCIENCES

## VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

DEPARTMENT OF FOREST PRODUCTS

*Thomas M. Brooks Forest Products Center*

October 29, 1987

Dear Professional Homebuilder/Remodeler:

I recently sent you a letter requesting your company's participation in a nationwide survey for siding products I am conducting as part of my studies here at Virginia Tech. If you have returned the survey, thank you for your help! Your response is very important to me because it will provide the information I need to complete my work towards a Masters degree in Forest Products.

I realize that business people, such as yourself, are very busy and you may not yet have found the time to complete the survey. However, I would like to encourage you to do so. The survey takes only a short time to complete and you need not identify yourself or your company. The information which you supply in this study may help you, the contractor, either directly or indirectly in the future, because you are providing information to enable siding manufacturers to better meet your needs.

If you are interested in receiving information on siding materials, simply check the appropriate space on the back of the survey and write your name and address on the back of the return envelope, or if you prefer, request the information in a separate letter.

Your answers are crucial, as I need a high response rate for the survey results to be reliable. I hope you can spare 10 minutes.

Once again, thank you for your help!

Sincerely,

*Edward C. Stalling*

Edward C. Stalling  
Graduate Student  
Forest Products Marketing

*Please help! I need more responses to complete this study and my degree. This from you would be greatly appreciated!*  
Thanks,  
Ed

**APPENDIX D**  
**Sample Size Calculations**

Assumptions for sample size:

1. Population is normally distributed.
2. Bound on the error of estimation is 5%.
3. Confidence interval is set at 95%, which is standard for surveys of this nature.
4. p is the proportion of contractors who have used wood siding; p is estimated to be .7, which is probably conservative.

Equation:

$$n = \frac{N(p)(q)}{(N-1)D + (p)(q)}$$

n = sample size

N = Contractor population size

p = proportion of Contractors who have used wood-based siding

q = 1-p

D = B<sup>2</sup>/4;     B = .05

$$n = \frac{100,000(.7)(.3)}{99,999(.000625) + (.7)(.3)} = 335$$

Results:

A minimum of 335 returned surveys were needed in order for the total survey to be within a bound on the error of estimation of 5% at the 95% confidence level. Assuming a 15% response rate and a 12% non-delivery, a minimum of 2500 surveys must be mailed. An extra 200 surveys will be added to this minimum for a total of 2700 surveys mailed.

Additionally, there are 2600 listings in The Blue Book of Major Home Builders (Anonymous 1987b). Using p = .9 with a response rate of 25%, a total of 137 large builder responses were sought by sending out a 550 surveys to builders listed in The Blue Book. The actual sample size after the "nth" selection was 571, therefore 571 surveys were mailed to the Blue Book builders.

THEREFORE A MINIMUM OF 3050 SURVEYS NEEDED TO BE MAILED NATIONALLY.  
THE ACTUAL MAILING WAS 2700 + 571 = 3271 SURVEYS NATIONALLY.

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Mendenhall, W., L. Ott, and R. L. Scheaffer. 1986. Elementary Survey Sampling. Wadsworth Publishing Company, Inc., Boston, MA.

**APPENDIX E**  
**Explanation of Statistical Methods Used**

1. Analysis of Variance (ANOVA)
2. Chi-square Test
3. Multiple Discriminant Analysis (MDA)
4. Newman-Keuls Test
5. Standardized Scores (T-Scores) by Individual
6. Z-Test, One-Tailed

**ANOVA:**

Analysis of Variance is a statistical procedure used to test statistical significance of differences when there are more than two means being compared. If only two means are compared, a "T-test" would be used. ANOVA analyzes if a dependent variable (i.e. determinance scores) differs between two or more levels of a single independent variable (i.e. four levels of Builder-Type). Assumptions of ANOVA include: (1) samples are random and independent, (2) dependent variable is interval or higher, and (3) sampled populations have the same shapes, means, and variances.

The hypothesis tested is that the mean scores of the independent variable are equal. The procedure uses the relationship of the between-group variance to the within-group variance (this relationship is the F-ratio) to determine the statistical significance of the differences in mean scores. A probability greater than the acceptable level (in this study, .05) indicates that there is no difference, that is, the differences are due to sampling fluctuations. If the probability is less than .05, a difference in group means does exist, beyond which can be explained by sampling fluctuation.

**Chi-Square Test**

This procedure tests the significance of differences observed between two categorical (non-metric) variables. Assumptions include (1) samples are random and independent and (2) observations are categorical and mutually exclusive. The procedure uses the Chi-square

distribution and basically compares the observed frequencies to theoretical frequencies.

#### Multiple Discriminant Analysis (MDA)

Unlike ANOVA and Chi-Square, in which only one dependent variable can be analyzed at a time (and as such are called univariate techniques), MDA belongs to the multivariate family of statistical procedures because many dependent variables can be analyzed at once. Multivariate techniques benefit by accounting for the relationships that might exist among the dependent variables, for instance intercorrelation.

