

AN ABSTRACT OF THE THESIS OF

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Title: Lead-User Research in the Wood Window Value Chain.

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Lead-user research is a relatively new marketing research technique, and it has not seen much use in the forest sector. Lead-user research is designed to capture not just the needs of the customer in their own voice but also to involve actual users of goods and/or services in their development. Lead-users are those individuals who are on the leading-edge in adopting new products and services and who expect to realize the most benefit from these new products and services. This expectation is what drives lead-users to innovate. The qualitative study described here identifies and explores the perspectives of lead-users in the wood window industry. These users identified what they liked or did not like about existing products and services as well as desirable new products and services. Qualitative measures were used to document and summarize the results.

Findings from this study outline various opportunities and challenges for the introduction of regionally targeted and green/environmental products, processes and services, thereby demonstrating the value of applying to lead-users for product development concepts. However, this study also highlights the challenges in using the lead-user method, including the varying definitions of a lead-user and the subjective nature of categorizing

someone as a lead-user. These findings show that while there are multiple opportunities for window manufacturers to innovate and, in so doing, create superior customer value, there is also a need for greater familiarity with the lead-user method so that it can be effectively applied.

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Lead-User Research in the Wood Window Value Chain

by
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A THESIS

submitted to

Oregon State University

in partial fulfillment of
the requirements for the
degree of

Master of Science

Presented June 18, 2009

Commencement June 2010

Master of Science thesis of Kathryn Jean Kamke presented on June 18, 2009.

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I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

Kathryn J. Kamke, Author

ACKNOWLEDGEMENTS

The author would like to acknowledge all of the individuals who participated in this study, both those who were interviewed and those who served as information sources. Their insight and willingness to participate made this research possible. The author would especially like to express gratitude to Jeff Vaughn for sharing his extensive knowledge of wood windows, which proved invaluable.

The author also wishes to express sincere appreciation to her advisors, Eric Hansen, Chris Knowles and Keven Malkewitz for all their advice and guidance. This support and suggestions were greatly esteemed. The author would also like to thank the Forest Business Solutions Group, members of whom generously read drafts of this document and offered comments for improvement in addition to serving as sounding boards when needed.

Finally, the author would like to express her heartfelt appreciation to her family for their support and assistance and to her and fiancé for his understanding of the need for the author to travel 3,000 miles away for graduate school. Without their love and understanding none of this would have been possible.

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Lead-User Research in the Wood Window Value Chain

Introduction

Continual advancements in globalization and technology have caused the U.S. economy to evolve from being information-based to innovation-based (NII 2004). The growth of new international markets and innovation centers pressures companies to innovate in order to be competitive. Additionally, consumers are embracing new technologies and ideas, driving companies to create new and better products. This change in the orientation of the U.S. economy has led to an increased focus in industry, academia and society on understanding and promoting innovation. Studies on the subject led one source to describe innovation as an essential factor for economic development (O'Shea and McBain 1999). Other sources demonstrate that new product development (NPD) and other types of innovation are key factors in competitive advantage of firms (Brown and Eisenhardt 1995, Martin et al. 1991, Pratten 1991, Scarborough and Zimmerer 2000). These same advancements in globalization and technology, however, also mean that innovation in firms cannot be limited to quality and efficiency (NII 2004) but also must encompass other areas in order for firms to maintain competitiveness.

The forest sector generally is perceived as having a conservative culture, which makes companies within this industry resistant to change (Hansen et al. 2007). A study conducted by Hansen et al. (2007) into the perspectives of forest industry managers, however, shows recognition that the nature of the industry is changing and that

companies must take major steps in increasing innovativeness. Previous research has revealed that in most cases, the industry as a whole focuses on process innovation while placing less emphasis on other types of innovation (Crespell et al. 2006, Knowles et al. 2008, Schaan and Anderson 2002). This is due in large part to the industry's traditional production orientation and commodity mentality. The majority of firms within the forest industry follows a low-cost strategy and therefore strives to increase fiber utilization and streamline production through process innovation (Crespell et al. 2006).

Empirical studies show the existence of a strong positive relationship between innovation and firm performance (e.g. Damanpour et al. 1989; Dawes 2000; Han et al. 1998; Hurley and Hult 1998; Hult et al. 2004). Additionally, research demonstrates the effectiveness of systematic approaches to NPD and proves the tendency of firms successful in developing new products to be high performers (Cooper et. al. 2004). Despite this, recent studies of the wood products industry indicate that companies are not particularly systematic in their approach to NPD, nor do they typically carry out detailed market research as part of NPD efforts (Hansen 2006). Competitiveness in modern markets is closely tied to NPD practices, with the highest performing companies being those that are most efficient in bringing new products and/or services to market (Han et. al. 1998, Hurley and Hult 1998). Accordingly, forest industry managers need to increase their awareness and use of various NPD tools.

One of the primary influences on the forest sector's approach to innovation is corporate culture (Hansen et al. 2007). Therefore, a change in corporate culture is necessary before

forest sector companies will adopt specific NPD tools and place more value in systematic approaches. In order to facilitate this change, practical examples of the use of NPD tools and the potential benefits of adoption need to be provided to industry managers. In this study we propose to utilize the “voice-of-the-customer” research technique to identify opportunities in the market. Voice-of-the-customer is a process used to receive feedback from and gain insight into the needs of the customer in an effort to provide the customer with the best service or product possible. This knowledge can be captured in various ways, including direct interviews with buyers and users of a product. Voice-of-the-customer research is an important tool in NPD as it gains information directly from current users of a product. Additionally, it dictates that companies must be proactive and constantly innovating by revealing the changing requirements of customers with time. A first generation of this type of research was carried out at Oregon State University in cooperation with FP Innovations in Canada (Fell et al. 2007).

Objectives

This study has two primary objectives:

- Identify user-lead innovations/concepts within the wood-window value chain.
- Identify user needs not currently met with existing product/service offerings.

In order to achieve these objectives, personal interviews will be conducted with a variety of users along this value chain including purchasing agents, installers, and professional contractors. This qualitative data will then be analyzed to identify themes.

The successful achievement of our objectives will provide benefit and/or impact through

the direct findings of the research, including the identified themes, and the indicated areas where existing products and services are inadequate or where new products or services are needed.

Theoretical Background

Innovation

Research demonstrates that innovation is strongly connected to firm performance (Damanpour et al. 1989; Dawes 2000; Han et al. 1998; Hurley and Hult 1998; Hult et al. 2004). An innovation is a product (good or service), process, marketing method, or organizational method in business practices, workplace organization or external relations perceived to be new or significantly improved (Dewar and Dutton 1986, Han et al. 1998; Hovgaard and Hansen 2004). Product innovation, or new product development (NPD), is, “one of the riskiest, yet most important, endeavors of the modern corporation” (Cooper 2001). Each year thousands of new products are introduced to the market. Companies race to be the first to market with revolutionary new products and to continuously challenge their own best products. These new products range from radical innovations, like the iPhone, to incremental innovations, such as the latest movie or the nth version of the Sharpie® pen.

Radical vs. Incremental Innovation

Innovations vary in the degree of newness to both the adopting unit (i.e. organization) and the market (Dewar and Dutton 1986). Beginning in the late 1970s, a theory emerged in marketing describing the radical-incremental dichotomy. For the purpose of consistency and understanding we will use the terms “radical” and “incremental” for this concept, however, other research uses the terms “breakthrough vs. incremental” (Tushman and Anderson 1986) or “continuous vs. discontinuous” (Porter 1998) to describe this same dichotomy.

Radical and incremental innovations differ in two dimensions. The first dimension is internal to the company. Radical innovations require a fundamental change to knowledge and/or technology new to the company, representing a potentially risky departure from existing practices (Rogers 1983, Dewar and Dutton 1986). Product categories that are considered to be radical innovations include new-to-the-world products and new product lines (Cooper 2001). In contrast, incremental innovations build upon or slightly adjust existing knowledge and/or resources within the company, utilizing existing strengths and competencies (Rogers 1983, Porter 1998). Product categories considered to be incremental improvements include additions to existing product lines, improvements to existing products, repositionings, and cost reductions (Cooper 2001).

The second dimension in which radical and incremental innovations differ is external to the company. Radical innovations are often associated with significant technological advancements. These novel products have the potential to revolutionize a market, such as the VHS format tapes for home VCRs or IBM's DOS operating system (Cooper 2001). Moreover, they have the potential to create their own market, such as lasers or e-commerce (Rogers 1983). Incremental innovations, however, typically involve modest technological changes, if any. This type of advancement rarely, if ever, shakes up a market or reduces the attractiveness of competing products (Rogers 1983).

Risk is a key difference between radical and incremental innovations. The greater the degree of change expected within a company to either technology or operations, the more risk is associated with the innovation. Also, the greater the degree of change expected in

use or familiarity for users, the more risk is associated with innovation introduction (Crawford and Di Benedetto 2006). Managers are likely to judge whether to go ahead with an innovation based on their level of familiarity and experience with the knowledge involved (Dewar and Dutton 1986). As a consequence, 50 percent of firms introduce no new-to-the world products, while a further 25 percent develop no new product lines (Cooper 2001). For users, Rogers states that “the complexity of an innovation, as perceived by members of a social system, is negatively related to its rate of adoption” (Rogers 1983). This means that the less familiar a market is with the technology or use of an innovation, the slower they will be to adopt it; or they may choose to reject the innovation altogether.

The distinction between radical and incremental innovations is not inflexible, rather, there is a continuum of innovations that range from radical to incremental (Dewar and Dutton 1986). An innovation’s placement on this continuum depends entirely on the perception of those individuals familiar with the current state of knowledge prior to the introduction of the innovation (Dewar and Dutton 1986). Additionally, innovations can change their classification over time. Technology that was once perceived as radical, such as the computer, is now perceived as commonplace. Furthermore, most innovations made in the computer field are now perceived as incremental rather than radical advancements.

Types of Innovation

One theory of innovation states that within an organization, innovations occur in one of three areas, product, process, or business systems. Product innovation is a change in an

organization's goods or services (Crespell et al. 2006). Process innovation is an introduced change in an organization's production process (Damanpour et al. 1989). Business systems innovation is the introduction of new management systems, marketing methods, administrative processes, or staff development programs (Crespell et al. 2006). Determining which form of innovation best suits a company depends on the culture and strategic orientation of the company (Crespell et al. 2006, Despondé et al. 1993). Many forest industry firms focus on process innovation as a result of their production orientation. Mature markets, such as solid wood products, focus on process rather than product innovation (Crespell et al. 2006). However, previous research indicates that an equal utilization of all three types of innovation is the most beneficial to market-oriented firm performance (Damanpour et al. 1989).

Product Innovation

Product innovation covers a broad spectrum of goods and services. New products are classified into six categories (Cooper 2001). These categories are (1) new-to-the-world, (2) new product lines, (3) additions to existing product lines, (4) improvements and revisions to existing products, (5) repositionings, and (6) cost reductions. Categories of products are determined by two dimensions, newness to the company and newness to the market. For example, new-to-the-world products are both highly new to the company and to the market, while new product lines are highly new to the company but not new to the market. Each of these categories comes with its own benefits and drawbacks. New-to-the-world products have a high rate of return when successful; however, they also are associated with a high degree of risk to the company in terms of committed time and

money (Rogers 1983). In contrast, cost reductions represent little risk to the company, since they utilize present capabilities and markets. In addition, they also represent a less significant benefit to the company (Cooper 2001).

Drivers of Innovation

Profits and increased market share have always been primary motivators for companies to innovate. However, the modern market is considerably more complex than in the past, adding to the motivations for companies to innovate. Rapid advancements in technology mean that the technology base itself is perpetually increasing (Cooper 2001). Both manufacturers and customers have an increased know-how, leading to many new products hitherto either un-thought of or previously thought unrealistic (Cooper 2001). For the forest industry, technological advancements equal both challenges and opportunities. While technology has led to the introduction of many products in other industries to compete with traditional wood products, it has also led to the introduction of wood-plastic composites and nanocrystals (cellulose).

Another factor driving innovation is changing customer needs. Few markets are static in terms of customer preference (Cooper 2001). The availability of information to consumers means that they are more aware than ever before of what products are possible. Customers have come to expect regular introductions of new products with significant improvements (Cooper 2001). Additionally, consumers look for more than just the fulfillment of function needs, i.e. the solution to consumption-related problems like preventing a potential problem, from their goods (Park et al. 1986). Consumers also look

for goods and services that will fulfill their experiential, i.e. provide sensory pleasure, variety and/or cognitive stimulation, and symbolic, i.e. define the self or identify one's role or group membership, needs. In terms of wood related products, many consumers look for goods that are environmentally friendly, such as certified forest products or products made from recycled materials, and are often willing to pay a premium to obtain such goods (Vlosky et al. 1999).

Shortening product life cycles is another driver of innovation (Griffin 1997b). Product life cycles are shortened both by technology advancements and changing customer market needs (Cooper 2001). One study shows that over the past 50 years product life cycles have been shortened by as much as a factor of four (Cooper 2001), meaning that new products that once had a life of 5 years or more could now become obsolete in a matter of months. This is particularly true of products in high technology markets (Cooper 2001). In order to address this situation, many firms will have a replacement product(s) in the development stage even as they release their new product (Cooper 2001).

Innovation is also driven by increased levels of competition, i.e. more firms are competing within markets (Griffin 1997b). One of the leading causes of this increased competition is globalization (Cooper 2001). Opening up countries to foreign firms provides intensified competition as well as new markets. As a result, product innovation is increased as firms ideate and manufacture products appealing to international consumers (Cooper 2001).

New Product Development

While innovation and new product development (NPD) are not new concepts, defining the process by which a company carries out NPD is a relatively new phenomenon (Cooper 2001). Initial research into the subject of NPD focused on defining the process of NPD, however, over time the focus has shifted to assuring implementation, managing, measuring, and continually improving the process (Cooper 2001, Griffin 1997b). Studies into the characteristics of successful and unsuccessful new products reveal a strong link between NPD process activities and the success or failure of new products (Cooper 1994). Griffin (1997b) states that “using a formal NPD process and not skipping steps in the process has long been a differentiating factor between successes and failures.” Griffin goes on to say that firms that fail to keep their NPD process up to date will increasingly find themselves at a competitive disadvantage (Griffin 1997b).

New Product Development Process

The basic NPD process as described by Crawford and Di Benedetto (2006) consists of five phases. Phase one, opportunity identification and selection, consists of the ideation of new product opportunities by various methods, including new needs/wants in the marketplace, changes in the marketing plan, and building on existing business operations. This phase also involves ranking the identified opportunities through research, evaluation and validation. Phase two, concept generation, involves selecting the highest potential opportunity and collecting new product concepts by various methods. This is the first phase that includes direct customer involvement. Phase three, concept/project evaluation, is an evaluation of the new product concepts developed in phase two. These

concepts are evaluated based on technical, marketing and financial criteria and the best two or three concepts are selected for development. Phase four, development, has two dimensions, technical and marketing. On the technical side, development teams undertake the design and testing of prototypes. Production of these prototypes is scaled up as necessary for product and market testing. On the marketing side, strategies, tactics and launch details of the marketing plan are prepared. The final phase, launch, is the commercialization of all plans and prototypes from the development phase. At this stage, the new product, depending on the marketing plan, may be marketed on a limited or full scale basis.

Cooper and Kleinschmidt (1986), rather than laying out a step-by-step NPD process, identify thirteen key new product process activities. These activities consist of: an initial screening, preliminary market assessment, preliminary technical assessment, detailed market study, predevelopment business/financial analysis, product development, in-house product tests, customer product tests, trial sell, pilot or trial production, pre-launch business analysis, production/operations start-up, and market launch. While Cooper does not specify the order in which these activities should be carried out, he finds that with some variation, when companies follow a defined NPD process these processes will naturally fall into roughly the same order (Cooper and Kleinschmidt 1986, Cooper 2001).

The NPD process descriptions as detailed by Crawford and Di Benedetto and Cooper demonstrate that there is no consensual “right” way to carry out the NPD process. Given the diversity of industries and of organizations even within the same industry, as well as

the complexity of the NPD process, no single set of NPD activities or steps can be defined as “right” for all firms (Calatone 1995). Even so, previous research indicates that most firms within an industry follow similar NPD processes (Griffin 1997b, Cooper 1994, Calatone 1995). A well-defined and clearly understood NPD process provides a roadmap for a company to follow from idea to launch that incorporates the success factors of NPD by design, rather than by chance (Cooper 2001). Defined NPD processes have go/no go points built in so that companies do not waste resources on concepts that do not meet technical, market, or financial criteria.

NPD processes are continually evolving and becoming more complex with time. Companies increase the complexity of their NPD process as a result of identifying new situations and issues that must be addressed (Griffin 1997b). For instance, increased competition causes companies to refine their NPD processes in order to speed time to market (Griffin 1997b). Additionally, firms increasingly use more sophisticated market research methods, e.g. voice-of-the-customer or lead-user, in order to ascertain user needs and improve their understanding of the target market.

New Product Success and Failure

An estimated 25-60 percent of new products fail (Griffin and Adams 2004, Cooper 2001, Hultink et al. 1997, de Bretanni 2001). The rate of failure for new products varies depending on the industry and on how a “new product” or “failure” is defined (Cooper 2001). De Bretanni (2001) argues that in order to understand why new products fail, it is necessary to first look at the type of innovation involved. As previously discussed, radical

innovations frequently use technology new to the world or to the firm, which is associated with both higher levels of uncertainty and risk of failure (de Brentani 2001). Furthermore, they often are more difficult to produce and require a greater commitment of efforts and resources by the company than do incremental innovations (de Brentani 2001). Crawford and Di Benedetto (2006) estimate that each year over a hundred million dollars is spent on the technical phase of new product development alone.

There are numerous definitions of what constitutes a failed product. One definition is a product that successfully made it into the test market, but never garnered enough interest to be introduced on a larger scale (Crawford 1977). Another definition is a product that fails to draw customer interest causing stores to remove the product from their shelves (Crawford 1977). A third definition comes from the marketing management perspective, namely, a product is considered a failure if it does not meet expectations (Crawford 1977). As part of the NPD process, management establishes their expectations, or goals, for the new product (Crawford and Di Benedetto 2006). For instance, management may state that the intent of introducing a particular new product is to gain a 5 percent market share in the target market. If the product fails to meet this stated goal than it did not meet expectations and is considered a failure. Low-profit products, even those that are kept in the product line, are also sometimes defined as “failures” (Crawford 1977). This is due to the fact that had the company known prior to the introduction of the product that it would generate so little profit, the product would have been killed during the NPD process rather than launched. It is important to keep in mind, however, that this last definition of failure does not include such products as infrequently purchased, but highly

specialized and necessary products, e.g. some medications, or products designed to fill out a product line (Crawford 1977). The conclusion to be drawn from these various definitions is that the definition of product failure is company specific and each company must clarify how they will define a “success” or a “failure” as part of their NPD process.

Crawford and Di Benedetto (2006) claim that the introduction of a successful new product can benefit an organization more than any other business practice. A study conducted by the Product Development & Management Association shows that, on average, a third of a company’s sales come from products introduced within the past five years (Griffin 1997a). Furthermore, a best practices study shows that top performing firms derive 49.2 percent of sales and profits from new products (Cooper 2001). Additionally, these new products achieve 47.3 percent market share in their target markets and have an average payback period of 2.49 years (Cooper 2001).

While radical innovations entail a much higher degree of risk and cost to the company, they are also the products by which a company can expect to gain large profits or achieve major competitive advantage (de Brentani 2001). Incremental innovations, while typically providing lower returns than radical innovations, have a lower level of risk and potential cost to the company, thereby frequently demonstrating a higher rate of success (de Brentani 2001). Most companies utilize a mixed portfolio of new products, including items classified as both radical and incremental innovations (Cooper 2001, de Brentani 2001). However, a best practices study shows that despite being more profitable, radical

innovations only comprised 10 percent, as compared to 47 percent for incremental innovations, of the total portfolio of new product introductions (de Brentani 2001).

Many factors contribute to the success of a new product. Previous research into the forest industry has identified four key factors for successful new product development (Bull and Ferguson 2006, Crespell et al. 2006, Stendahl et al. 2007). First, the product must have superior customer value in respect to competing products. Second, the company must have an organized new product development strategy which is supported by the entire organization. Third, the company must have a market oriented corporate culture. Finally, there must be support for product development from the senior management of the company.

The first of these four factors, establishing superior customer value with respect to competing products, is a matter of customer perception (Zeithaml 1988). According to Woodruff (1997) “Customer value is something perceived by customers rather than objectively determined by a seller.” Customer value is the trade-off between what a customer receives and what they give up to acquire and use a product (Woodruff 1997). Benefits to the customer include product features, quality and service. Sacrifices to the customer include the amount the customer paid for the product plus the time and effort spent acquiring the product and learning to use it. Also taken into account are the costs to use, maintain and dispose of the product. Therefore, in order to create superior customer value, the perceived benefits must outweigh the perceived sacrifices. It then follows, that for a new product to succeed, customers must ascribe a higher customer

value to the new product than the competitor's product. Listening to and integrating the voice-of-the-customer early into the new product development process is the best way to assess customer perceptions (Cooper 2001).

NPD Tools

There is a wide variety of information available to companies concerning NPD tools and "best practices." Sources such as private reports furnished by market research firms, online courses, and numerous research facilities offer summations of which tool, or combination of tools, will best facilitate successful NPD. In reality, NPD tools, like NPD processes, are constantly evolving and becoming more sophisticated (Griffin 1997b).

Therefore, it is not possible to state that one tool, or set of tools, is "best" in all cases.

The ways in which companies manage NPD, and by extension the NPD tools they choose to utilize, are affected by both company orientation (Crespell et al. 2006) and the various drivers of innovation (Cooper 2001, Griffin 1997b).

Company orientation dictates which NPD tools the company will choose to utilize.

Companies with a production-orientation tend to focus on process innovation (Crespell et al. 2006). Process innovation addresses a company's production or delivery method, both attributes internal to the company. Tools that will be used in this situation include firm evaluations of current processes, with a focus on assessing problem areas and identifying areas where improvement is desired (Goldratt 1992). Another tool that might be used by production-oriented companies is a competitor study to identify how other companies solved similar problems. Mature industries in general also tend to focus on

process innovation (Crespell et al. 2006). Market-oriented companies, however, often balance product, process and business system innovation (Damanpour et al. 1989, Crespell et al. 2006). In contrast to process or business systems innovation which require more internal assessments, product innovation requires that companies carry out external assessments, i.e. market research, specifically into the needs of the target users.

Drivers of innovation, such as increased competition and shortened product life cycles, cause organizations to put into action changes that speed products through development, improve efficiency, and improve NPD effectiveness (Griffin 1997b). Cooper (1994) states that doing their “homework” upfront, is one of the best ways a firm can both reduce cycle time and time to market. Therefore, tools that precede the development of a product, such as market studies and technical feasibility assessments, become even more critical to the NPD process. A major time waste occurs when products are poorly defined, usually as a result of poor pre-development activities, when entering the development phase. A product is poorly defined when it has a vague target or shifting goal (Cooper 1994). Market research clearly identifies the target user, and describes this user in terms of their needs and behaviors. This information is critical to firms both in creating an appealing product and in developing a successful marketing campaign. Furthermore, firms that perform good up-front research are better able to anticipate problems and likely changes in the product design (Cooper 1994). The earlier a company can address problems in the product design, the less time and money are wasted on faulty products.

The best performing firms are those that simultaneously use multiple NPD tools effectively (Griffin 1997b). However, this is only one aspect of successful NPD. The best performing firms are those that adhere to a specified NPD process and utilize NPD tools in a meaningful manner (Cooper 2001, Cooper 1994). Despite this, a significant percentage of firms fail to do so. A PDMA best practices study found that 38.5 percent of firms either did not use or used only an informal NPD process (Griffin 1997b). Previous research in the forest industry reveals similar findings with a substantial number of companies responding that they lack programs to systematically capture innovative ideas and/or processes to promote innovativeness (Hansen 2006). Additionally, firms generally invest relatively little on up front activities, such as market research, spending on average only seven percent of the project's total expenditures and devoting only sixteen percent of person days on these crucial activities (Cooper 1994). However, firms that did invest wisely in these up-front activities released fewer failures to market and received higher returns on successful products (Cooper 1994).

Voice-of-the-Customer Market Research

“Innovation is a collaborative effort. It requires active cooperation and communication between the marketers and the designers and between the creators and the users” (NII 2004).

Origins of Voice-of-the-Customer

The term “voice-of-the-customer” grew out of the quality movement that began in the United States in the early part of the twentieth century. The American Society for Quality

and Reliability defines quality as “the totality of features and characteristics of a product or service that bear on its ability to satisfy given needs” (Gehani 1993). In the United States the original impetus for quality derived from the need for rapid industrialization (Gehani 1993). One of the earliest theorists, engineer Fredrick W. Taylor, pioneered the concept of “scientific management.” He suggested that a systematic analysis of the movements involved in any operation would reveal that each operation could be divided into simpler tasks, each of which could be performed in a pre-determined “one best way” (Maguad 2006, Gehani 1993). Taylor’s method was designed to ensure quality by standardizing production, an important undertaking for an era when production was shifting from master craftsmanship to mass production in factories.

Following World War II the Japanese made great strides forward in the quality movement. In the 1950s and 1960s Japanese manufacturers focused on quality in an effort to recover from post-war destruction and their image as “producers of shoddy goods” (Gehani 1993). Japanese manufacturers adopted and integrated several different quality management theories that became part of the quality value-chain. These theories included famed statistician W.E. Deming’s process control and process variation reduction theory, which dictated that statistics be incorporated into production planning and control so that workers would be able to monitor and control product quality in the production process. Another theory adopted by the Japanese was Joseph Juran’s cross-functional (i.e. company-wide) integration, which advocated hands-on leadership and involvement by senior management and the integration of quality management into all departments rather than delegating it to a single department (Gehani 1993).

The quality movement re-gained momentum in the United States during the 1980s. While quality had initially been a shop-floor issue addressed by the foreman, it had become a strategic element of planning and mission defined by top management (Gehani 1993). Maguad (2006) identifies five emergent forces that demanded a quality reform (1) greater complexity and precision of products, (2) threats to human society, health, and the environment, (3) government regulation of quality, (4) the rise of the consumerism movement, and (5) intensified international competition in quality. The convergence of these forces put the spotlight on the issue of quality; this, in addition to the growing belief that quality improvements lead to greater profitability (Griffin and Hauser 1993), caused companies to adopt quality as an essential strategy. In terms of product development, these various drivers of quality emphasized the need for companies to both collect verbalized customer needs and observe customer behavior (Gehani 1993), i.e the “voice-of-the-customer.”

Voice-of-the-Customer

The voice-of-the-customer (VOC) is a category of market research techniques used to capture customer’s needs. A frequent fallacy in the use of the term VOC is to apply it to almost any market research technique that relies on customer input (Katz 2001).

However, there are four key components to VOC: (1) a complete set of customer wants and needs, (2) expressed in the customer’s own language, (3) the wants/needs are organized in a hierarchy, and (4) the hierarchy is prioritized based on the relative importance and current performance/satisfaction (Katz 2001, Griffin and Hauser 1993).

VOC studies are generally conducted at the start of a new product, process, or service

design development in order to best apply the customer needs and generate the highest level of customer satisfaction (Griffin and Hauser 1993).

A customer need is a description, in the customer's own words, of the requirement to be fulfilled by the proposed product or service (Griffin and Hauser 1993). A customer need is not a solution or a physical description, but rather a detailed description of features that the customer would like to see in the product or service. The actual concept generation is carried out by a product development team within the company. Griffin and Hauser (1993) argue that the reason product development teams should not ask a customer for solutions is that it causes them to focus on solutions too early in the process. Focusing on solutions too early in the design process can cause developers to focus on individual design attributes, rather than considering all aspects of the product that affect the customer needs.

Surveys of customers usually identify 200-400 needs, ranging from needs customers expect the product to fulfill, to needs that the customer wants to see satisfied, to needs that it would be nice to see met, but are not essential (Griffin and Hauser 1993). Due to the large number of reported needs, they are arranged in a hierarchy and structured into primary, secondary and tertiary needs (Griffin and Hauser 1993). This enables the development team to identify the strategic needs (primary), i.e. the project parameters and performance requirements, and then elaborate on these needs with the tactical needs (secondary), i.e. specifics to be addressed, and the operational needs (tertiary), i.e. details (Smith and Love 2004, Griffin and Hauser 1993).

Customer needs are prioritized so that decisions can be made balancing the cost of fulfilling a customer need with the desirability, to the customer, of fulfilling that need (Griffin and Hauser 1993). A product consists of a set of features, which are set by the design parameters, which are in turn determined by the functional, symbolic or experiential requirements that correspond to specific customer demands (Park et al. 1986, Chen et al. 2003). Therefore, establishing the needs upon which the customer places the highest priority tells developers what features a product must have to satisfy the essential needs of the customer. Customer needs can be expressed in terms of three categories: revealed, expected and exceptional requirements. Revealed requirements are those needs that satisfy, or dissatisfy, the customer in direct proportion to their presence, or absence in the product or service (Mazur 1997). For example, the faster a product is delivered, the more the customer likes it and vice versa. Revealed requirements are typically the needs that the investigator discovers simply by asking the customer what they want. Expected requirements are the basic functions that customers expect from a product or service, without which the product or service might cease to be of value (Mazur 1997). While these needs are often so basic that customers may not mention them without prompting, failing to meet these requirements is not an option. The last category is exciting requirements. These are the requirements that exceed customer expectations (Mazur 1997). While the absence of these requirements would not cause customer dissatisfaction, their presence tends to make the customer particularly happy. These are the most difficult needs to discover, because customers are unlikely to voice these requirements, instead these are the needs that are typically imagined by the company in order to fulfill a need

the customer might not have recognized until presented with a product or service meeting that particular need.

Input into design decisions is also gathered from customer perceptions of products or services that currently compete in the market of interest (Federman 2001, Griffin and Hauser 1993). This assessment looks into which product within the market fulfills which needs best, or, in lieu of an existing product, how customers are fulfilling those needs. It also looks into customer satisfaction with how their needs are currently met, perceptions of service quality, and whether or not any gaps exist between the best competitor's product and the company's own current products (Federman 2001).

Methods

While there is no one right way to gather the VOC (Katz 2001), one of the more common methods is "Quality Function Deployment" (QFD). The earliest QFD models focused on quality assurance in the factory so that production processes would deliver goods as designed (Mazur 1997). As QFD became more common, the focus shifted from assuring purely quality products to assuring quality designs. The most recent QFD models were popularized first in Japan during the mid-1970s. These models shifted the focus of quality once again, this time to the quality of understanding the customers' requirements that determine the designs (Mazur 1997). Griffin and Hauser (1993) describe QFD as a "total-quality-management process that uses the voice-of-the-customer to inform the research & development, engineering, and manufacturing stages of product development." Akao (2004) defines QFD as a process which

converts the consumers' demands into 'quality characteristics' and develops a design quality for the finished product by systematically deploying the relationships between the demands and the characteristics, starting with the quality of each functional component and extending the deployment to the quality of each part and process.

Research indicates that cooperation and communication between departments responsible for the different stages of production leads to greater new product success and more profitable products (Griffin and Hauser 1993). QFD improves communication between the different departments by linking the voice-of-the-customer to decisions at the engineering, manufacturing and R&D stages. This method relies on interfunctional teams that use a series of matrices, often referred to as "houses," to utilize customer input at each stage of the production process. In this method, multiple departments might carry out market research (Griffin and Hauser 1993). QFD uses customer perceptions of their needs to understand how product characteristics and services affect customer preference, satisfaction, and purchasing decisions (Griffin and Hauser 1993).

QFD uses four "houses" to present data. The first of these four houses, known as the "House of Quality," is also considered by many to be its own method of collecting VOC (Akao 2004). The "House of Quality" links customer needs to design attributes (Griffin and Hauser 1993). Design attributes are not limited to the physical aspects of a product, but also encompass other aspects such as service. The "House of Quality" (Figure 1) forms a matrix plotting customer needs, listed in order of importance to the customer, against the product, or technical requirements, specified by the manufacturer. The matrix shows where there are strong, moderate, or weak correlations between what the customer feels is important and the design requirements the company feels are important. The

“roof” of the house is used to denote in what categories compromises will or will not be made. Design decisions are then made based on these compromises and the strength of correlation between customer needs and technical requirements.

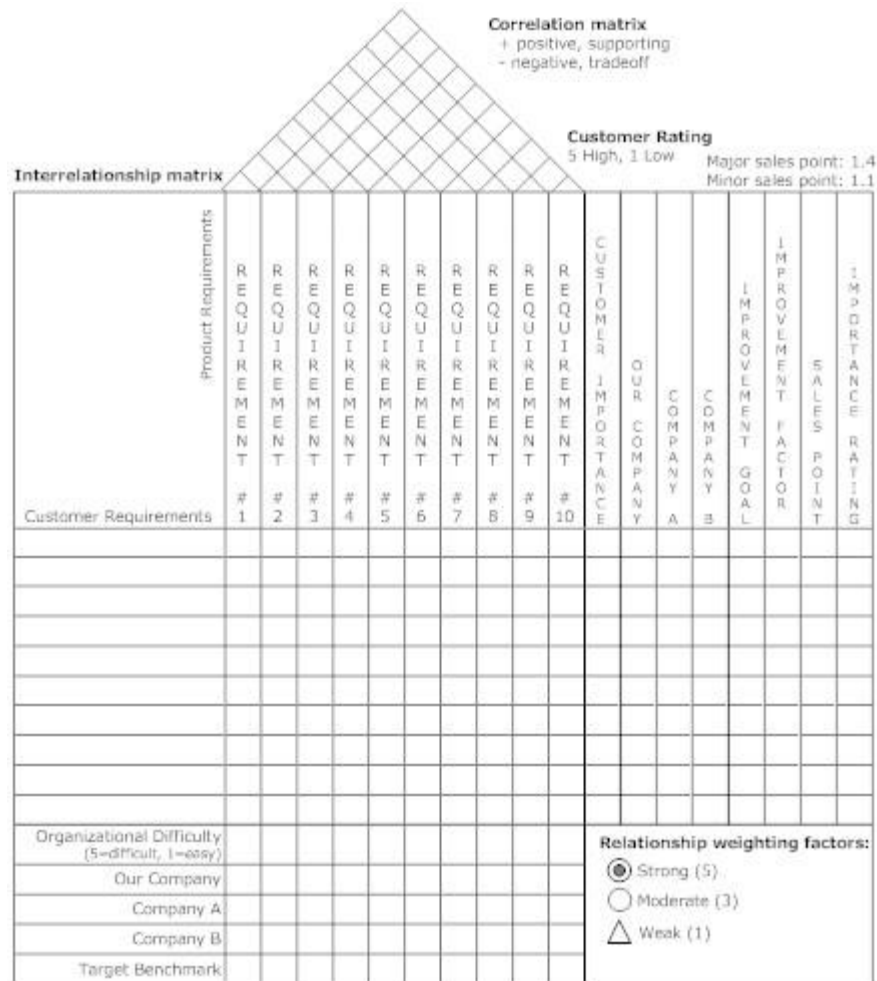


Figure 1: The “House of Quality” matrix (Project Management Hut 2008)

VOC consists of both qualitative and quantitative research. An oversight by many when addressing VOC data is to not address both the words and numbers collected (Katz 2001). Qualitative and quantitative research are often considered to be mutually exclusive,

however, this is not the case in VOC research. Customer needs can be expressed in both words and numbers. Examples of customer needs in number form include, but are not limited to, levels of satisfaction with a product or service (often expressed using a Likert type scale of 1-5 or 1-7), the number of times a particular product or service has been used, and the level of agreement with a particular statement (generally expressed on a scale of 1-5).

Tools

Tools used to collect VOC vary depending on the desired information and the method the investigator wishes to use to integrate the VOC. Various tools include customer surveys, focus groups, personal interviews, contextual inquiry, ethnographic techniques, etc. The common aspect shared by all of these tools is that each involves a single or a series of structured, or semi-structured, interview(s) that focus on the customers' experiences with current products or alternatives in the market of interest. The collected needs are then organized and analyzed using one of various methods.

A simple example of VOC research is a customer satisfaction survey. This type of survey is generally administered either concurrent with or directly after the acquirement of a product or service. It typically asks a series of questions that build on each other. For example, the first question might ask whether or not the customer is satisfied with the good(s) or service(s) they just received. This question could ask for a simple yes or no response, or it might ask for a response on a Likert-type scale (e.g. 1 = very unsatisfied, 7 = very satisfied). To determine the exact reason for this response, the next question

might ask for an explanation of why the customer was either satisfied or not satisfied with the good(s) or service(s). A more in depth survey could follow this up with another question asking the customer what they would change about their experience. This third question is similar to a lead-user study as it is asking the customer for a solution to their dissatisfaction. Unlike a lead-user study, however, customer satisfaction surveys are generally administered to as many customers as possible. The data collected from these surveys are examined for commonalities in order to organize the responses into meaningful categories. These categories are organized into a hierarchy based on the frequency of their mention.

Using Lead-Users in Product Development

Defining a Lead-User

Previous research shows that from 10 to nearly 40 percent of users engage in modifying or developing products (von Hippel 2005). Studies of these innovators, both individuals and firms, reveal them to be “lead-users.” Lead-users are defined as those individuals or firms within a user population who (1) are at the leading edge of important trends, i.e. are presently experiencing needs that will later be experienced by many users, in the marketplace of interest and (2) anticipate realizing relatively high benefits from obtaining a solution to their needs and as a consequence may innovate (von Hippel 2005, von Hippel 1986).

The definition of a lead-user has two dimensions. The first dimension, being ahead of important marketplace trends, is expected to predict the commercial attractiveness of

innovations (von Hippel 2005, von Hippel 1986). The theory of innovation diffusion states that some users, i.e. innovators and early adopters, will regularly adopt innovations before other users in the marketplace (Rogers 1983). These innovators and early adopters, i.e. “lead-users,” are therefore the best predictors of what will be needed later by the majority. Additionally, other research shows that most people are constrained by phenomena known as “design fixedness” and “functional fixedness.” Design fixedness is characterized by the fixation on a known or suggested design solution, despite obvious flaws, because it was either the first solution to meet some threshold criteria or because of reluctance to change from an initial kernel idea (Busby and Lloyd 1999). Functional fixedness is defined as the inability to imagine a novel application for a particular item due to familiarity with its present application (Lilien 2002, Ulwick 2002). Lead-users, however, are generally best able to imagine novel solutions to needs (Franke 2006), such as applying knowledge from an unrelated field or making connections to similar materials used for other purposes, and thereby overcome functional fixedness (Lilien 2002).

The second dimension of the lead-user definition, the high expected benefits, derives from research into the economics of innovation. The economics of innovation serves as an indicator of the probability of innovation. Previous research of industrial product and process innovations show that the more an individual expects to benefit from a needed innovation, the greater investment he or she will have in obtaining a solution (Franke 2006).

Traditional Product Development vs. Lead-User Concept Generation

Traditionally, product development begins with market researchers studying users within the target market in order to ascertain unfulfilled needs. This information is then provided to in-house developers, who are charged with developing a product that satisfies these needs (Crawford and Di Benedetto 2006). Market researchers use methods such as market surveys, customer rating, focus groups, and so on, to collect information about the needs and wants of the “average” user. The average user, consisting of the early and late majority of adopters, represents approximately 68 percent of the market population (Rogers 1983). The rationale behind addressing the needs of average users is fairly logical. Average users represent the largest portion of the market population. Therefore, products designed to satisfy their needs should have the most commercial appeal (Ulwick 2002).

On the other hand, there are limitations to the information gained from “average” users. Innovations derived from these users tend to be incremental rather than breakthrough improvements (Lilien 2002). As previously stated, this is largely due to their “design fixedness” and “functional fixedness.” Moreover, products suggested by these users are frequently inefficient and ultimately not what consumers want (Ulwick 2002). This is a result of the user not recognizing their true need and instead reporting symptoms of the real need. Finally, traditional market research asks the users purely for their needs, which leaves the actual generation of the product solely up to the firm’s development team. The drawback to this is that the product is based on how the development team interprets the reported customer needs, a perception which may or may not be what the customer intended (Crawford and Di Benedetto 2006).