MDA is the appropriate technique when the dependent variable is non-metric (categorical) and the independent variables are metric. The primary objective of MDA are to understand group differences and to predict the likelihood that an individual respondent will belong to a particular group based on several independent variables. In this study, the technique is used to explain group differences rather than for prediction, yet prediction was used to validate the perceptual models developed.

MDA is one of the most widely touted of the procedures for developing analytical models that help to evaluate differences among market segments or constructing a spatial model of product categories. It finds the weighted combination of independent variables (i.e. attribute ratings) which discriminate most among the dependent variable categories (i.e. the different siding products). It does

this by maximizing an F-ratio of between group to within-group variance. The second and subsequent weighted combinations are then found which discriminate maximally among the groups, with the constraint that they all be uncorrelated with each other.

The MDA solutions presented in this report were all rotated using the Varimax procedure (done within the SPSS-X statistical package) to improve interpretation. For the reader interested in the use of MDA, the following references are recommended: Hair et al. (1987), and Churchill (1987).

#### Newman-Keuls Test

When ANOVA indicates a statistical difference in groups exist, there is no indication of which groups are statistically different from each other. After finding a significant difference with ANOVA, post-hoc multiple comparison tests can be employed to discover which pairs or combination of pairs have significantly differing means. The Newman-Keuls Test is a post-hoc multiple comparison test. It is one of the more powerful of the post-hoc tests, and is used when group sizes are similar. In this study, the size of the groups (different builder types) were similar and thus this more powerful method was used.

Standardized Scores (T-Scores) by Individual

Standard, or normalized scores, describe the relative position of a score with respect to the entire distribution of scores. The standard score that corresponds with a given raw score indicates how many standard deviations the raw score is either above or below the mean. While standard scores usually have a mean of zero and a standard deviation of one, a desirable way to express standard scores is by "T-scores," that is, having a mean of 50 and a standard deviation of ten.

The standardized score is calculated as follows:

$$Z = \frac{X - u}{sd}$$

Where; Z = Standard score for individual i.  
 X = Raw determinance score of attribute A for i,  
 which, by the definition of determinance,  
 equals (Importance of A) (Difference of A).  
 u = Mean determinance of all 23 attributes for i.  
 sd = Standard deviation of all 23 attributes for i.

The standard score is then transformed into a T-score by:

$$\text{T-Score} = 10(Z) + 50$$

Thus each individual (i) has a T-score for each attribute, which indicates the position of each attribute relative to all 23 attributes.

**Z-Test, One-Tailed**

This procedure was used to determine which attributes had statistically higher determinance than the grand mean of all attributes (and would therefore be labeled "determinant" attributes). The null hypothesis is that the attributes tested is equal to the grand mean. The alternate hypothesis is that the attribute's score exceeds the grand mean.

The test statistic for each attribute is the Z-score and was calculated as follows:

$$\text{Test Statistic} = \frac{(\text{Determinance Score} - \text{Grand Mean})}{\text{Standard Error of the Mean}}$$

The grand mean was equal to 50 and the standard error of the mean equalled .5547858. The standard error was calculated by dividing the grand standard deviation (50.95) by the square root of the number of cases (8434 cases -- approximately 367 respondents and 23 attributes per respondent).

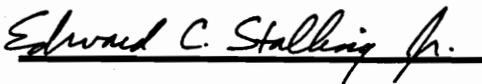
The test statistic was compared to the critical value using the table for the normal curve (1.645 for a one-tailed test with alpha=.05), and those attributes with test statistics exceeding this critical value were labelled determinant.

## VITA

Edward C. Stalling, Jr. was born in Norwalk, Connecticut on June 23, 1958, to Edward C. Sr. and Barbara Stalling. Upon graduating from Staples High School in Westport, Connecticut in 1976, Ed moved to Fort Collins, Colorado to pursue forestry education. Ed was awarded a Bachelor of Science degree in Forest Management from Colorado State University in December, 1981.

While an undergraduate, Ed gained forestry experience through summer employment in Virginia, Colorado, Washington, and Alaska. After graduating, he went "North to Alaska," working in timber management on the Tongass National Forest. While in Alaska the U.S. Department of Agriculture awarded Ed a Certificate of Merit for outstanding performance, and presented him with a Cash Award for an HP-41 program Ed wrote for calculating road construction costs.

Ed left the Forest Service in 1986 to pursue a Master's degree in Forest Products Marketing at Virginia Polytechnic Institute and State University. His interests in substitute products and consumer research led him to develop the proposal for this study. Ed was awarded the 1988 Wood Award from the Forest Products Research Society for one of the chapters in this thesis: "The Competitive Position of Wood as a Residential Siding Material: A Model of Professional Consumer Perceptions."



Edward C. Stalling, Jr.