The lead-user approach to product development is substantially different than the traditional approach manufacturers take to product development. First, lead-user market research addresses a significantly different group of users than traditional market research methods. While traditional market researchers study the “average” user, they regard individuals at the leading edge of the market, or at the lagging end, as outliers and not of interest (von Hippel 2005). Research, though, demonstrates the importance of investigating the “outliers” at the leading edge of the market (von Hippel 2005). The degree of difference, however, between study subjects in lead-user as opposed to traditional market research means that traditional processes of market research are not easily adapted to the lead-user approach.

The lead-user market research method as developed by von Hippel (2005, 1986) consists of four primary steps. First, the researcher must identify what characteristics a lead-user in the product and or market segment of interest must possess. Second, the researcher identifies actual lead-users who fit these criteria. Third, researchers bring the lead-users together with in-house developers and engineers to engage in a group problem-solving session(s). Fourth and finally, the research and development team test whether the concepts generated by the lead-users will also be valued by average users in the target market.

Lead-user market research tends to generate more breakthrough improvements than traditional methods (Lilien 2002). This is due to lead-user studies asking the user not only for their unfulfilled needs, but also for their solutions for these needs (von Hippel 2005,

Ulwick 2002). Lead-users are able to suggest solutions to needs as they typically have fuller understanding of the new product and service needs for their industry (Herstatt and von Hippel 1991) and a greater willingness to create solutions for these needs. Research shows that ultimately concepts generated simultaneously with need recognition are superior to those concepts generated from pure need assessment (Lilien 2002, Goldenberg et al. 2001, Finke et al. 1992). A study conducted within one firm (3M) found that ideas generated by the lead-user process had significantly higher novelty (i.e. “new to the world”), addressed more customer needs, had significantly higher forecasted market share (on average 68 percent versus 33 percent for non-lead-user ideas), and eight times higher projected sales (\$146 million annual sales versus \$18 million) than projects originating from traditional methods (Lilien 2002). Furthermore products developed in collaboration with lead-users have demonstrated a higher rate of new product success (Gruner and Homburg 2000).

Lead-user market research does have some limitations. First, lead-user research requires significant time and resource commitments. A great deal of time is required at each step of the lead-user approach, from identifying characteristics and lead-users, to organizing group sessions, to testing concepts. Many firms are not willing or able to commit the time and resources needed, especially since the outcomes of the lead-user approach are not guaranteed market success. Second, products developed by this method may have limited or delayed commercial appeal. Since lead-users are anticipating the needs of the greater market population, users may not at present have the needs that the lead-user generated concept fulfills. Third, needs and solutions suggested by lead-users may be fairly

heterogeneous, i.e. specific to their needs, limiting the broader appeal of the generated concepts. Fourth, despite several published applications of the lead-user method which show promising findings, little empirical evidence exists to support the application of this method (Lüthje and Herstatt 2004). This lack coupled with the method's uniqueness, means that most firms possess limited knowledge as to how to carry out lead-user concept generation. Finally, in many cases lead-users are difficult to differentiate from average users.

Differentiating Lead-Users from "Average" Users

While studies show that lead-users tend to generate attractive user innovations, one of the key difficulties in carrying out lead-user new product development is in differentiating and identifying lead-users from other users. Von Hippel's (1986) definition describes the actions of a lead-user, but it does not address the characteristics that make an individual a lead-user. This omission is addressed Schreier and Prügl (2008) in their study looking at the antecedents of "lead-userness." This study identifies three key characteristics of a lead-user. First, lead-users tend to possess greater consumer knowledge and use experience in the product market. Consumer knowledge refers to the previous knowledge a consumer can draw on when making a consumption decision, e.g. selecting the appropriate product for a task, while use experience refers to a consumer's familiarity with the function and usage of a product. Therefore, lead-users are those individuals who frequently demonstrate a more extensive knowledge of performance and physical product attributes in addition a high familiarity with the use of a product. Based on this richer understanding, lead-users are better able to push the boundaries of the product category.

Second, lead-users demonstrate the belief that outcomes are determined by one's actions. Studies show that individuals who have a strong sense of this trait tend to be more creative. In terms of lead-users, this creativity translates into willingness to deal with new usage situations and risky propositions, appreciativeness of improvements to existing products, and innovativeness. Third, lead-users have innovative personalities. Innovativeness is described as a predisposition to innovation, i.e. a willingness or an openness to change (Knowles 2007). In other words, lead-users are those individuals who are most likely to look for new products and to be able to cope with change. The consequence of these lead-user characteristics is that lead-users tend to adopt new products faster and more frequently than average users (Schreier and Prügl 2008, von Hippel 1986). Also, lead-users, who are on the leading-edge of market trends, tend to be the first to experience needs and consequently expect high benefits from new solutions (von Hippel 1986).

Wood Window Market

There are numerous window materials, styles, and features available on the market today. The four most common materials used for the framing members, i.e. jams, sills, stiles, rails, mullions and muntins (Figure 2), of windows are wood, aluminum, vinyl, and fiberglass (Window & Door 2008). These materials are used both separately in window construction, e.g. a solid wood window, and together, e.g. a wood window with exterior aluminum cladding.

Anatomy of a Window

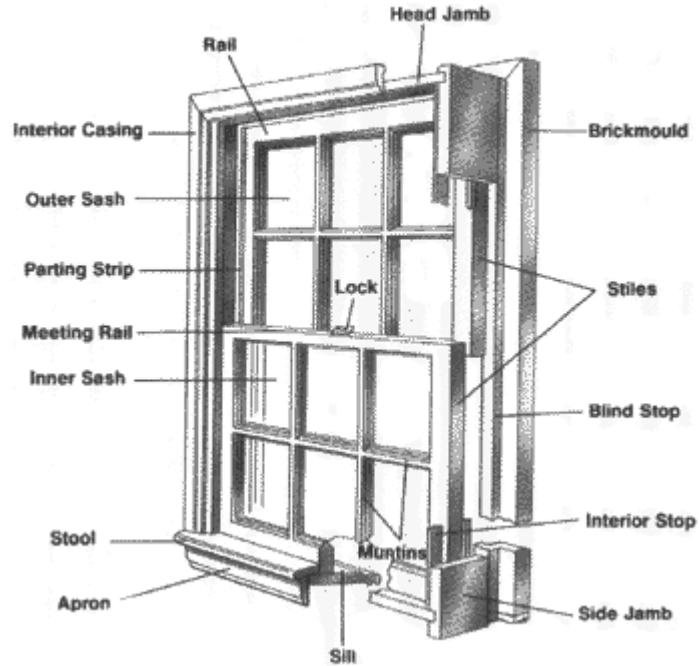


Figure 2: Diagram of a wood window showing the different framing members (www.wdma.com)

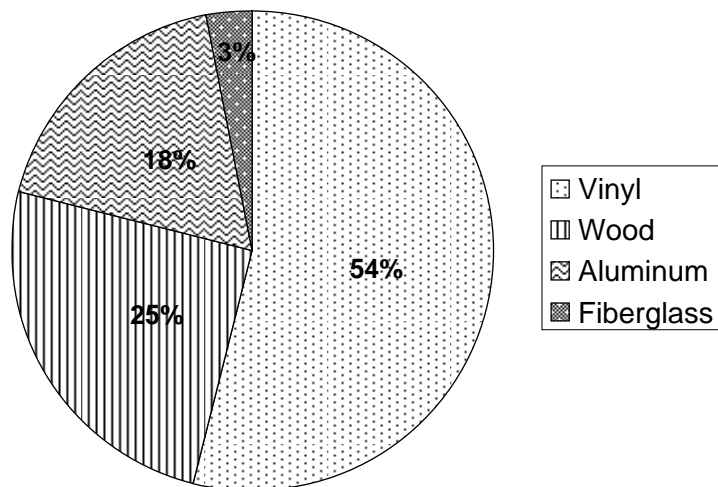
Some typical window styles used in homes include single-hung, double hung, casement, awning, bay and bow windows. Window styles are classified based on a number of factors. These factors include how a window is shaped, i.e. bay and bow windows both project from a home, whereas other windows are flush with the exterior of the building. A second factor is where the window is hinged, i.e. awning windows are hinged at the top, while casement windows are hinged on the side. Another factor is how the window opens, i.e. awning windows swing out at the bottom to open, while casement windows swing open in a vertical plane. Additionally, windows are classified by what portions of the window are moveable, i.e. double-hung windows have two sashes that can be open

and closed vertically, whereas in single-hung windows the top portion of the window is fixed and only the bottom sash is moveable (Windows and Doors Manufacturers Association (WDMA) 2008).

Market Share of Wood Windows

In terms of residential market share, vinyl is the most popular window framing material in the U.S. In 2007 13.2 million vinyl units were sold for new construction, while 22.5 million units were sold for remodeling and replacement purposes (Windows & Doors 2008). Of the other three primary framing materials, wood was the second most popular with 6.2 million units for new construction and 8.9 million units for remodeling and replacement, aluminum was the third most popular with 4.4 million units for new construction and 1.9 for remodeling and replacement, and fiberglass was the fourth most popular with 0.8 million units for new construction and 0.5 million units for remodeling and replacement (Windows & Doors 2008). Figure 3 shows the market share percentage for the four most common window materials in new construction (Figure 3A) and remodel/reconstruction (Figure 3B).

A: Market Share of Window Materials for New Construction



B: Market Share of Window Materials for Remodel/Reconstruction

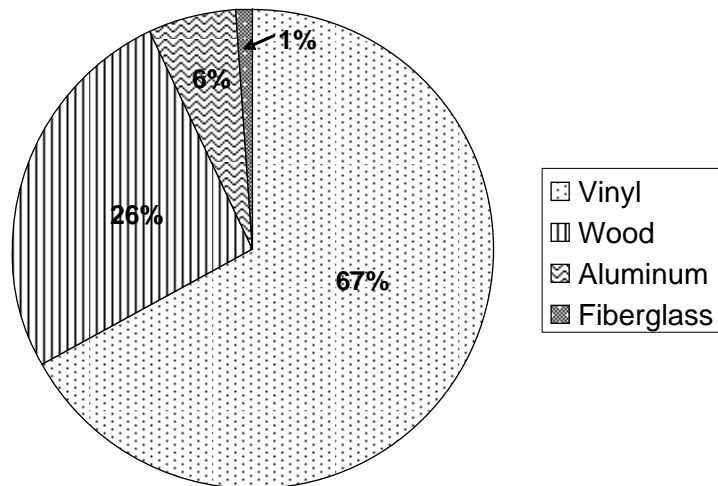


Figure 3: Market share of window materials in new construction (A) and remodel/reconstruction (B). Data from Windows and Doors 2008.

While vinyl is the most popular framing material at present, wood windows maintain a steady market share. The reason for this is that wood windows provide several key

advantages. Aside from being a renewable resource, wood also requires less energy for processing and the production process results in fewer pollutants (WDMA 2008). Additionally, wood is a natural insulator. As an insulating material, wood is 400 times more effective than steel and 1800 times more effective than aluminum (WDMA 2008). Furthermore, research shows that when properly installed and cared for, wood windows have a longer life span than the other materials, particularly aluminum and vinyl, which have a tendency to rust, corrode, or warp over time (WDMA 2008). Wood windows can also be refinished as needed. Perhaps the primary factor in selecting to use wood windows, however, is appearance. Wood is typically preferred to the other materials for its aesthetic value. Window manufacturers have even developed what are known as “clad” windows so that homeowners can enjoy the benefits of both low maintenance and aesthetics (WDMA 2008). Clad windows are windows that have vinyl or aluminum bonded to the wood members within the window. The aluminum or vinyl surface is most typically only on the exterior of the window, but it can also be interior. This reduces window maintenance and helps protect the wood from the natural elements, but still provides the aesthetically pleasing appearance of wood framing on the interior of the building.

Window Innovations

Clad windows are one example of how wood window manufacturers have innovated to meet market demands. Other recent innovations include integrated blinds and shades, which are blinds or shades sealed between two panes of an insulated window and operable by a mechanism on the interior side of the unit; low-emittance glass, which is

glass coated with a clear material that improves thermal efficiency, cuts glare, and mitigates the transmission of ultra-violet rays; and glass that can lighten or darken when a low-voltage current is passed through it, which is useful for privacy purposes or to lessen glare (WDMA 2008). While these later innovations are not wood window specific, they demonstrate that the window industry is constantly looking for ways to meet emerging customer needs.

Methods

Data for this study was collected through the use of personal interviews. The personal interview is a common qualitative research tool. In this method, data is collected by means of a direct, face-to-face or over the telephone conversation between the interviewer and the interviewee. The interviewer asked questions of the interviewee and recorded their responses either during the interview or immediately after. Following the voice-of-the-customer methodology (von Hippel 1986), responses were recorded in the exact terminology used by the interviewee.

Methodology

Personal Interviews

Personal interviews have a number of advantages over other data collection methods.

First, personal interviews have the potential to overcome the poor response rates associated with other survey methods, e.g. mail survey (Barriball and While 1994, Goyder 1985). This is particularly true for interviews conducted with lead-users. Unlike randomly selected potential respondents, lead-users are generally more willing to participate as they expect to benefit significantly from study outcomes (Herstatt and von Hippel 1992).

Additionally, lead-users typically want to share their expertise. Another advantage of the personal interview is that it enables the researcher to explore the respondent's attitudes, motives, and beliefs in more depth (Barriball and While 1994) than through other methods. Furthermore, in personal interviews, particularly unstructured, or semi-structured interviews, respondents often provide answers to questions that the interviewer did not ask or did not think to ask. While there are also several disadvantages

to the personal interview method, such as significant time requirements and higher expenses, the relatively small sample size in this study mitigated these to a certain extent.

Interviewing Lead-Users

Using a modified approach to von Hippel's "lead-user" market research method, data in this study was collected in the form of words and ideas. In this study step one, *specify the characteristics a lead-user will have in the product and or market segment of interest* (see Study Design), and step two, *identify lead-users who fit these criteria* (see "Sample Selection" under Data and Analysis), remained the same as the lead-user market research design described by von Hippel (1986). Step 3 is where this study differs from von Hippel's. Rather than *bringing the lead-users together with R&D and market personnel from a company to engage in a group problem-solving session(s)*, the researcher spoke with each lead-user individually. This was done both for logistical reasons and because rather than trying to assist one company in developing new products, this study was designed to demonstrate a research tool to companies. Finally, step four, *test whether the concepts found valuable by the lead-users will also be valued by average users in the target market*, is not carried out in this particular study.

The key aspect of lead-user market research, as compared to typical VOC research, is that respondents are asked not just for their needs, i.e. words, but also for their solutions, i.e. ideas. While von Hippel's lead-user research initially was developed to address high technology fields, such as software, where products quickly become obsolete, research shows it can be applied to less dynamic industries, such as wood windows (Fell et al.

2007). For that reason respondents were asked questions about specific ideas they have for new window products and services.

Study Design

This study used a single case study with embedded multiple units of analysis research design. This method was used in order to permit analysis at various unit levels, e.g. window market, locale, and profession. As stated by Herstatt (1992), the lead-user market research method is “built around the idea that the richest understanding of new product and service needs is held by just a few ‘lead-users.’” Consequently, units of analysis were selected based on their identification as individuals who exhibited the identified lead-user characteristics in the wood window industry. The identified lead-user characteristics employed in this study were: a extensive consumer knowledge and use experience in the wood window market, creativity (i.e. a willingness to try new products or try existing products in new usage situations), an innovative personality (i.e. a predisposition toward new and uncertain situations), and a propensity for adopting new products and trends faster or more frequently than average users (Schreier and Prügl 2008).

Initially four user categories were identified for each of the two locales. These categories were sales agent, installation specialist, homebuilder and homeowner. However, after beginning to identify and evaluate lead-users, an additional category, architect, was added. Within the categories of sales agent, homebuilder and architect additional sub-categories were specified. For sales agent these sub-categories were full-service retailer (i.e. sell and install windows), do-it-yourself retailer (i.e. sell windows, company may or may not be

hired to install the window), resale/millwork (i.e. company both resells products from manufacturers and manufacture their own custom product), and distributor (i.e. company is responsible for selling products from one specific company to a region). For homebuilders there were two sub-categories, single-location and multiple locations. These classifications were used to denote the size of the company. For architects there were also two sub-categories, individual (i.e. self-employed) and firm. In total there were ten identified user categories for each of the two locales.

Interview Protocol Development

As this study was an elaborative model, i.e. multiple variables were examined, to enable cross-unit comparability semi-structured interview protocols were developed for each of the user categories. Semi-structured protocols ensure that answers to general topics are gathered from all respondents (Flick 2002). Each of the four interview protocols developed for this study had two sections, the first contained general questions used for all respondents while the second contained user category specific questions. For example, all respondents were asked about the factors influencing customer window selection, but only sales agents were asked why their company chose to carry particular window lines over others. The complete interview protocols used in this study can be found in Appendices A-D.

A further function of a semi-structured protocol is as a directing tool to keep both the interviewer and interviewee on topic (Flick 2002). One characteristic of a lead-user is expert knowledge of a particular product and market. The typical lead-user is very willing

to share this expertise, often deviating from the study questions. Therefore a structure to redirect and keep the discussion relevant is important. Furthermore, a protocol provides prompts in case the dialogue between interviewer and interviewee stagnates. Finally, and of great importance in interviews with lead-users, the research involved in developing the protocol ensures that the researcher is able to present him or herself as a knowledgeable participant in a meaningful discussion.

A semi-structured interview rather than a structured interview was used for this study due to the fact that it was a study of lead-users. Structured interviews require interviewers to adhere to a standardized set of questions, meaning that the order and the wording of the questions are fixed. While this method ensures that the same topics are covered by each respondent, it does not permit deeper probing into responses or deviation from the set agenda. In contrast, semi-structured interviews permit researchers to follow-up on particularly interesting responses and to explore emergent themes. While some established general themes are investigated, the majority of a semi-structured interview is directed by the interviewee. In a lead-user study it is expected that the interviewee will allude to an idea that the interviewer did not think to ask. Furthermore, these emergent ideas are often the responses that the interviewer is most interested in and will want to pursue further. Fortunately, the relatively small sample size of the population in this study mitigates one of the key disadvantages of a semi-structured interview, the ability to intelligently summarize the data generated.

The interview protocols used in this study were designed by using the theoretical background provided earlier and from informal discussions with informed individuals, including a sales/installation specialist and a homeowner. As a lead-user study, the intent of this study was to determine new product ideas to satisfy user needs not currently met by existing wood window products and services. To do this the interview protocols asked a series of questions designed to approach this goal from multiple directions. The reason for using this multiple direction approach was twofold. First, while multiple respondents found it difficult to express a new product or service idea when asked without context, when asked about specific challenges encountered or to discuss product features believed important often they vocalized new product and service ideas. Second, asking various questions that addressed the product, services, and processes encouraged respondents to think about the full scope of innovation, rather than focusing narrowly on physical product features.

In accordance with this approach, respondents were asked three types of questions: (1) perspectives of existing products and services and how they meet user needs, (2) user category specific problems and their [the respondent's] solutions, (3) innovative products, either by manufacturers or the respondent. Additional questions were asked to determine (4) to what extent manufacturers are currently utilizing voice-of-the-customer research in new product development and (5) experiences with green building. While personal interviews with lead-users were the main source of information in this study, personal observations, company data, and online resources were also utilized.

(1) Perspectives of existing products and services

While the interview protocols were semi-structured, meaning no set order of questions was followed, all respondents were asked the same two questions to start the interview. These questions concerned product choice. First, respondents were asked to identify what factors of wood windows, e.g. quality, brand, function, service, etc., customers consider when making the decision about which window to purchase. Second, respondents were asked to identify what factors of wood windows they felt were the most important for customers to consider when making the decision about which window to purchase. The motives behind these questions were to ease respondents into the discussion and to start them thinking about specific product features and where the most common window needs might exist. After this point the discussion followed no set course, but rather was guided by responses supplied by the respondent.

(2) User Category Specific Problems and Solutions

The following questions addressed problems encountered and solutions arrived at by users that were specific to their position in the wood window value chain.

Sales Agents

Question	Expected Answer
Why do you choose to carry particular product lines and not others?	Determine what aspects of a manufacturer are most important to the individuals selling the products
What are some of the typical complaints that you hear from customers?	Determine in what areas, i.e. form, function, service, quality, etc. customers are most likely to be dissatisfied to identify areas for manufacturer improvement

What aspects, if any, of storing and/or inventorying windows do you find to be particularly frustrating?

Determine if the company has developed any methods to resolve these issues that manufacturers might be able to incorporate into their packing or shipping practices.

Installation Specialists

Question

Expected Answer

What aspects, if any, of window installation do you find particularly frustrating? How do you resolve these issues?

Identify if the user has developed any specific processes or designed any special tools to improve window installation that manufacturers could utilize to add value to their products

Have you ever modified a window during installation and if so how?

Determine if the user has added or removed any product features that manufacturers may want to address in future designs

Homebuilders/Architects

Question

Expected Answer

Do you typically specify products from the same company, and if so, why?

Determine what aspects of a manufacturer or product are most appealing to these users

What do you do if your client desires a product that is not offered by one of the companies that you commonly use?

Identify unique customer needs and solutions.

What aspects, if any, of window installation do you find particularly frustrating?

Determine if the company has developed any methods to resolve these issues that manufacturers might be able to utilize in adding value to their products

Homeowners

Question	Expected Answer
Describe your experience with wood windows (from selection to post-installation)	Provide an overall view of the window purchasing experience from the point of view of the end-user
Why did you choose to purchase your window from that company, and did you feel limited in your choices?	Determine if there was sometime that the user would have liked to have done but there was not a product to meet his or her needs.
What maintenance issues, if any, have you experienced since your windows were installed?	Determine what features a manufacturer might add to a window to avoid this issue or if encountered suggest how a homeowner might resolve it

(3) Product Innovations

All respondents were asked to address questions about product innovations. The first product innovation question asked respondents what companies or products currently on the market they found to be particularly innovative or exciting. One of the purposes of this question was for the researcher to determine user perspectives of which companies successfully innovate. However, the key purpose of this question was to focus respondents' thoughts on innovation as a lead-in to the next question. The second product innovation question asked respondents if they were to design a wood window to explain what they would add or subtract from what is currently available. This was one of the, if not the key question to this study.

(4) Use of Voice-of-the-Customer Research

All respondents were asked questions concerning the practices of window manufacturers in asking for and utilizing feedback. The first question asked whether or not manufacturers asked for feedback from the users and/or the user's company and if so, how they obtained this feedback. The second question asked whether or not respondents felt that manufacturers utilized their feedback and to provide specific examples. The primary motivation behind these questions was to determine whether or not manufacturers were currently applying voice-of-the-customer research, particularly whether they were applying formalized methods.

(5) Experiences with Green Building

As a result of early interview responses, a question concerning green building was added to the interview protocols. This question queried respondents as to what experiences they have had with green building. An addendum to this question was how the respondent interpreted "green." It was the intent of this question to ascertain the market appeal of products and services that are in some respect green. While this question was primarily targeted at homebuilders and architects, some sales agents were also asked this question.

Pre-Testing

Prior to data collection the interview protocol was pre-tested on one member of the wood window value chain outside of the identified sample. The decision logic for selecting this individual was convenience sampling. While this method may not yield the best results, it saves time, money and effort (Patton 1990). Furthermore, it is a sufficient

method for the purpose of refining the interview protocol and assuring that questions are being interpreted correctly and working appropriately. The lead-user for the pre-test was identified based on the experience of the researcher. This pre-test was conducted following the same procedures described for the actual interviews, with a focus on improving the interview protocol and procedures. Minimal changes were required based on received feedback.

Data Collection and Analysis

Sample Locations

Respondents were identified from two metropolitan locations. Locations were chosen based both on the size of their new home construction market and their anticipated remodel/reconstruction market. Additionally, they were chosen for the differences in their climates.

Portland, OR

In recent years Portland, Oregon, has demonstrated steady growth in new home construction and in remodeling/reconstruction. Portland has an estimated population of 550,396, making it the 30th largest city in the U.S. From 1997-2007 an average of 1,058 single-family new home construction building permits were obtained per year. While the number of obtained building permits does not necessarily equal the number of new homes constructed in a given year, it is good relative estimate. There are no statistics for the number of remodeling/reconstruction projects per year. However, three good predictors of homeowners choosing to remodel or reconstruct a home are existing home

sales, the age of the structure and the effect of climate on the structure. From 2004 to the third quarter of 2007 no fewer than 4,000 existing homes were sold per quarter. From the fourth quarter of 2007-2009 this number dropped to an average of 2,000 homes sold per quarter. What this means for the remodel/reconstruction market is that with the decline in the housing market, homeowners may be more inclined to remodel/reconstruct their existing home rather than build a new home. In terms of age of the structure, 237,269 homes built in Portland prior to March 2000. Of these homes 170,803 of these homes were built prior to 1970, with a further 80,769 built prior to 1939 (Portland, Oregon 2008). Again relating this to the remodel/reconstruction market, older homes are more likely to be remodeled/reconstructed than newer homes. Aging or deterioration of structures due to climate conditions is also a driving force behind the decision to remodel/reconstruct a structure. In Portland, these conditions include an average of 12-18 days of precipitation a month for the majority of the year (Portland, Oregon 2008), wind-driven rain and fog (particularly on the coast, but also further inland), and humidity. Compared to some climates, an average of 12-18 days with precipitation a month might not seem remarkably high, however, the duration of the rainy season in combination with the other factors results in high average moisture content in wood creating an environment conducive to wood-destroying organisms (Mankowski and Morrell 2000). While the impact of weather conditions can be mitigated, when combined with faulty construction or poor maintenance wood will decay as a result of rot, fungi, or insects.

Las Vegas, NV

Las Vegas was chosen as the second locale for this study because in recent years it has also demonstrated a significant amount of new home construction. Las Vegas has an estimated population of 558,800 making it the 28th largest city in the U.S. (Las Vegas, Nevada 2009). This is also a 15.5 percent increase in population from 2000. From 1997-2007 an average of 4,841 single-family new home construction building permits were obtained per year. Like with Portland, while the number of obtained building permits does not necessarily equal the number of new homes that are built in a given year, it is a good estimate. Also like Portland, there are no actual statistics for the number of remodeling/reconstruction projects per year. Again, however, the current decline in new home construction, in 2007 only 2,356 building permits were obtained while in 2003 the number was 6,861, has made the remodel/reconstruction market a key target market for the entire wood window value chain. A unique aspect of the Las Vegas housing market is its highly transient population, only 37 percent of Las Vegas residents lived in the same house five years ago, additionally many homes are built as speculation homes or with the intent to “flip”, i.e. fix-up and resell, quickly. From 2004-2009 no fewer than 7,000 homes were sold per fiscal quarter. In terms of the window market, these statistics suggest that most users will select production, cost efficient products rather than custom or more costly products. Furthermore product selection in Las Vegas is influenced by the hot, windy, and dry climate. Las Vegas has desert conditions with high temperatures of around 100 degrees Fahrenheit in the summer, minimal rainfall, and typically around 216 clear days during the year (Las Vegas, Nevada 2009).

Sample Selection

Interviews in both of these locations were conducted with a range of “lead-users” across the wood window value chain. Five primary user categories were indentified, with additional subcategories for three of these. For example, Sales Agent had four user subcategories, full-service retailer, i.e. retailer who resells windows but also does design and installation work, do-it-yourself retailers, i.e. retailers who primarily resell windows, resale/millwork, i.e. retailers who both resell windows from other manufacturers and does custom millwork, and direct distributors, i.e. retailers who work directly for one manufacturer. The researcher’s goal was to interview two individuals from each category for both geographic areas. Table 1 shows the target user categories and the actual number of interview conducted.

Table 1: Lead-user categories identified for the wood window value chain and the number of interviews conducted in each category.

User Category	Geographic Area		Total
	Portland	Las Vegas	
Sales Agent	11	4	15
<i>Full-service retailer</i>	6	2	8
<i>Do-it-yourself retailer</i>	1	2	3
<i>Resale/ millwork</i>	2	0	2
<i>Distributor</i>	2	0	2
Installation Expert	2	0	2
Homebuilder	3	2	5
<i>Single location</i>	1	0	1
<i>Multiple location</i>	2	2	4
Architect	5	1	6
<i>Individual</i>	2	1	3
<i>Firm</i>	3*	0	3
Homeowner	1**	0	1
Total	22	7	29

*This was a group interview consisting of three people from the same firm.

**The homeowner was also an architect and is only counted once in the total number of interviews conducted.

A total of 29 individuals were interviewed, 26 of these in individual interviews and 3 of these in a group interview. Of the respondents, twelve owned, or co-owned the business for which they worked, two were presidents or CEOs of their company, three were managers, and three were heads of their divisions. Of the remaining four individuals, three were principle architects at their firm, one was an experienced installer for his company, one was an outside sales representative, and one was a development coordinator.

The primary method used in this study to identify potential interviewees in both Portland and Las Vegas was “snowballing.” The term snowballing refers to the process of identifying additional respondents through the recommendations of previous respondents. Figure 4 illustrates how this method was used in Portland and Las Vegas.

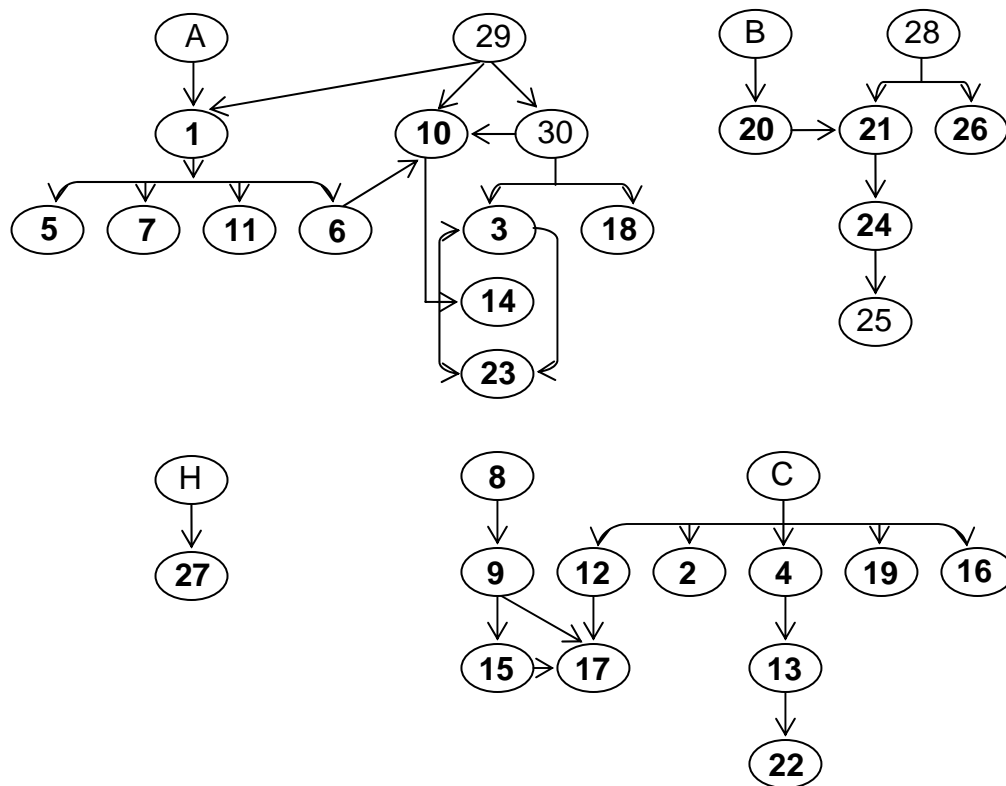


Figure 4: Illustration of snowballing method showing how individuals were contacted based on the recommendations of other individuals. Bolded numbers indicate individuals who were interviewed, non-bolded numbers indicate individuals who were not interviewed, but recommended someone who was. Letters refer to manufacturers. Arrows indicate recommendations. Only contacts that led to interviews are shown.

In Portland, there were two starting points. One, the researcher contacted manufacturers and asked for the names of local retailers who fit the specified lead-user criteria (see Study Design), and two, the researcher contacted a representative of the Oregon Remodeler’s

Association and asked for the names of local builders and architects who fit the specified lead-user criteria. These individuals were then contacted and in turn asked to recommend the names of other individuals fitting our criteria. This process was followed until a minimum of two individuals were identified for each of the ten target categories except for homeowners (Table 1).

In Las Vegas, initial respondents also were identified by contacting various manufacturers and determining the names of their local retailers. Also, the local chapters of the National Association of Homebuilders (NAHB) and the American Institute of Architects (AIA) were contacted and asked to recommend members. Additionally, an assistant professor from the Department of Architecture at the University of Nevada, Las Vegas and an individual from the Window and Door Manufacturers Association were contacted. Of these sources, the only ones who responded with recommendations of individuals fitting lead-user criteria were the window manufacturers and the NAHB. This process was supplemented by internet searches to identify local retailers, homebuilders and architecture firms, who were then contacted to determine their relevance. Potential respondents identified by this method were selected based on their interest in our project, knowledge, and their willingness to agree to a longer interview. Of the 30 total potential respondents contacted, only eight responded that they used wood windows (Table 2). Of these eight, seven individuals were interviewed. The eighth was not interviewed due to concerns about sharing of proprietary information. A minimum of one individual was interviewed for the sales agent, homebuilder and architect user categories (Table 1).

Table 2: Individuals in Las Vegas contacted to ascertain relevance and willingness to participate in study. No response (NR).

User Category	Use Wood Windows			Total
	Yes	No	NR	
Homebuilder	2	15	4	21
Architect	1	0	2	3
Sales Agent	5*	0	1	6
Total	8	15	7	30

*One Sales Agent who did sell wood windows could not speak to the researcher due to concerns about sharing proprietary information

Information about these individuals as lead-users was obtained via peer-recognition, journal articles, company websites, and interview responses. The primary characteristic used to identify lead-users in this study was a demonstration of extensive consumer knowledge and experience in the wood window market. This was determined both by peer evaluation and the impressions of the researcher over the course of the interview. Other lead-user criteria were also considered, such as an innovative personality and the propensity for adopting new products and trends. These characteristics were determined by the researcher based on statements made by the user over the course of the interview. These statements included the discussion of specific new products and trends the user either had or was planning on utilizing, and their ideas about new products or services that they would like to see. The researcher's impressions during the course of the interview played a major role in judging whether or not individuals possessed these lead-user characteristics.

Initial contact with all potential respondents was made via phone in both Portland and Las Vegas. During the first contact the lead researcher explained the purpose of the study, the reason the respondent was being asked to participate, what would happen during the interview, how long the interview would take, and how the information they provided would be used. Interview dates and times were scheduled with those lead-users who agreed to participate. For respondents in Las Vegas, the interviews were carried out in 30-45 minute phone conversations conducted at the time agreed upon during the initial contact. Respondents in Portland were provided with a list of preferred dates and times for interviews. These interviews were scheduled at locations convenient for the respondents. All interviews in Portland were conducted face-to-face. A reminder call or email was sent either the day prior to or the morning of the meeting. Unfortunately, using multiple methods of data collection means that there is a potential for bias between the phone interviews and the face-to-face interviews. The researcher tried to mitigate this by adhering to the interview protocols.

Data Collection

All interviews were digital audio-recorded unless the situation made it not possible. Audio recording interviews allowed the researcher to more accurately retain the interview data and to be more engaged in the conversation (Yin 1994). Additionally, recordings provided extensive textual data for use in analysis. In instances where it was not possible to record, extensive field notes were taken for use in data analysis. Audio recordings were captured for 19 of the 20 Portland respondents and none of Las Vegas respondents. These

recordings were verbatim transcribed and compared to field notes in order to increase synchronic reliability. Transcripts of the audio recordings were used for data analysis. After each interview the researcher summarized what was learned via field notes. This constant summary method was used to guide further interviews. New themes that arose during interviews were incorporated into later interviews.

Theme Identification

The creation of the study plan and interview protocols identified categories and themes anticipated to emerge from the data. For example, a theme that the researcher anticipated in this research was “weatherization.” Additional themes emerged from topics commonly mentioned by interviewees as the researchers conducted interviews. For example, a theme that emerged early in the interview process was “green building,” consequently the interview protocols were revised to include this theme. Depending on the context, topics that were mentioned by three or more respondents were considered to be themes and are reported. Three was chosen as the minimal number because it represents ten percent of the total sample size of 29.

Data Analysis

In recent years there have been significant advancements in qualitative analysis methods, particularly as they apply to forest business research settings (Stendahl et al. 2007, Bull and Ferguson 2006, Hovgaard and Hansen 2004). The approach that was used in this study is similar to that described by Rubin and Rubin (1995) consisting of three primary steps.

Step One: Data collection and analysis were partially concurrent as new information from each additional interview was carefully considered. In addition to the categories or themes identified during the development of the interview protocol, additional common themes were identified as interviews were conducted. Before step two of the analysis, multiple transcripts were read carefully in order to identify additional themes in the data. These themes provided the initial set used in the process of data coding as described in step two.

Step Two: The qualitative software analysis tool NVivo was used for data coding based on the previously identified themes. During this data coding process, additional themes were added as they emerged. Themes were coded first as subthemes, e.g. durability/exposure, low maintenance or quality. These subthemes were derived from respondents' actual words. The quantity of subthemes necessitated the organization of these into larger themes, e.g. function. This was done with subthemes that were mentioned by at least three individuals. The logic behind organizing the subthemes into the larger themes should be readily apparent, in the few instances where the logic might not be apparent the researcher has made an effort to justify the reasoning behind the organization. Upon completion of this coding process, a summary of all text, coded according to theme, was created. The summaries were again read carefully with a goal of identifying subthemes.

Step Three: The last step in analysis was a complete recoding of each interview transcript using each of the newly identified subthemes. This ensured complete coverage

of the transcripts via additional consideration of the total text. Summaries that resulted from step three provided the quotations that were used in explaining the findings of the research.

Bias and Validity

Bias

Qualitative research takes a naturalistic approach to understanding phenomena in context-specific settings, i.e. “the real world.” Unlike quantitative research, the researcher does not attempt to manipulate the phenomenon of interest, nor do they seek to determine cause-effect relationships (Flick 2002). In quantitative research, tools, such as statistical procedures and other means of quantification, are used to arrive at conclusions. In contrast, the researcher is the primary measuring device in qualitative research. This increases the chances of unwanted bias. Subjectivity is particularly dangerous during data collection. Audio recording interviews and transcribing these recordings verbatim for data analysis helps prevent unintended biases resulting from field notes. Additionally, researcher awareness of the possibility of bias allows for the purposeful management of this issue (Yin 1994). Researchers should note where unintended bias may exist. They should also note where intentionally leading questions were used in order to elicit particular answers. Acknowledgement of these biases in documentation allows readers to better interpret the results of the qualitative research and understand why particular questions were asked.

Bias is also a risk during data coding and interpreting data to draw conclusions. To prevent unintended bias or to make clear to readers where bias may exist, a systematic and clearly documented system for coding should be used. Furthermore, a clear explanation of how conclusions were reached and recognition of where bias may exist in data interpretation permits readers to better follow the thoughts of the researcher.

Triangulation is of critical importance when conducting qualitative research to prevent researcher bias and to ensure convergent validity. Triangulation requires a comparison of data from multiple sources and or different data collection methods. These sources include, but are not limited to, additional researchers, news stories on the company, company web sites, company annual reports, and company promotional materials. Triangulation occurs when these methods support, i.e. converge on, the same conclusion or, at least, do not contradict it (Miles and Huberman 1994). This is a technique that must be built into the study design prior to data collection. There are four common methods of triangulation to be considered: data triangulation, investigator triangulation, theory triangulation, and methodological triangulation (Miles and Huberman 1994). Data triangulation is when two or more different sources, e.g. a company website and a personal interview, provide evidence to support the same hypothesis. While this cannot be interpreted as absolute proof, it does indicate that there is reason to believe that the hypothesis is supported by the data. Investigator triangulation occurs when different researchers collect data and arrive at the same conclusions about said data. Theory triangulation involves analyzing data by means of unique or competing hypotheses. This technique, however, can prove problematic if contrary hypotheses predict like results.

Methodological triangulation is when data is collected by different methods, such as personal interviews, company reports, and observations. While not all techniques of triangulation need be used in any given study, researchers should not rely on just one of these methods to limit bias and increase study validity. In this study, data and methodological triangulation were used. Investigator triangulation was not used as only one individual collected data for this study, while theory triangulation was not used as the purpose of this study was exploratory rather than explanatory or causal.

Validity

To maximize the quality of the research design, Yin (1994) suggests four aspects to be addressed: (1) construct validity, (2) internal validity, (3) external validity and (4) reliability.

Construct validity involves establishing adequate operational measures for the phenomenon of interest. These measures include using multiple sources of evidence, maintaining a chain of evidence and having respondents review a draft of the case study report for accuracy (Yin 1994). These tactics are used during data collection and in the early stages of conclusion composition. To achieve construct validity in this study, several of the suggested techniques were employed. Data triangulation was employed, by consulting company websites and industry sources, i.e. journals and associations, allowing researchers to better judge the accuracy of data. In addition to a detailed description of all techniques and methods used in this study, chains of evidence were constructed to illustrate the logical links between initial objectives and conclusions formed by the researcher or vice versa. Finally, findings from this study were provided to respondents

who requested to see the results of this study. This was done to ensure accuracy of results and representativeness.

Internal validity, which is described by Yin (1994) as “establishing a causal relationship, whereby certain conditions are shown to lead to other conditions, as distinguished from spurious relationships,” does not apply to this study. Internal validity only applies to explanatory or causal studies, while this study is exploratory in nature. Therefore, no significant measures were taken to ensure this type of validity.

External validity requires the specification of the scope to which a study’s findings can be generalized (Yin 1994). This is critical in terms of evaluating the importance of a study’s findings. External validity must be built into the research design as it dictates the use of replication in multiple-case studies. This means that findings must be replicable in other, similar cases. The more cases that reveal similar results to the first, the more researchers are able to state that the study’s findings are generalizable to a larger population. The nature of lead-user market research, however, is that it focuses on a limited number of cases that may not at present represent the larger population. In other words, the population of this study, lead-users of wood windows in Portland and Las Vegas, may have needs that do not currently reflect those of the average window user in these markets or elsewhere. The purpose of this research method, though, is to anticipate needs that the market will face in the future. Therefore, replication of the exact results is not possible since they are a reflection of the current market. For example, the researcher anticipates that certain results will remain the same over time, such as many customers

basing their wood window choice on aesthetic principles, however, other results, such as the extreme focus on cost by both customers and sellers is indicative of the current state of the market.

While the replication of the exact results from this study are not possible, in order to demonstrate the reliability of the study it should be demonstrated that the methods used in the study can be repeated by another researcher and that similar, if not identical, results will be reached (Yin 1994). The use of a case study protocol and a database containing all case study data are two data collection methods that ensure transparency of methods and ability to emulate. In this study the research methodology was well documented. The study protocol described the methodology and analysis methods used. The study database contained well-organized notes and other documents that were used for data analysis. Data for each lead-user were kept separate, labeled with a common identifier, and organized in identical order and format to ease readability and comparability. By doing this, readers will have all of the documents and methods required to emulate the study.

Results

In the following section the results of the study are presented. As no substantial differences other than a few regional perspectives were noticed between respondents from the two locations, the results are presented together. To guarantee the anonymity of the individual respondents, all interviewees are referred to by their user category. Names of companies and manufacturers are referred to as Company A, Company B, etc. Location names have been omitted. The questionnaire for each of the user categories can be found in Appendix A-D.

Factors Influencing Customer Product Choice

Users indicated five primary themes influencing customer product choice: form, function, serviceability, cost, and greenness/environmental impact. Table 3 shows these themes and the commonly mentioned subthemes where applicable listed by user category. It should be noted that one of the subthemes, value, did not fit into any of the larger categories as it is actually a function of quality and cost, therefore it is listed independently. Additionally, most users indicated two or more factors influencing customer choice, so the number of factors listed in a user category may exceed the number of respondents in the category.

Table 3: Factors influencing customer choice of wood windows. This table shows the frequency of each factor by user category. User categories are Sales Agent (SA), Installation Specialist (IS), Homebuilder (HB), Architect (AR), and Homeowner (HO). Bolded numbers indicate the most frequently mentioned factors.

Factor	User Category					Total
	SA	IS	HB	AR	HO	
Form						
Aesthetics	6	2	3	3	1	15
Historical Accuracy	2			2	1	5
Brand	6	1	1	1		9
Choice (inc. hardware)	2		1			3
Function						
Function/Performance		1	1	1		3
Durability/Exposure	4	1	1	2		8
Low Maintenance	1			1	1	3
Quality	3		1	1		5
Serviceability (lead times, delivery, warranty)	2	1		1	1	5
Cost	10		2	4		16
Greenness/Environmental Impact						
Energy Efficiency	5		2	2	1	10
Value (Quality/Cost)	2		1	1		4

Five subthemes were mentioned nearly twice as frequently as any other factor influencing customer window choice. The most consistently mentioned factor was cost, which is both a theme and a subtheme for coding purposes. While one installation specialist stated that “if they [the customer] ask for wood, cost is not their main consideration” other individuals responded:

I don't think everybody has the best price in mind. You know, in hard times like this, price basically comes up a little bit where people will end up going with somebody who is a little bit cheaper. *Installation Specialist, Portland*

It's all about price and...you'd think people looking for an architect would care more about that [gestures to solid wood, true divided light,

historic looking window] I go through this battle on almost every single job and I lose most of them because it all comes down to price in the end. But that's just the way it is...they would rather spend the money on a Wolf range even though they don't cook, then put it towards their windows. But that's just the way it and it's just ridiculous...they go for the status symbol. And it drives me crazy. *Architect, Portland*

If you had asked that question a year ago, I would have said quality over price, now price is a much bigger factor. People are looking at the bottom line...they are ignoring efficiency and aesthetics in favor of price. *Sales Agent, Las Vegas*

The second most commonly mentioned factor was aesthetics, i.e. the look of the product often in relation to the style of the house. The following comments are presented as examples:

Not sure our particular customer demographic has too many concerns other than quality and aesthetics. Starting at a million to three million, for the buyer it's more of a concern of aesthetics than anything else. *Homebuilder, Las Vegas*

The next step is overall design of the product and what they want their home to look like. Whether it's a Craftsman where you're using a lot of double hung, or it's for a contemporary where there's a lot of picture windows and casements. *Sales Agent, Portland*

So what we do is we look at our customers and we kinda categorize them in terms of...the look they want, if they are looking for a rustic type home with all wood siding and wood interior...I almost always steer them entirely away from any vinyl products, because when you're staining a home, especially on an interior, vinyl products only come in light colors, whether it be white or almond or that type of thing. So those don't look good with natural stained wood, unlike wood windows with a wood cladding on the inside, will blend very nice. Same with the exterior, you want a rustic home they are going to have a wood clad...with vinyl or metal. And you can get different colors so it blends in real well. So we categorize them that way along with if they want a really high-end custom look window you are going to...gravitate towards a wood window. *Homebuilder, Portland*

Overall, the third most commonly mentioned factor influencing customer choice of windows was energy efficiency. The following examples illustrate this:

Probably the energy factor is the biggest. We get a lot of people replacing their old wood windows with vinyl windows, some with wood windows. Vinyl is definitely the, particularly by window count, considerably more vinyl windows are going in. And they're replacing old aluminum windows and old wood windows with those. *Sales Agent, Portland*

People who are more green building conscious are more concerned with energy efficiency....Low-e windows are big here because of the sun. *Homebuilder, Las Vegas*

The fourth most consistently mentioned factor was brand. According to respondents customers associate brand with either quality, prestige or both.

Brand can play a factor...our customers don't really have a choice in what type of window we install...but we might choose a particular brand to help in marketing our homes...to increase the perceived value of the product. *Homebuilder, Las Vegas*

For the most part our clients contact us because they have identified [Company A] with regard to what we do for a living. At least 80% of our volume is related to [Company A] wood windows and doors. So a good number, I would say probably 60% of the people who contact us do so with [Company A] in mind. We do a little bit of public education or educating a client on [Company A]...most people who have an older home and have spent much time looking at windows, [Company A] pops up on their radar fairly quickly. *Sales Agent, Portland*

Brand names, some people if you're not driving a BMW you're not driving....they use brand names to qualify what they're buying....it doesn't mean anything, but if their neighbor thinks [Company E] is the best then they'll want [Company E] without giving it a second thought. *Sales Agent, Portland*

The fifth theme to be mentioned frequently as a factor was durability/exposure, i.e. how well the window holds up when exposed to the weather.

What I think goes sort of hand-and-hand with price is durability, because a low cost is not truly a low cost if it's only good for 5 years.
Sales Agent, Portland

One of the things about a wood window that tends to scare people is they are very concerned about the windows rotting. ...a lot of people had bad experiences from their existing windows, whether that's 5 year old pine windows or 80 year old fir windows, they're going to see a lot of wear and tear. You know people don't...want to see that again. *Sales Agent, Portland*

Within user categories sales agents and architects were the most likely to state that customers considered cost to be an important factor, while installation specialists and homebuilders were most likely to refer to aesthetics as a factor. As only one individual was queried in the homeowner category, it is not possible to state what factors were mentioned most frequently. However, for this one individual, form and green aspects were key factors. The green aspects were particularly important to this individual due to the fact their home has LEED gold certification.

Product Factors Considered Important by Users

Similarly to the first product choice question, user responses to this question indicated five primary themes: form, function, serviceability, cost, and greenness/environment aspects. Table 4 shows these themes and the commonly mentioned subthemes for each according to user category. Again it should be noted that one of the subthemes, value, did not fit into any of the larger categories as it is actually a function of quality and cost, therefore it is listed independently.

Table 4: Factors sellers believe are the most important when choosing windows. This table shows the frequency of each factor by user category. User categories are Sales Agent (SA), Installation Specialist (IS), Homebuilder (HB), Architect (AR), and Homeowner (HO). Bolded numbers indicate the most frequently mentioned factors.

Factor	User Category				Total
	SA	IS	HB	AR	
Form					
Aesthetics	7	2	4	5	18
Choice	4			1	5
Function					
Function/Performance	4		2	1	7
Durability/Exposure	4	2	3		9
Quality	4		1	3	8
Serviceability (lead times, delivery, warranty)	2		1		3
Cost	8	2	1	2	13
Greenness/Environmental Aspects					
Energy Efficiency	2		1	2	5
Value (Quality/Cost)	3	1			4

Overall the four most commonly mentioned subthemes were the factors of aesthetics, cost, durability/exposure and quality. Aesthetics was most consistently referred to as a key factor:

We're here because we feel that windows and doors are the most important architectural feature to a house. The homes that we work on for the most part are...greatly defined architecturally by their windows and doors, at least the original materials....So if you're asking me what I think people should be thinking about its going to be aesthetics: what is it going to look like? Is it going to work in the context of my house? And the year it was built?...nothing can ruin the look of a home architecturally in our mind more than the windows or doors. *Sales Agent, Portland*

The first thing from my perspective is design, and what style of house are you trying to build....I've got an architect doing French country and he opens up his plans and all of a sudden you've got an immediate 'oh gee I understand what profiles of windows to use, the hardware is sort of the old style French country hardware, the colors you want them rustic or

sophisticated...’ You’re connecting on a design level. And nine times out of ten that’s the lead question, what are you trying to accomplish. *Sales Agent, Portland*

Cost was the second most commonly mentioned subtheme, and was frequently mentioned as a qualifier to aesthetics. In one architect’s words, people operate with “a champagne attitude on a beer budget,” meaning people generally want the best looking product, but find that their budget might not allow for this.

One of the things first would be budget...first we have to make sure that they can afford something besides vinyl, if they can’t then we’re pretty much going to be at vinyl. Once the budget says they can do whatever then it’s...a matter of...aesthetics with wood. *Sales Agent, Portland*

I try to find out what they want. If they have a historically significant house or one they want to make historically significant than I steer them towards wood windows. Sometimes when they get to that...the final decision, its price that really boils it down. *Sales Agent, Portland*

A happy medium between really architectural aesthetics and trying to keep the cost...to you know a reasonable level. *Sales Agent, Portland*

Always start with cost, what does the project allow. Then the aesthetic decision and then best quality they can get given budget constraints. *Sales Agent, Las Vegas*

Other individuals stated that while cost is a primary factor for customers, they should take other factors into consideration:

Windows are one of the first places where people try to cut costs. People don’t have a realistic budget number going in. They are under budget for windows. In the long run it’s not saving any money because of service issues and energy efficiencies...The amount of money it takes to replace the wrong product down the road is a false cost savings. We had one guy last year who went from a big house, nice job, went from bronze tinted low-e to clear glass to save money, which would probably have paid for itself in two years in energy savings. *Sales Agent, Las Vegas*

Durability/Exposure was the third most commonly mentioned subtheme.

Weatherization...in my mind there is no more important issue than that. Sure...you get the windows with the mullions, and the grid work, and the profile, those are all important things, and those are all addressed, but I don't think there is anything more important on any window in our area than how they hold up in weather. That's probably what we look at as number one. *Homebuilder, Portland*

Houses at the beach or up at the Columbia Gorge the environment is so much higher, the performance standard has to be so much higher or else you are going to have problems, and everyone recognizes it. And...there are x, y and z products that in those environments will fail, its sort of a given that you have to make very careful selections of products. *Sales Agent, Portland*

I like using wood windows because...their longevity...I've read the average life expectancy of a wood window is 70 years. And you can go down into the Willamette valley near Corvallis and see all these little farm houses with their original wood windows and they're still hanging together, you don't see that with these other things. *Architect, Portland*

The fourth most frequently mentioned subtheme in terms of what factors users feel are the most important when selecting a window was quality.

For us we look for a window that will satisfy the requirements for the design of the building. Quality is a concern from a builder's standpoint because you have to warranty for up to 10 years, so you don't want it to leak, or warp, you don't want problems opening being because of expansion for the materials ...because of customer complaints, quality and cost are the main concerns. The best window at the most reasonable cost. *Homebuilder, Las Vegas*

Within user categories the most frequently mentioned factor for sales agents was cost, while the most frequently mentioned factor for homebuilders and architects was aesthetics. In fact, all of the architects, or architect groups, interviewed responded that aesthetics was a key decision factor, and that the choice of the window, therefore, was

really project driven:

Its really project driven so...especially in the scenario where like I said probably I would estimate 70% of our work is adaptive reuse and often we're working with historic buildings either on the national register or just being sensitive to the age and wanting to do something that is compatible, the majority of those buildings have wood windows in them. So that's a big driver in determining what product we're going to select, its being driven by the aesthetic of the project. *Architect, Portland*

Interestingly enough, windows to me are the most important aspect in the design. I used to think form came first and fenestration came second, but I've changed my mind about that. You could put good windows on a terrible form and it still looks good. So windows are very important to me, and because I do kind of high end stuff typically...and it used to annoy the hell out of me where I would see a cool house be remodeled and they would put in crummy looking windows, which they did all the time in the 50s and 60s, they'd put in these aluminum sliders in these classic colonials...windows to me, as I said they are the most important aspect of design. *Architect, Portland*

I think for me its aesthetics, looking at the window from the outside, so its profiles...a lot of my projects involve National Register projects so we're dealing with folks who are very fussy about the width of the stile and how the glass is divided and trying to match, often trying to match a historic window nearly exactly. *Architect, Portland*

Manufacturer Feedback

User responses to this question were organized into two categories, 'yes they do ask for feedback' and 'no they do not ask for feedback.' The yes category was further divided into the methods manufacturers use to obtain this feedback. Table 5 shows the results. It should be noted that the same person can answer both yes and no to this question as some individuals stated that of the multiple manufacturers with whom they interact, some do ask for feedback and others do not. Additionally, some respondents reported multiple means by which manufacturer's obtained feedback, including multiple methods employed

by the same company.

Table 5: Responses to whether or not manufacturers ask for feedback, and if so how they obtain it. This table shows the frequency of each factor by user category. User categories are Sales Agent (SA), Installation Specialist (IS), Homebuilder (HB), Architect (AR), and Homeowner (HO). Bolded numbers indicate the most frequently mentioned factors.

Response	User Category				Total
	SA	IN	HB	AR	
Yes					
Formal survey	4		1		5
Rep calling user	6	1	3		10
User calling rep	4	1	1		6
Factory tours	1		1	2	4
Product feedback	2	1	1	1	5
Dealer meetings	5				5
Product Classes/Seminars	2		1	5	8
Meeting with dealers/distributors	2		1	1	4
No	1		2	3	6

On the whole, users indicated that most manufacturers do ask for feedback, however, they also indicated that there is a significant degree of variability in how this information is obtained. The most commonly mentioned method was sales representatives from the manufacturer calling the company to ask about problems, how they liked the products, etc. Examples of this include:

Generally we have intermediaries acting to us, we call them reps. These people are generally in touch with us checking, asking just that same question, 'is everything ok?' At this particular level where I'm at in my point in my career, I've been at it longer than they have, if I know what the product is, I can work with them to tell them to do it this way, I don't need 'are you happy?' *Sales Agent, Las Vegas*

Particularly [Company A], [Company F] not so much. We have a rep call from both companies just about weekly. So if we have any issues they get taken care of promptly. And of course we can always call and get things taken care of. And the sales managers typically come around a few times

a year to check on things, see how things are doing, present product or new processes. *Sales Agent, Portland*

Product classes/seminars were the second most consistently mentioned feedback method. Product classes/seminars is a feedback method whereby manufacturers educate users both about the new products and features they are introducing and about current products and services. Multiple respondents mentioned that [Company A] requires all individuals who choose to sell their products to attend product classes. Overall, architects were the most likely to report that manufacturers employed this feedback method with them, however, they also indicated that they felt this was done not as an honest effort to learn their opinions, but as part of a sales pitch. These combined sales pitches and feedback solicitations ranged from the subtle, as reported by one group of architects:

Usually in lunch time seminars they [the manufacturers]...it's a closing question that they ask...‘how do you like our products?’...‘any particular critiques?’ It's usually done at the very end in passing...after they've already fed us lunch ...so they prep us with a \$3 turkey sandwich...it [the turkey sandwich] works too! *Architect, Portland*

To the slightly more overt:

Through the conferences and national conventions and the builder's exchange things it happens. They'll...and with continuing education now, that's always a consideration for evaluating and...checking out a particular manufacturer. *Architect, Portland*

To the extreme end of the sales pitch spectrum, as one architect stated baldly that:

I wouldn't say that they're looking for feedback so much as they're looking to sell the latest model to us and are making sure we're familiar with their product, but we definitely get a lot of solicitation from different representatives...we're the first kind of gateway, in terms of what we specify often ends up being purchased, we get a lot of

solicitation from all the different manufacturers, throughout any part of construction process that we might have any control over, and windows are not an exception. *Architect, Portland*

The third most common method mentioned were sellers calling representatives.

Generally users indicated that this was a result of manufacturers only listening to their feedback when they forced them to do so:

We have to kind of force it upon them, we'll have to give them a call and say hey this does not work we need you to do this better or we need you to provide us with a better ship date or the screens can't be smashed in, so we voice our opinion but never does ever a manufacturer come and say hey we were just wanting your feedback, let us know how we're doing. *Installation Expert, Portland*

Well let me put it this way...we're very vocal with our feedback, whether it's asked for or not. *Sales Agent, Portland*

An interesting finding in Las Vegas was that over half of the respondents stated that it was the dealer or distributor from whom they purchased the product rather than the manufacturer who asked for their feedback:

[Company J] has a two step process, we buy from a distributor, not from [Company J]. The distributor does a monthly visit. They keep us well informed with product development....[Company J] doesn't really do much in the way of requesting feedback from the end user, at least not through us. *Sales Agent*

I talk to the people at [Company 2] enough that we know what is going on. I have a close relationship with the dealers I work with regularly....What's frustrating, though, is the ones that have cut back so much because the people you need to talk with aren't there any more. *Homebuilder*

All sales agents mentioned at least one company that solicited their feedback, although one also indicated that they carried products from a manufacturer(s) who did not seek feedback. They also reported the most diversity in the methods employed. All installation specialists indicated that manufacturers asked for their feedback through some method. Two homebuilders claimed to have never been asked for feedback. As a whole, architects were the most likely user category not to be solicited for feedback, or if they were solicited to feel that this was not done with honest intent.

One method of feedback collection that was mentioned by multiple sales agents, but does not apply to any other user category, was dealer meetings. Two separate companies were mentioned as hosting either a “Dealers of Distinction,” i.e. top dealers from around the country, meeting or an advisory board meeting, i.e. top distributors from across the country. According to users both of these dealer meetings were designed so that manufacturers could gain a geographically diverse feel for customer needs:

In the last three years this will be the second time that they’ve had what they call a “Dealers of Distinction” meeting. Two years ago it was in [location], this year it was in [location], and we’ve been invited both times to participate in it. And it’s a handful of dealers from all across the country and the purpose is to get together, and there are all sorts of speakers who come out and [company president] is there along with every other department head...so at that meeting they’re very accessible, I’m not suggesting they’re walking around with a tape recorder saying ‘ok, now what do you want us to do...?’...that’s not the case by any stretch. *Sales Agent, Portland*

They also have what they call an advisory board, where once a year they invite their, probably their best business partners, their distributors, and they meet back at the manufacturing facility in [location] for three or four days and they have several roundtable discussions as far as what the product...what [Company C] should be developing as far as staying on the cutting edge of technology when it comes to windows and

doors...but they do invite their customers in for meetings like that. And they pull them in from all over the nation so they have a pretty good in a random sampling of what they're looking for. *Sales Agent, Portland*

There was a general consensus among the respondents as to which window manufacturers were the best and the worst about seeking out customer feedback. Some companies were frequently mentioned for their regular practice of asking for feedback through both formal and informal methods. In fact ten respondents, including sales agents and homebuilders, all mentioned Company A as having good practices for collecting customer feedback. Four respondents referred to the feedback processes of Company B favorably. In contrast, Company F was given very mixed reviews from respondents. While one respondent stated that they chose this company specifically for their "service and consistency," other respondents did not have this favorable of a view:

A joke, because they would ask for it, but nothing would ever happen...they wouldn't do what you said. I think it was more of a taking their dealers temperatures to see how satisfied they were. *Sales Agent, Portland*

Their whole company is pretty horrible now...they really used to be a good company, but they're not owned by [Company F] anymore, they're owned by [umbrella corporation] back east and it's totally changed everything. Their service has gone down, their quality has gone down...They basically have someone back east dictating what to do in this market with having no knowledge of what the west coast likes or doesn't. And usually when those buyouts happen it's because some company is struggling, so the new company tries to cut overhead, they usually cut service departments more than anything else. To them it makes sense because right away it doesn't affect it, but over time it definitely affects it...And they had a good product. I mean even when I didn't like the company I would say they had a good product... [Company F] is going through employees right now like you change your clothes. I've probably had 12 different reps and I've met 2 of them. That's not a good sign usually for a company going through people like that. *Sales Agent, Portland*

Other manufacturers were cited for not even bothering to ask for feedback at all. One sales agent, when trying to explain why manufacturers might not be inclined to ask for his input, stated that the relationship between the dealer and the manufacturer was “almost an adversarial relationship,” stemming from the fact that the distribution method of the product has a “huge impact on manufacturer success.” This statement, however, was the opinion of one individual, not a general consensus.

Feedback Utilization

A number of respondents did not respond favorably to the question of whether or not manufacturers utilized their feedback. Five individuals responded that while manufacturers did ask for their feedback, they did not do anything with this information once they received it. An example of this response is:

I don't think we actually see any results. Probably, just because of the timing....We may review some of that and if nothing really happens for six months to a year it really falls off our radar. We see if we pay attention to them, they will add colors or wood species or glass types. Seeing that a lot with [Company B] and [Company J]....We're noticing that the big companies are doing a lot of consolidation, buying up companies that are doing stuff they didn't do to broaden their product offerings. *Sales Agent*

Several other individuals stated that manufacturers may utilize their feedback, but they failed to do so in a timely manner. There were several reasons provided for this:

To a certain degree...as much as possible within their plan...they [the manufacturers] get thousands of opinions...I don't know how they analyze the data, but if the same issues are constantly coming up they will consider implementing. *Homebuilder, Las Vegas*

We want eleven foot tall doors, [Company K] knows that we want this...they do ask...but it takes a while to come in to play. *Sales Agent, Las Vegas*

They are listening and are adapting...some product lines much more so than others....[Company H] has very versatile and adaptive products....A lot comes down to as large as [Company H] is, it is a newer company, so their newer equipment gives them more flexibility....On the other side [Company G] is an older company but restricted by structure of facilities.
Sales Agent, Las Vegas

If they are around they will listen....The biggest problem more recently is they are [the manufacturers] having issues already....Although this is more on the dealer side, are they going to stay in business or not.
Homebuilder, Las Vegas

Finally, one respondent, while providing multiple examples of a company utilizing feedback, also provided an example of the company actively ignoring their feedback:

[Company D] used to sell another product that was a replacement double-hung kit, which you've probably seen from other companies.... Anyway, it's a kit where you get, instead of getting a full double hung window you just get two sashes and a couple of pieces of plastic that you put into your frame. So you rip out the old sashes, you put these couple of pieces of plastic in it, and then you pop in these little sashes. So basically, you're getting a new window, but you're keeping your existing frame. [Company D] used to make that, we sold lots of them. They were hugely popular in Oregon...but they weren't very profitable for [Company D] and [Company D] stopped selling them, and that kind of disappointed us because we were probably one of the top sellers in the whole country of that particular product. *Sales Agent, Portland*

Users who responded that manufacturers did utilize their feedback provided twelve different examples, several of which resulted in user led innovations. Examples are organized below by theme:

Feedback on prototypes and products:

[Company A]...what they actually did a few...starting about a year ago, is they brought product development people out of their corporate headquarters with prototypes and said 'hey here is a new product, it's not written in stone, here are some of the new features. This is totally a

development process, we want your opinion.’ And they did that twice around the casement windows that they developed. Which I was very thrilled by. *Sales Agent, Portland*

We’ve even had products launched where we’ve received prototypes and we’ve done feedback on prototypes. We’ve had several in the last 6 months. Where like [Company A] was developing a new product and they wanted to see it put through dealers throughout the United States.... for example the latest one is [Company A’s] new Ultimate product that they have launched....They can do a casement window that’s 40” wide by 92” tall that pivots 140 degrees so you can wash it from the inside of your house and never have to wash it from the outside ...they spent a lot of money in developing it and they’ve done a really good job in showing it off. *Sales Agent, Portland*

A window manufacturer said that they were thinking about a new window line and can they come and meet with me. We sat down at the table and they asked if you were starting a new window line, what would you do? And six people sat there and took notes.... I’m happy about that. It’s really great to be able to participate and sort of see the sowing of the seed of a new window line. *Homebuilder, Portland*

The water management, it wasn’t adequate...basically it failed the field test because of the water management system in that window...the representative from the manufacturer was there at the test so we could brainstorm on it. They added additional weeps in the parts that needed it, that was holding water, and they’ve got a better product out of it....we trust that manufacturer because we know that they’ll...step up to the plate when we have a problem. *Homebuilder, Portland*

Regional Impact

A couple years ago we had a huge run of fir products that were being requested. And there was a competitor locally that...was doing really well with fir and we were being priced out of the market on it. Well we completed a survey that was...pretty intense. It was a very detail oriented survey asking about what kind of jobs, and what kind of product that was the product that had the fir, and on down the line. So here we are maybe 2-3 years later and we have two different types of fir, a very high-end fir and then a mixed-grain Doug fir, that is competing with that problematic window that we had. So when you’re talking about surveys from the factory that is one we can see direct results from. *Sales Agent, Portland*

The fact that they have the Doug fir option, this mixed grain fir, that's totally a result of us asking for it over and over and over again. Now not just us as in [company name], but many of the top users of the product in the Northwest have been asking for it for a long time. *Sales Agent, Portland*

I've actually watched them over years actually do these changes that we've been asking for, next thing I know they come out with it and say 'we heard from enough people that they wanted this and it was worth doing.' Like...offering different species of wood...on the wood they had a VG fir, because most wood windows are pine standard, although most companies have gotten where they have other options now. A lot of their competition had a pretty low priced fir, because it was not VG it was just mixed-grain...so [Company A] had VG only, so it was just really expensive. So we kept telling them...we can sell this to some of those doctors and stuff who have the money, but a lot of people don't. It took them a couple of years, but they came out with a mixed-grain and it's been going great ever since. *Sales Agent*

New Products Introduced

We've got our own custom shop where we build things that...if [Company D] can't do it, if no one can do it, we'll build it for you. And five years ago people were asking about...bi-folding, like Nana Wall type doors. So it's a bi-folding system where all the doors stack like an accordion to one side. So [owner] started building these on his own. He would buy the parts from [Company D], he would buy the hardware that allows for this accordion type set-up...from a completely separate company, and then in his shop he would build from scratch these bi-folding doors. And then we installed a couple of them at the "Street of Dreams" a couple of years ago. It was one of the hits of the show, everybody loved it...[Company D] heard about it and were so impressed they started their own line based solely on what [owner] had done. *Sales Agent, Portland*

Products Discontinued

Sometimes it's more of not specifically listening to us, but just...like for example sliding windows...[owner] hates sliding windows. He never sold any and would only sell them if someone insisted on a sliding window. So we didn't sell many sliding windows, and it wasn't just us, it was a lot

of...[Company D] dealers....And that's part of the reason [Company D] stopped selling it, was because we stopped selling it. *Sales Agent, Portland*

Changes to Product Features

Our owner requested that [Company B] change the locking mechanism on their double hungs. The lock sat up on the window frame and looked ugly, but based on comments they changed the lock to a hidden snap lock that sits flush with the frame. *Installation Specialist*

[Company B] also increased the veneer thickness on their fiberglass products as a result of customer requests. *Installation Specialist*

Changes to a Service

This new window line that [Company A] has...they're very responsive, as a matter of fact if we have any problems or any feedback at all...we're encouraged to email them, and those emails go right to the top to the product planners and...they're always planning new things and they'll actually ramp stuff up and bump it ahead of other projects based on feedback from their dealers....Like...different finishes on hardware, oil rubbed bronze, and satin nickel and bronze hardware. The screaming got really loud for that and they...introduced that sooner than they had planned on doing....Different sizes, wider double hungs. We needed sizes that were wider than 48" and I guess they had enough yelling form all over the country so they bumped it up to 54"....Quality issues, if there is any shipping damage they want to make sure they can know about that so they can address packaging. *Sales Agent, Portland*

I would say a few years ago we were having some extreme issues with doors out here and it wasn't the way they were manufactured. It was just the way that when they got to the job site they weren't protected...the handle isn't put on until the very end of the process, but where the door was prepped to receive the hardware had bare wood....And maybe installed on the coast, well its 6 months before they get around to putting the handles on and in the meantime it may take on water, it may delaminate, or the clad would pop off. We just had tremendous issues on doors. We found a product that was almost like shrink wrap that would stick to the door, stick to wood, stick to the inside, stick to the cladding or the painting on the outside, but not leave...a residue...we just did it as our own internal test case, because it was costing us way too

much as far as service time and people and customer satisfaction, and we did a test for just about a year and then sent it into [Company C] on what we were doing and that actually resulted in them coming up with a cover...to put on those doors prior to being shipped so they could weather the elements and storms and...not having any problems. *Sales Agent, Portland*

Changes to Cost

They were responsive to the issue about pricing...we were getting priced out of the market...and we told them what price they need to sell at...and they were able to deal with that. *Sales Agent, Las Vegas*

Customer Complaints

Customer complaints was a user-category specific question for sales agents. Since the intent of this question was to determine in what areas, i.e. form, function, service, quality, etc. customers are most likely to be dissatisfied in order to identify areas for manufacturer improvement, results are discussed based on theme rather than subtheme. Therefore subthemes that received fewer than three mentions are included here only as illustrations of specific examples. Table 6 shows the full results.

Table 6: Common customer complaints. Bolded numbers indicate the total for a category.

Response	Sales Agent
Few to no complaints	
Don't get many complaints because of their focus on service	2
95% of issues resolved by [Company J] service program	1
Complaints	
<i>Part failures</i>	10
Leak	2
Fog up/Condensation	2
Seal failures in glass	4
Sticking windows/warped sashes	2
<i>Service</i>	4
Project delays/long lead times	2
Service response (getting things fixed in a timely manner)	1
Sales people mistreat their customers	1
<i>Installation problems</i>	3
<i>Cost</i>	3
<i>Durability</i>	5
Maintenance	3
Sashes rotting	1
Delaminating	1
<i>Product Features</i>	6
Cannot operate	2
Workmanship (quality/details)	1
Thin glass (to cut costs, not as strong)	1
Energy Efficiency	1
Doesn't look like they expected	1
Ugly windows	1
<i>Choices</i>	3
Want more gimmicks	1
Not enough choice in hardware styles	1
Can't buy pre-finished	1

Three respondents indicated that they received few to no customer complaints. Two of these indicated that they did not hear many complaints because of their focus on service:

For the most part we really don't have...because of the fact that everything is handled by us...we're involved in the whole process...Unfortunately any time, any time we don't have contact with

the client, with the homeowner, there is an opportunity for problems.
Sales Agent, Portland

There isn't one. If you're going to buy \$80,000 worth of windows from me, which happens around here regularly, I want to make sure you're really happy and you don't have a common complaint about your windows. That's what you got to be. *Sales Agent, Portland*

However, both of these individuals went on to qualify these statements and say that in the long run problems occurred that customers complained about:

Long term what can become an issue is the glass, insulated glass seal failures and you know the need to maintain their windows you know the need to keep the dirt out of all the joints I mean you don't...so many windows deteriorate no matter what they're made of as a result of people not taking care of them. And they'll complain about the need to take care of them, and that's kind of an interesting argument there. *Sales Agent, Portland*

And if I have one service issue over time, the two that people don't like is that the windows can't leak and the windows can't fog up and that is a manufacturers issue episodically, I've never had it...no manufacturer seems to have an exclusive on those problems. *Sales Agent, Portland*

The most common customer complaints concerned part failures. Part failures include windows sticking and seal failures in glass. Signs of seal failure in glass that sales agents referred to were leaking, fogging up, and condensation:

Probably either water infiltration or seal failure, those two would definitely be the big ones. Uh...we've moved away from...lots of small lights, as in true divided lights insulated, if it's not insulated its not a problem. But...we've learned from...one of our glass suppliers, that they're more comfortable, and science seems to show, that there is a lower rate of seal failure on larger units. So we, along with many other people have adopted simulated divided lights, not as a standard per se, but just as something we do and recommend. *Sales Agent, Portland*

After part failure, the most consistently mentioned complaints concerned dissatisfaction with product features, durability problems, and service issues. Operation was one product feature that several users mentioned as problematic for customers:

Generally people are in a new house that they've never operated before so sometimes its like having a brand new car...a Mercedes...or Cadillac with a computer system that tells you you're backing up or how warm your seat is...lots of buttons to try to figure out. It can be frustrating. Windows and door systems...motorization of door walls operate in a specific way and if you leave something on the track...then there's a problem. A lot of people moving up on scale, we're giving you a much more elaborate door hardware than you're used too....This one couple, they thought they had to throw manual deadbolts every time the door needed to be closed...they got really frustrated...and the doors swung out rather than in...I stopped by to see how they were doing and they complained about how hard it was to open their doors...I realized pretty quickly what the problem was, no one had told them how to operate their doors....Upscale homes often mean upscale products people are not used to working with. *Sales Agent, Las Vegas*

With lift and slide doors people forget that they need to open each panel before they slide the whole thing open. *Sales Agent, Las Vegas*

The most common durability complaint that customers had was the need to maintain their windows:

We started a job at [location] the other day, and we supplied them with windows about 10 or 15 years ago and they hadn't been really well maintained and the sills were rotting out. So even though they weren't totally blaming us you could see it in their eyes...saying we wish this hadn't of happened, of course we wish it hadn't of happened either. *Sales Agent, Portland*

I would say that they feel they're bulletproof...yes the glass has a twenty year warranty against seal failure...the whole product has a warranty in and out ten years...the cladding has a thirty year warranty on the exterior. They read all these warranties and they hear maybe what they want to hear and they figure that well if I have a twenty year warranty on my window or my glass I don't have to do anything to it. It still requires maintenance...and that's where I'll get complaints from people... 'Well nobody ever told me you had to paint it.' 'Nobody ever told me you had to clean it.'...I think the biggest thing is being up front and honest with

people and saying you know what, there may be reduced maintenance, but there is no such thing as a maintenance free window. *Sales Agent, Portland*

While many of the other mentioned complaints could also apply to other window materials, cost was one customer complaint that was specific to wood windows. One of the sales agents who mentioned this complaint also spoke about the need to educate the customer as to why wood windows cost more and why it is worth it to pay a higher price for them:

Well, I mean, the biggest one I hear is all about cost. A lot of my dealers even don't realize that, hey this is hand-made wood window product, and...there is a lot involved in the finish on the aluminum clad and the millwork on the interior and the mitering and the tolerances that I talked about...those are the things that are associated with the actual cost of it....It's not a laminated or a veneer product; it's a solid wood product. So cost is the biggest one to overcome. And how you overcome it is talking about what I just talked about, you know, this is what you are paying for. It's not apples for apples comparing it to other products. *Sales Agent*

It's hard to go to a person and say I want you to buy [Company D], or even just I want you to buy a Douglas fir window, with double paned glass and all that nice stuff that costs \$1,000, when that same person can get another window for half that price and it has a lot of the same characteristics...and they're saving \$500 on one window, and they're got 30 windows in their house. It's hard to justify that and to educate a person on why. And even when you educate them a lot of times they're going to say, yeah you're right, it's a better product, but I'm on a budget and that \$10,000 savings can go towards my deck, or my pool, or my water fountain or whatever. And then 10 years later if you ask them, are you glad you bought these cheap windows? Sometimes they say yes, sometimes they say no. *Sales Agent*

Innovative Companies and Products

Overwhelmingly users responded that [Company A] was the most innovative company.

However, while all respondents who mentioned [Company A] viewed it as a good company, their views varied concerning the innovativeness of the organization. For example, while one respondent stated that [Company A] was the “leader in innovative products” another said that [Company A] was “usually one of the last to come out with new products, but when they do come out it’s a good product.” Seven other companies also were named as being innovative. An interesting statement made by one individual claimed that different manufacturers have their own innovative “niche”:

Typically your big three are the most innovative, [Company A], [Company B] and [Company E], and each one in their own way....[Company E] has been very innovative in trying to attract the homeowner, in making it easier for the homeowner such as their blinds between the glass or things like that. [Company B]’s been innovative in working with composite materials, mixing woods and plastics in trying to create a window that is less expensive and more environmentally friendly if you will. [Company A]’s actually trying to innovate and come up with products that are higher-end but can be used in commercial as well as residential. So I mean each company kind of has their own niche for what they are trying to develop and for the market they are trying to get.
Sales Agent, Portland

Table 7 shows the full list of companies and products the users claimed to be innovative.

Table 7: Companies and products users find to be very innovative. This table shows the frequency of each product/company mention. Bolded numbers indicate the most frequent responses.

	Response	Frequency
Companies		
	Company A	10
	Company B	3
	Company D	1
	Company E	1
	Company F	2
	Company G	1
	Company H	1
	Company I	1

Products

Windows

Tilt-turn window	4
Push-out Casement window (both for new and replacement) [Company A]	3
Ultimate Casement [Company A]	3
Double-hung window [Company A]	1
Infinity line of products [Company A]	1

Doors

Bi-folding door [Company D]	1
Multi-folding door [Company D]	1
Total wall of doors	1
Lift and slide door	1

Glass

Suspended particle distribution (SPD) glass/privacy glass	3
Simulated divided light	1
Energy efficient glass	1
New glazing techniques	1

Hardware

Ergonomic handles	1
Better hardware making larger windows possible	1
Specialty hardware	1

Product Features

Fiberglass products	4
Jam designs [Company A]	1
Modern/old designs	2
Finishes	1
Species variety, e.g. fir	4
Custom extruded aluminum cladding [Company A]	1
Copper clad window [Company D]	1

Service

Online quoting system [Company J]	1
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Durability

Clad wood	1
European design that has cladding held off from wood to let water drain and wood expand w/o seal failure	1
Wood preservative [Company J]	1

Green/Environmental Features

Composite materials [Company B]	2
Sustainable forestry, production and designs	1
Sun tunnel	1
Green paint (non-toxic)	1

The tilt-turn window, fiberglass products and species variety were all mentioned by multiple respondents as being particularly innovative or exciting. The tilt-turn window is a European design, and while not new to the world, it is relatively new to the U.S. When speaking of this product respondents said:

There's a whole product line that I think is fabulous...the tilt-turn approach. It just gives you so much flexibility... you can clean the outside of the glass because you can swing the whole damn thing in. In the tilt condition you have the small venting and in the turn you have the huge venting... And the other thing we've used them for periodically... its basement bedrooms. Lot of conversion of basement rooms to bedrooms. And if you think about it, if you have to open the window out into the light well or sidewalk you have all kinds of problems there. If you can tilt it in you've got the security issue taken care of, the ventilation, nobody's going to slide into the house and do bad things. So yeah it's fabulous. As windows go that's probably the most flexible. *Sales Agent, Portland*

One of the neat things that we offer, that very few...companies offer, is something called the tilt-turn window. And it's a European style window, and it's neat when you're at Home Shows and you see people who have either lived in Europe or an old German family or couple that walks in and they say 'ah I feel...it's just like home!' And this is a product where you can literally grab a pistol grip handle, and we build these windows almost as big as doors, and you can turn it in and it opens like an in-swing casement window or like an in-swing door...it doesn't have a door sill in it or anything...and open it up and then you can close it, click it, and turn it the other way and it will tilt in. *Sales Agent, Portland*

Fiberglass products, which cover a range of products including fiberglass windows with wood veneer interiors and wood windows with fiberglass cladding, were also mentioned by multiple individuals as being exciting new product options:

The fiberglass window that has the wood veneer on the inside because the wood veneer is about a 1/16 of an inch thick and it's...its very, very small...I like that a lot. I mean it's very attractive also, and a lot of consumers are like 'hey we don't have to paint' and on the inside wood you stain it.... the environmental movement I think has...made the

fiberglass window gain more popularity because fiberglass is made out of sand...[on the exterior] with [Company B]...they stamp out a piece of vinyl [cladding] and put the wood in and it fits like a glove. [Company A] uses the same technique but its with aluminum...they've been having problems with the expansion contraction rate of the two products, so if you have wood, and it expands and contracts even slightly, and you have something that fits it like a glove, and its vinyl, well that vinyl doesn't expand and contract at the same rate the wood does so you're going to have some delamination...so there were a lot of issues with how the windows are going to perform 10-15 years from now. With fiberglass it's a fiberglass material with a thin wood interior, fiberglass doesn't expand and contract. *Installation Specialist, Portland*

I think fiberglass windows are a good step of getting away from vinyl. I'm so glad that I have a window that has pretty decent frame strength even though it's just a pulled tube if you will or channel of material that allows air flow around it...All of a sudden a client can change the color of their window, you couldn't really do that easily with vinyl. It's the ability of recycled feedstock glass into that material, the ability to potentially meet a price point where applying a fir veneer could give a similar look to maybe that special order Doug-fir full wood window. *Homebuilder, Portland*

New wood species was the other most frequently mentioned innovation. While introducing new wood species might not seem particularly innovative, there is a process that manufacturers carry out before introducing a new species. For example:

[Company A] has a wood scientist who approves wood species...so the wood species that are available right now have all been approved by this wood scientist, and they are associated with cost and the actual milling capabilities of those woods. You know...what is going to stand up? So...if somebody calls and says 'hey I want alder on a wood window today' they're not going to be able to get that. And the reason for that is because our wood scientist has not approved it. *Sales Agent, Portland*

Introducing a new species of wood to a product line is not a simple process, this is the reason that it is considered innovative that more companies are offering the option of a variety of wood species for some of their products. When speaking of the variety of

species that are now available a sales agent said: “it was pine or nothing until probably up to about 6 years ago. Now we have mahogany, fir, vertical grain fir, mixed-grain fir...” indicating the variety of species that manufacturers offer.

A particularly interesting innovation that was only referred to by a single respondent, but could be a potentially desirable product in the Pacific Northwest market, was a different method of cladding wood windows:

The Europeans don't do that, they do offset clad material that's basically... its not really screwed on...but you screw on mounting strips and you slide it on, and they recognize that having the airspace lets water drain out...all of our research has shown that cladding needs to be held off the surface. *Sales Agent, Portland*

Another interesting response on the topic of innovation was made by a Las Vegas respondent when speaking what he feels motivates both design and innovation in Las Vegas:

Vegas is...I don't think innovative as much as the design systems are such that they are indulging people's dreams. This particular climate doesn't necessarily lend itself to designs that we put in houses. Multi-slide or moving wall door systems where you have a 27 foot long and as high as 10 foot tall door wall where you push button and it all goes into a wall...You're talking about a hole in the side of your house that is bigger than your garage...there is no energy efficiency or need in that other than indulgence. *Sales Agent*

There were, however, multiple respondents who felt that there are no truly innovative products on the market. According to these respondents most new products are either redesigns or imitations of product offerings from other companies:

I don't know if I can think of any that are out there from the rest of the market. Seems like as soon as anyone comes out with anything, any type of new technology, the others are right behind them...especially in that same price range. There's nothing out of the ordinary or advanced as far as technology goes...Windows haven't changed a whole lot in 100 years, well maybe energy efficiency has changed and screen quality, but that's about it. *Homebuilder*

Nothing has really jumped out at me...I really think that most things have already been thought of...I've seen more redesign than strictly new. *Sales Agent*

User Generated Design Ideas

Respondents had a variety of ideas for new products, ranging from service issues such as drag and drop images of windows on websites for use in Revit, a computer program used by architects to create 3-dimensional models, to adaptable grid designs for replacement.

Table 8 shows the complete set of design ideas.

 Table 8: User generated ideas. Concepts are organized by category.

Design Ideas

Window Structures

- Stronger architectural character (i.e. variety in profiles like streamline profile, small profile, chunky appearance, historical profile, etc.)
 - Use of more traditional designs (simple, well made)
 - More uniform sizing system for general products
 - Replacement casement/replacement double-hung
 - Adaptability of window designs (grid layout) for replacement
 - More options with round top windows and casements (more sizes)
 - A bigger off-set insulated 90 degree window, glass closer together and sight line smaller
 - Larger windows that also address wind strength
 - Large butt glazed window
 - Fir as standard option
 - Non-finger jointed wood exterior in more species
 - More economical way to provide fir/mahogany (companies inventory these materials)
-

Window Features

- More/better hardware selection
 - Regional products – use indigenous species, they usually hold up better in the climate
 - Different quality cladding, glass, etc. depending on the side of the house (but still have all look the same)
 - More cladding color options
 - Cladding in a material other than vinyl
 - More flexibility in glider windows (clad colors limited, wood species limited)
 - Roll up screens
 - More companies do blinds in glass
 - Better standard glass option
 - See more of the European ideas brought over here
-

Designing for Durability

- Better adhesive between cladding and wood
- Product that would meet wind specifications and not have maintenance concerns above 5 stories
- Less expensive water drainage system
- Way to get water out of system (at glazing unit)
- Composite materials in frame – water resistance, longevity, less maintenance
- Better weatherization (water flashing, longer lasting adhesives, etc.)
- Sliders that don't leak

Better wood treatment system; wood species that doesn't mold (or treatment); no discoloration or water stain either

Anything to lower maintenance

Better thermal performance $U=.2$ or lower

Solution to the problem that insulated glass has transportation issues → transportation causes seal failures and leaks in insulation as a result of pressure changes

Glass

Different glazing to improve performance

Improved Operation

Variation in operation (double hung options vs. single hung)

Quality control in how operates

Easy to clean

Service Offerings

Less cumbersome product catalogs; less items per page; less images per page; more items as custom rather than standard

Windows delivered as package rather than one at a time

Manufacturer follow-up calls/inspections to make sure products are OK

Websites: don't make people sign in or register in order to find out information

Websites: 3D window design/specs online for use in Revit

Human beings on the phone for Pacific time zone

Make testing reports more easily accessible

Re-localization of window companies (plants)

Better methods to ensure correct product specification, correct installation

Longer warranty to account for build time

More promotional support in advertising for customer awareness

Green/Environmental Features

Rubber sealing gaskets that do not include Neoprene (toxicity)

Many of the user design ideas concerned the appearance of the window, including designing for extra large openings:

More options with round top windows and casements...[Company K] only goes so tall in round tops, I'd like to see a wider offering of sizes....This isn't a structural issue, just how its manufactured....In Vegas people do lots of projects with larger openings, and they end up using steel frames. *Sales Agent, Las Vegas*

We needed a window that was not available on the market at the time and the manufacturer that we were using developed a window for our project specifically...we were using [Company E] architectural series in the home...we wanted a huge butt glazed windows with a huge single pane ½” glazed 10’x16’...we got it manufactured not in a manufacturer facility, but actually built on site. They installed the frame and then the glazer came in and installed the glass. A window this size can’t be one pane, ten foot windows are made of three panes, but in a way so that you can’t see seams...not the same energy efficiency as other windows that have argon between two panes of glass, but for a high dollar home that has views that’s what people want. *Homebuilder, Las Vegas*

Ideas involving window replacement or window part replacement that involved the least amount of change to the window or the window frame were also mentioned by multiple users:

A replacement casement window or a replacement double-hung window. The [Company D] double-hung replacement window is not really designed to fit within the frame of...an old window, it’s designed to be a brand new installation, you know ripped down to the studs. And I’d like to design a window that could replace...you know just tear out the sashes, leave the frame as it is, and pop a little kit right in there...I think there’s a much bigger market for that and I think in the economy we’re in now that’s something people can afford. *Sales Agent, Portland*

If I need to match a divided light grid pattern I want the adaptability. The design layout of the grids, the design for repair, issues like that I think are very important to me. *Homebuilder*

Manufacturer websites were mentioned by several respondents as an opportunity for companies to offer service features that would add value for their customer:

This office is 100% on Revit, AutoCAD is basically a thing of the past, and windows in particular need to be 3D. There are these things called Revit families...if they had their windows it would make our detailing extremely easier...much more easier...It might be a reason to select a particularly manufacturer....We don’t do 2-dimensional drawings anymore, we do everything 3D model and when you start to cut that into

pieces what happens when we want to use a [Company C] window we have to have someone in our office build that window in 3-dimensions with all the functionality and things into it in order to work for us. Whereas if a manufacturer can provide that ready to go, that matters, it saves us time, we'd use their products. *Architect, Portland*

Other additional services were also mentioned, including:

Might like to see a bit more promotional support in advertising just for customer awareness....Its just a factor of the economy which is that most companies have cut their promotional budgets. *Sales Agent, Las Vegas*

Storage

Prior to the start of data collection the researcher anticipated that sales agents would have physical storage issues with windows. However, this turned out not to be the case. The only problem that the respondents mentioned in terms of storage was not getting paid for product that they had to hold on to for longer than they had anticipated. The following statement illustrates the typical perspective of sales agents and storing product:

We try to time it so that...we get the delivery at our warehouse straight from the factory and from there take it to the customer within a week.... So we don't have a lot of overhead in our warehouse and so that everything is timed right so the customer gets it when he wants to get it. But there's been times when...the homeowner is driving the bus, so to speak. The homeowner wants it ASAP and the homeowner doesn't realize sometimes how long a projects going to take. I've had people, who have said...and [Company D]'s lead time, everyone's lead time in the wood window industry is pretty long, and [Company D] is longer than most, we're like 7-8 weeks....and I get a lot of people who are like 'I've got to have it in 4, I've absolutely got to have it in 4.' And so sometimes I'll call the factory and say, hey this guys got a big order with us, he needs it in 4 weeks or he'll walk what can you do, and sometimes the factory can come through, maybe they can pull some strings. But, I've done that in the past and 4 weeks later the guys not ready yet. *Sales Agent, Portland*

Green Building

Green building was a theme that emerged early in this study. Accordingly, after reviewing the first few interviews, the interview protocol was revised to reflect this. Users were asked if they had any experience with green building and what their concept of green building was. Two of the key themes that emerged from this were as one sales agent stated “it’s easier...to say what isn’t green than what is green” and also that the level of interest in green building does not always match level of output:

Green building is something I am very interested in...well what I mean by that is our...enthusiasm outweighs our actual performance to date. To this point I’d say the thing that I’ve identified most successfully for what we offer as a reasonably green product is [Company A]’s [X] product with fiberglass. As a production project efficiency is very key. It’s fiberglass so it’s from silicate primarily, instead of vinyl which is oil based. *Sales Agent, Portland*

Respondents expressed very different concepts of what it means to be green:

What we really promote is a home that is so called...sustainable. Something that’s really going to last and its built well, I feel that that’s...we’re doing our part in the green so called. *Homebuilder, Portland*

One of the key things I think about green is no waste....[Company A] does that with all of their sawdust and they generate power, there is zero waste, almost nothing wasted. So when I think about being green, when I think about us as a company being green, the first place I start to think of is waste and materials that we’re creating and using and what’s happening with them and the more...you can put yourself in a position where the least is going to some kind of waste site where its going to remain forever, everything that you do that prevents that from happening in my mind at least to come degree is going to be considered green. And then...I suppose the materials that you’re using how sustainable are those and that whole conversation would be the next layer of it. *Sales Agent*

Whenever we do one of these jobs where we’re restoring old product, that’s about as green as it gets, salvaging old products and keeping them in place is good green policy....We have gone to...engineered cores on

our doors, not every time but a lot of doors that we build. So that's a plywood material and it takes the high quality veneers and it you know vastly expands what you can do with one piece of wood, your yield is...much higher. *Sales Agent*

Various respondents discussed what was required to design a building utilizing FSC certified wood so as to gain LEED certification or to fulfill the requirements for the Living Building Challenge:

We are the only wood window, or at least the only fir window company, that is certified for FSC certification. So we can offer a 100% FSC certified...we are the only company that has an actual chain-of-custody certificate.... So you know on the standard we might only pull in say 5% of our wood is FSC certified and then the rest is SFI or whatever certification. But if someone says 'I want my project to be 100% FSC certified' we can make that happen. *Sales Agent, Portland*

The market here is huge, we had an inquiry from an architect locally who wants pricing for some custom windows, but wants it FSC. And we are not specifically a FSC manufacturer so we're breaking the chain of custody that they try to establish. But on the other hand like a lot of people that are in that same boat, what we will probably do for them is buy x amount of FSC product, sort of like carbon offset, and say 'yeah you bet, we'll buy this product over here and we'll put it into our product in general and the equivalent product is coming to you as not certified, but you've done the right thing.' It's not perfect but...in the particular thing they're asking for we would have to buy like about 5 or 6 different dimensions of FSC lumber. *Sales Agent, Portland*

There are so many different levels, from a light shade of green to a deep forest green. For what [our company] does they already build a green house, a quality home, with a whole system of how the house functions....We already meet most of the certifications. To get LEED certified we only have to modify a few things. So...we're just improving what we're already doing....A good solid energy efficient home is better for the environment and better for the people living in it....[green building] is not a trend that is going to go away, the buzz may die down, but its just setting industry bar higher. *Homebuilder, Las Vegas*

The thing that we've been thinking a lot about, again going back to Living Building, they're asking us not to include neoprene. That's on the

material red list, and I don't know how you're going to find a window without neoprene. So that's my challenge to the window manufacturing. They've already come so far in terms of using the right products, but not in terms of neoprene....It's...the rubberized gasketing used in window...when the window is closing...there are concerns that it's a toxic material and its off-gassing. And so that's why it's on the material red list....For Living Building, windows need to be operable for proper ventilation....So getting a window that is operable that doesn't include neoprene that's a challenge. *Architect, Portland*

The primary issue with green building appeared to be the cost:

Some we get a lot of people interested in it but after they get pricing, most people don't do it yet, which is to bad, but I understand, everybody has a budget, in time as more and more people use it the price will come down. But right now when its just used here and here its still pretty spendy. More and more companies are starting to focus on it though, 5 years ago I don't think more really cared, but now they're finding out that the public does care. *Sales Agent*

Las Vegas

During the course of this study it was found that compared to other material options, wood windows represent a relatively small percentage of the window market in Las Vegas. Additionally, the wood windows that are sold are clad not solid wood. Queried individuals provided several reasons for why wood is generally not a preferred window material in Las Vegas:

The home construction market is significantly different from that in other regions throughout the U.S. Due to the mechanisms of land transfer from BLM holdings to private developers almost every home here is constructed by a large developer such as [Company 1]....Secondly, wood windows are almost never used here due to climatological reasons. Wood has a high failure rate in our hot dry climate and as a result windows are usually metal, vinyl or some combination of these materials. *Assistant Professor, Department of Architecture, University of Nevada Las Vegas*

The cost is so prohibitive. *Purchasing Agent, Homebuilder*

Really a regional difference...if a wood window company wanted to enter the market and compete they would have to come up with something that would blow people out of water...and I haven't really seen that. *Director of Strategic Marketing, Homebuilder*

The main reason stated by Las Vegas users, however, as to why wood windows tend to be used only in custom, very high end homes, is customer perception. Despite research that shows otherwise, end-users of windows in Las Vegas typically view wood windows as not suitable for the climate.

Discussion and Conclusions

Regional Perspectives and Opportunities

One of the key findings of this research, which is perhaps an intuitive finding, is the existence of regional perspectives. Particular themes were evident in this research that both cut across user category and stood out in discussions. For Portland, there were three regional themes, weatherization, Douglas-fir as a standard material option, and green building. The researcher anticipated that Portland would exhibit a need for products that would withstand the severe weather of the Pacific Northwest. In addition to the overall rainy climate, most regions of Oregon are subject to high winds, while the coast has the added factor of salt water and the mountains have plummeting temperatures (Portland, Oregon 2009). Nearly every respondent mentioned issues with weatherization and discussed instances where products failed as a result. The opinion was expressed that windows suited to other regions, such as the dry Midwest or mild mid-Atlantic, are not necessarily suited to Oregon's climate.

In addition to this anticipated theme, one of the regional themes for Portland that the researcher did not anticipate was the desirability of a standard window constructed of Douglas-fir. Respondents cited such reasons as it being stronger than the standard pine, better suited to sustain in Oregon's severe climate, and the desire to match historic designs. While some companies have introduced a Douglas-fir option and [Company D] exclusively makes Douglas-fir windows, typically it is only available on a few styles of window and has an up-charge from the standard window price, making them prohibitive to many customers. Interestingly, Portland respondents appeared to be very cognizant

and pragmatic of the fact that while Douglas-fir is desirable to them, it may be less desirable to manufacturers as it is very much a regional interest.

The theme of green building was evident in both Portland and Las Vegas. Every respondent had an opinion on green building even if their particular views on the subject varied. The levels of knowledge and experience with green building differed greatly among respondents as did views on what actions needed to be taken to address the recognized need. Some individuals felt that if a home was built well to start with this met the needs of sustainability, yet others felt that this was not enough to be green.

Individuals stated the need for more FSC certified products, local sources, energy efficient products, and recycled content in products and packaging. They also said that all stages of industry need to practice sustainability, from forestry and harvesting practices, to zero waste production at the manufacturer, to recycling packaging and waste material from construction sites. Green building is a growing trend across the country, and respondents in this study indicated their belief that as consumers become more educated about the topic and about the available products and as legislation increasingly promotes it, it will become more common. For this reason, environmentally responsible products and practices are very attractive market opportunities for window manufacturers, particularly as there is a potential competitive advantage for green companies.

Like Portland, Las Vegas also demonstrated regional themes. One of these was the desire for indulgent products. Multiple respondents discussed products where the primary attribute of the product was either to be “cooler than my next door neighbor” or to be a

“cooler” product in its own right, e.g. the sliding wall of doors. Another example of consumers placing indulgence over function is the popularity of large picture windows in Las Vegas. Homeowners want large picture windows so that they can observe their views. However, these windows are typically energy inefficient and costly. Also, unfortunately for the wood window market, these large windows are typically made out of other materials. Large non-operable and operable wood windows are one area of product development where window manufacturers are already making comparable products or working on satisfying the need for comparable products.

Another regional theme from Las Vegas is the perception of both consumers and some sellers that wood is not a viable material choice for windows in Las Vegas due to the climate and type of homebuilding market. Several individuals who stated that their company does not use wood windows cited the reason as being wood’s tendency to dry and crack in hot, dry climates like Las Vegas. While proper maintenance of the window would prevent this, the users who did use wood windows, only used clad wood, not solid wood. The other factor making wood windows appear unappealing to Las Vegas consumers is the cost of wood as compared to the other materials, vinyl, aluminum and fiberglass. Las Vegas is primarily a production home market, meaning that to keep costs down, homebuilders will typically choose less expensive windows. It is therefore apparent that in order for wood windows to gain more market share in Las Vegas customers need to be educated as to the reality of the capabilities of wood windows and companies need to offer a price point wood product for use in the production market.

Finally, energy efficiency, in terms of the ability to keep heat out and still bring day lighting in, was a regional theme in Las Vegas. Minimizing heat loss and heat gain are two key components to the energy efficiency of a product. In Las Vegas the high temperatures and the long hours of sunlight make heat gain a particular challenge, particularly when homeowners like to have observable views and to use day lighting in their homes. Traditional skylights are generally not used in Las Vegas because they let too much heat in with the light. Designing solutions, such as the sun tunnel which consists of a dome of the roof of the house that channels sunlight through Mylar tubing into light receptacles built flush with the ceiling, is clearly a product opportunity for window manufacturers.

Introducing regional products to address regional needs provides both opportunities and challenges to manufacturers. In terms of opportunities, there is a clear demand for these kinds of products. In Portland, Douglas-fir windows do and will continue to sell well, however, other markets have not recognized a need for this species. This tests a manufacturer's desire or need to introduce a product that might do well in one market but not have larger market appeal. In Las Vegas there is a clear opportunity for wood windows in that they do not have a large market share at present and by introducing products that can do the same things the other materials can, e.g. larger frames, less weathering, more versatile shapes, they have the potential to compete. However, it is risky any time a company commits the resources to produce a new product. If that product succeeds then the company and the market benefits, if the product fails then the company is hurt and is often less willing to take future risks.

Green Products, Processes and Services

Perhaps one of the biggest opportunities at present is in green products. As evident from the responses of users in this study, in recent years the trend to “go green” has gained a strong foothold in the building industry. While Portland certainly demonstrated this trend to a more pronounced degree, Las Vegas also showed this trend. With respect to green products, respondents had many ideas for products they felt met the green criteria and were highly marketable. These products included replacement windows or adaptable grids that would enable consumers to change an aesthetic or repair a window without completely ripping it out and installing a new one, products made out of recycled content or with composite materials, products that are energy efficient, products that allow for the use of natural lighting, such as sun tunnels, and so on. Furthermore, the commercial appeal of “green” is not limited to one geographic region nor is it limited to merely green products. Respondents also indicated a desire for green processes and services. In terms of green processes, various respondents stated that they wanted companies to practice more environmentally friendly production, such as sustainable forestry, zero waste production, use of recycled content, locally manufactured products, etc. In terms of services respondents indicated that minimizing packaging and waste and allowing for the recycling of waste that is used was of interest. The diversity of green innovations asked for by respondents demonstrates the wide variety of opportunities available to marketers in this area. Additionally, as many respondents indicated, while green can be considered a trend, it is a trend that appears to be here to stay and will only increase in its appeal as more government regulations and incentives are introduced and as the public becomes more educated on the subject.

The Challenges to Identifying Lead-Users

In this study the researcher attempted to demonstrate the use and value of lead-user market research in the wood window industry. However, there are several challenges to the use of the lead-user method. One of the key challenges to this method is in separating lead-users from average users. As previously discussed, this is partly because the traditional definition of a lead-user as someone who tends to quickly adopt new products and trends and who expects to benefit greatly from doing this (von Hippel 1986) is a rather broad statement. Even the more detailed characteristics presented by Schreier and Prügl (2008) still leave room for interpretation. Therefore there is a heavy reliance on the subjective judgment of the interviewer to determine whether or not an individual meets the criteria. Additionally, the characteristics of a lead-user are not always apparent until after an interview has taken place.

In this study, to initially identify individuals, sources external to the users were consulted, including industry journals, professional associations and peers. On the positive side, these resources were able to provide opinions of the potential lead-user qualities of individuals and companies from a peer perspective. Peer recognition of an individual or company as a lead-user is useful as peers are more likely to have extensive knowledge of the practices and propensities of a company or individual to display lead-user characteristics. However, most people who were contacted were not familiar with the term lead-user and attempts to explain this concept did not always meet with success. Furthermore, peers are not always willing to recognize the positive aspects of other companies who frequently are perceived as rivals. On the other hand, if two or more of

these sources recommended the same individual or company as being leaders in the market or particularly knowledgeable this lent support to the idea of them being a lead-user. Other research performed to identify potential lead-users consisted of searching the internet, careful reading of company websites, and occasionally consulting industry journals to determine (a) if they [the potential lead-user] were applicable to this study in terms of their use of wood windows and (b) how they viewed themselves in terms of target markets and company positioning. These sources were used to get a feel for the relevance and lead-userness of the company or individual. After completion of this study it can be said that these external and internal sources were fairly good judges of the knowledge and expertise of the individuals in the market, this, though, is only one aspect of a lead-user. In addition, while previous research in the topic did provide the researcher with a fairly good understanding of the market and products, by no means does the researcher know or understand everything about the market. As a result, judging a potential respondent on what can be referred to as a “gut feeling” may not accurately define a lead-user. Consequently, the researcher may have omitted some individuals who were lead-users and incorporated some who were not.

Another challenge of lead-user research is determining to what degree a potential respondent must exhibit lead-userness in order to be considered a lead-user, primarily, whether or not they have to have a high degree of all lead-user characteristics. All of the respondents queried in this study fit the knowledge criteria of a lead-user, but knowledge is only one aspect of what makes a lead-user. The other characteristics of a lead user, the propensity to put one’s self in new situations and take risks in adopting new products and

trends first, could not be determined without speaking to the respondents. From the personal interviews varying degrees of lead-userness were observed. Table 9 shows how the researcher rated the individuals in this study based on the four lead-user characteristics used in this research and the researcher's overall judgment of the individuals as lead-users.

Table 9: The four specified lead-user characteristics and the level to which respondents are judged to possess each one (I = high, II = medium, III = low). Lead-userness refers to the researcher's overall opinion of the degree to which the user is a lead-user.

Lead-User Characteristics					
User	Consumer knowledge/use experience	Creativity	Innovative personality	Adopts new products/trends	Lead-userness
1	I	II	III	III	II
2*	I	I	I	I	I
3	I	I	II	I	I
4	II	II	II	III	II
5	I	I	I	II	I
6	II	III	II	III	III
7	I	II	II	III	II
8	I	II	III	III	III
9	I	II	III	III	III
10	I	I	I	I	I
11	I	III	III	III	III
12	I	II	III	III	II
13	I	I	I	I	I
14	I	I	I	I	I
15	I	II	II	III	II
16	II	III	I	III	II
17	I	I	I	I	I
18	I	I	I	III	II
19	II	I	I	II	II
20	I	II	I	II	I
21	I	I	I	II	I
22	I	I	I	I	I
23	I	III	III	II	II
24	II	III	II	III	III
25	I	I	II	II	II
26	II	II	II	II	II
27	I	III	II	II	II

* This was a group interview, but for the purposes of this table it is listed as a single lead-user as all of the individuals in this interview showed the same degree of lead-userness for each of the characteristics

An example of the varying degrees of lead-users is installers, who while necessarily very knowledgeable of the product and market trends, were not the most likely to adopt new products and trends. Their work relies on doing exactly what the homeowner, contractor or architect tells them to do in terms of what product to install and in following manufacturer installation instructions for warranty purposes, leaving very little room for innovation in this framework. On the other hand, architects or homebuilders who are constantly looking for new ways to suit the ever changing needs of clients' lifestyles, or to create architectural masterpieces, are more likely to seek out new products and trends, but they might be less knowledgeable about specific products or uses. In some cases it was quickly evident if someone was clearly a lead-user, while in others it remained questionable. In some cases an individual exhibited extensive consumer knowledge and a desire to incorporate new and innovative products in a home design, however, they were hesitant to use new products because they feared that these new products might not be fully tested.

It should be noted that while the stated lead-user parameter in this study was lead-users of wood windows, this actually encompassed several lead-users categories, i.e. sales agents, installation specialists, homebuilders, architects, and homeowners. Individuals were therefore judged on their lead-userness based on their role in the wood window value chain. For example, in determining their propensity to adopt new products and/or trends installers were judged based on their use of new tools and installation techniques, while architects were judged based on their incorporation of new window products in designs.

The challenges in identifying lead-users are the reasons why in this study individuals of varying degrees of lead-userness were included. While most individuals interviewed for this study had new product ideas, a few had never thought of an idea for a new product. Product innovation was one of the key lead-user characteristics for which this research was looking. If an individual failed to exhibit this particular characteristic it then was up to the researcher's discretion of determine whether or not the respondent had enough other lead-user characteristics to still be included in this study. As previously stated, the inherent nature of installation specialists' job does not incline them to be lead-users. However, they are still included in this study because the researcher felt that their insight into their particular role in the wood window value-chain was important and because the particular installation specialists who participated in this study did exhibit low levels of lead-userness. For the other positions, though, this determination was much more challenging. Overall, individuals were included because they demonstrated the other lead-user characteristics to strong degrees and because often they did suggest new product ideas in the response to other questions. For example, one homebuilder from Las Vegas said that she did not "have a clue" and "usually just adjusts to what is out there" with respect to user generated ideas. However, this same individual had some very definite ideas about how to make windows more energy efficient through the use of coatings, which she mentioned in response to the question about what factors of windows are most important to her. Another example of this was a sales agent from Portland who said that he could not "think of anything off the top of my head that's not available somewhere in the marketplace," but this same individual operated a custom millwork shop.

Earlier it was discussed how, because of their level of expertise in the subject, lead-users tend to want to share their knowledge. This may be true, and the researcher relied on this fact. However, in this study the researcher encountered the problem of lead-users not wanting to share proprietary information. It is a competitive advantage for companies to introduce new products. For this reason, sharing proprietary information, even for the sole purpose of student research, posed a challenge in convincing potential respondents to participate. One potential respondent stated point blank that they could not participate because the sharing of product ideas could harm their company. Other potential respondents might have refused to participate for this same reason without informing the researcher of their logic. Even individuals who did choose to participate may have elected not to fully disclose their ideas due to this same constraint. This unwillingness to share concept ideas might have led the research not only to judge the lead-userness of the individual incorrectly, but also may have not led to the best study results.

The onerous process of identifying an individual as a lead-user is another one of the drawbacks to the lead-user method as a market research tool. While it is likely that a researcher who is a member of the same industry would have more pre-existing knowledge of individuals and companies within the market, which would significantly reduce the challenge of identification, the researcher in this study was an industry outsider and had to rely heavily on the opinions in identifying lead-users. Lead-user research is nowhere near as simple a process as selecting average users from a market to interview. However, it is to be hoped that the quality and depth of information garnered from lead-user research, as evidenced by this study, makes it a worthwhile method to pursue.

Conclusions

The two key insights to be gained from this research are the challenges in identifying lead-users and the many opportunities for products and services in the window market that manufacturers are not currently exploiting. While identifying lead-users and implementing the lead-user research method is a challenge, the knowledge to be gained from these individuals cannot be overlooked. Nearly every individual interviewed had at least one idea for a new product, process or service. These concepts, particularly those mentioned by multiple individuals, illustrate not only specific products and services of interest to the users, but also the categories of products or services that are most relevant to users. The literature claims that the needs experienced by lead-users will be later experienced by the rest of the market, therefore products and services that address the needs of lead-users within these categories should also appeal to average users. It should be recognized that the findings from this study are only relevant at this specific point in time. While it is reasonable to assume that there will not be any drastic shifts in the wood window market so as to render the findings from this study completely obsolete, in order to obtain information on the current market a new study must be conducted.

Unfortunately our results also indicate that while most firms do ask their customers for feedback, most do not appear to have a consistent method to collect this information and share it with relevant members of their organization, such as the R&D and marketing departments. It may be that manufacturers do not recognize the need for incorporating user feedback in the initial design phase of a project. Previous research seems to indicate that this was the case but that the perspective is changing. It is the hope of the researcher

that studies like this one demonstrate that lead-user, or really any type of voice-of-the-customer research, is a tool that manufacturers should adopt and learn to utilize effectively in new product development.

Limitations and Future Research

Limitations

The primary limitation of this study is that findings cannot be extrapolated to a larger population. Lead-users are by definition not representative of a larger population. These individuals may anticipate the needs of a market months or even years before the rest of the market (von Hippel 1986), or have needs that the average user will never find important. To clarify this second point, first, several themes identified in this study relate to either the production wood window market or the custom wood window market. Many users of windows for one reason or another are not interested in purchasing a custom wood window. Therefore innovations in this area will not appeal to them. Second, many people have no opinion about windows, they view them simply as part of the house structure. As long as the window is there and performs its function, i.e. does not leak and can be opened, no further details are important to the user. This means that these users are not likely to express a need or a want for innovations.

The individuals in this study were non-randomly selected from two metropolitan areas, Portland and Las Vegas, based on their expertise on wood windows. As a result, the needs expressed by these users not only might not be reflective of the average user, they might not be representative of lead-users in other metropolitan areas. As noted in the discussion, the findings from this study showed regional perspectives, e.g. Portland has a need for Douglas-fir windows. Product innovations like this may or may not appeal to other geographic locations, there is no way to determine if they do without further investigation.

Future Research

As a conclusion to this research and as part of the Oregon Wood Innovation Center's commitment to industry outreach and education, a summary report of the findings was written for the express purpose of distributing to R&D and managers in the window manufacturing field. The intent of this document is twofold. First, it describes gaps in the market that current products and services do not meet, ones that might be desirable to manufacturers to pursue. Second, this document is meant to illustrate how to use lead-user research to generate new product and service ideas. However, to assess the value that this document and by extension this research has for managers and R&D personnel in manufacturing, a survey of these individuals must be conducted. By determining the degree of usefulness the findings of this study has for these individuals, researchers could refine the study methods and questions to better suit their needs. A refined study methodology could potentially provide even more detailed customer perspectives and more clearly described product and service concepts. Furthermore, one critical element of the lead-user method as described von Hippel that was missing from this study was a meeting between actual product developers and the lead-users to brainstorm product and service ideas. Future research could remedy this lack.

One limitation of this study is that the views of the respondents only reflect the opinions of one very specific region. While the strong regionalism noted by the researcher provides a clear picture of Oregon window customers, it does nothing to describe the needs of customers across the rest of the country. This is particularly limiting as Oregon is by no means the largest window market. Future research could utilize the methods employed in

this study in other regions to gain a more diversified view of window users. In terms of the use of this information to manufacturers, if these areas show similar regional characteristics, this would be useful to marketers in determining what products to market and how to market these products to users in each region.

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APPENDICIES

Appendix A: Interview Protocol for Sales Agents

Interview Protocol for Sales Agents

The purpose of this interview is to obtain information, based on your personal view, of how well existing products/services in the wood window industry meet your needs and/or what new products/services are needed. This interview is part of an effort to identify gaps where customer needs are not currently met and identify potential solutions to those needs. Your answers will be kept confidential and none of the information will be tied back to individual names.

General Questions

Decision making factors:

- What factors about the product or service (e.g. quality, cost, brand, service) do you think customers consider when making their decision about which window to purchase?
- What factors do you think customers should consider when making their decision about which window to purchase?

Customer needs and innovations:

- Do manufacturers ask you for your feedback/input? How do they collect this information (e.g. survey, phone calls)?
 - In your opinion, did they listen to you and/or utilize your feedback?
- If you were designing a wooden window, what would you add/subtract from what is available on the market today?
- Are there any companies/products that you find to be particularly innovative? Do you see any particular trends in these innovations?

User Category Specific Questions

Information about product sources:

- Why has your company decided to carry the window lines that you have? Why these companies and not others?
- Do you always use the same suppliers? Or if a customer has a specific need will you look at other companies?

Customer needs

- What are the primary complaints that customers have about their windows? (e.g. material issues, installation issues, use/maintenance, etc.)

Information about processes:

- What aspects (if any) of storing windows do you find especially frustrating?

- How do you resolve these issues?
- What aspects (if any) of inventorying windows do you find especially frustrating?
 - How do you resolve these issues?

Appendix B: Interview Protocol for Installation Specialists

Interview Protocol for Installation Specialists

The purpose of this interview is to obtain information, based on your personal view, of how well existing products/services in the wood window industry meet your needs and/or what new products/services are needed. This interview is part of an effort to identify gaps where customer needs are not currently met and identify potential solutions to those needs. Your answers will be kept confidential and none of the information will be tied back to individual names.

General Questions

Decision making factors:

- What factors about the product or service (e.g. quality, cost, brand, service) do you think customers consider when making their decision about which window to purchase?
- What factors do you think customers should consider when making their decision about which window to purchase?

Customer needs and innovations:

- Do manufacturers ask you for your feedback/input? How do they collect this information (e.g. survey, phone calls)?
 - In your opinion, did they listen to you and/or utilize your feedback?
- If you were designing a wooden window, what would you add/subtract from what is available on the market today?
- Are there any companies/products that you find to be particularly innovative? Do you see any particular trends in these innovations?

User Category Specific Questions

Information about processes:

- What aspects (if any) of window installation do you find especially frustrating?
 - How do you resolve these issues?
 - How frequently do you have to modify a wood window during installation?
 - Can you give me an example of how you have to modify?

Innovations:

- Have you or your organization designed any special tools to assist in installing windows?

Appendix C: Interview Protocol of Homebuilders and Architects

Interview Protocol for Homebuilders/Architects

The purpose of this interview is to obtain information, based on your personal view, of how well existing products/services in the wood window industry meet your needs and/or what new products/services are needed. This interview is part of an effort to identify gaps where customer needs are not currently met and identify potential solutions to those needs. Your answers will be kept confidential and none of the information will be tied back to individual names.

General Questions

Decision making factors:

- What factors about the product or service (e.g. quality, cost, brand, service) do you think customers consider when making their decision about which window to purchase?
- What factors do you think customers should consider when making their decision about which window to purchase?

Customer needs and innovations:

- Do manufacturers ask you for your feedback/input? How do they collect this information (e.g. survey, phone calls)?
 - In your opinion, did they listen to you and/or utilize your feedback?
- If you were designing a wooden window, what would you add/subtract from what is available on the market today?
- Are there any companies/products that you find to be particularly innovative? Do you see any particular trends in these innovations?

User Category Specific Questions

Information about product sources:

- Do you typically specify windows from the same companies? If so why do you prefer these companies to others?
- What sort of companies do you purchase windows from (e.g. manufacturer, wholesaler, etc.)?
- If your normal suppliers did not have the window you need, would you look elsewhere, or would you try to adjust your project to fit what they do have?

Information about processes:

- What aspects (if any) of window installation do you find especially frustrating?
 - How do you resolve these issues?

Green

- Do you have much, if any, experience with green building?
 - What do you interpret building “green” as?

Appendix D: Interview Protocol for Homeowners

Interview Protocol for Homeowners

The purpose of this interview is to obtain information, based on your personal view, of how well existing products/services in the wood window industry meet your needs and/or what new products/services are needed. This interview is part of an effort to identify gaps where customer needs are not currently met and identify potential solutions to those needs. Your answers will be kept confidential and none of the information will be tied back to individual names.

General Questions

Decision making factors:

- What factors about the product or service (e.g. quality, cost, brand, service) did you consider when making your decision about which window to purchase?

Customer needs and innovations:

- Did the manufacturer ask you for your feedback? If so, how do they collect this information (e.g. survey, phone calls)?
 - In your opinion, did they listen to you and/or utilize your feedback?
- If you were designing a wooden window, what would you add/subtract from what is available on the market today?
- Are there any companies/products that you find to be particularly innovative? Do you see any particular trends in these innovations?

User Category Specific Questions

Information about product source:

- Why did you choose to purchase your window(s) from that particular company?
 - Would you recommend them to others?
 - Would you use their products again yourself?
- Did you feel you were limited in your choices? Was there something that you would have liked to have done but there was not a product that met your needs?

Information about processes:

- What aspects (if any) of the window installation did you find especially frustrating?
 - How did you resolve these issues?
- What maintenance issues (if any) have you experienced since installing your windows?
 - How have you resolved/avoided these issues?

