Product Framework

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Tenon
Wood Solutions to the World

PAN PAC
FOREST PRODUCTS LIMITED

SCION
Next generation biomaterials

locusresearch
Sustainable Design & Development

Contents

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Introduction

The compass research programme was established to create an in-depth understanding about the use of finger jointed, treated and primed timber products in the exterior cladding siding & trim market within the United States.

A key deliverable of this research project was to identify options for adding significant value to finger-jointed material and applying this information to enable new product development strategies to be formed.

The research team established a broad understanding of 'the context' including macro-economic factors, demographics, trends and influencing factors. The assessment of context delivered a clearer view of the key regions within the US that represented the strongest potential for the products. With such a large market it was essential to focus on the most appropriate and opportune areas.

With the regions defined, it was possible to then move into the 'product oriented' research with the end consumers & users.

Defining the 'Product System' provides a clear and holistic view of the product in context. A product system broadly encompasses the social, economic, technical and environmental factors relating to a product.

Importantly the product system defines who the customer is, and then establishes their requirements through qualitative, in-person workshops. This process seeks to understand the roles, needs and expectations of the customer in relation to the specific product. The 'weighting' of the requirements is then quantified through questionnaires across a larger sample group.

These customer requirements are related to the technical, measurable factors of a product. The process uses well-established methods to create a prioritised list of technical requirements, which are the most relevant to the customer.

This is balanced with practical in-depth reviews of competing products, to shed light on what successful products in the market are doing to achieve market share. These reviews also provide the benchmarks for future products.

The 'Product Life Cycle' is defined to objectively document the supply chain, distribution, installation and use of the products. This provides a clear flow of processes for an effective environmental assessment using life cycle assessment (LCA) tools. Delivering a strong insight into the total environmental impact of the product, and with an increasingly green consumer, problem areas for improvement can be isolated.

The breadth of this information allows the creation of new opportunities and insights by relating the different trends and drivers across the spectrum.

Acknowledgements

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We would also like to extend thanks to other key contributors: Cameron Crump (Tenon USA), Rick Williams (Pan Pac), Ed Hudson (NAHB), Eric N. Hansen and John Tokarczyk (Oregon State University), Paul Brosnahan (Arcom), Sabrina Morelli (USGBC), Bohdan N. Horeczko (ICC-ES). We would especially like to thank Jane Nolan and the NAHB for their contribution and assistance with the customer workshops.

This project would not have been possible without the support of the Forestry Industry Development Agenda (FIDA), Pan Pac Forest Products and Tenon.

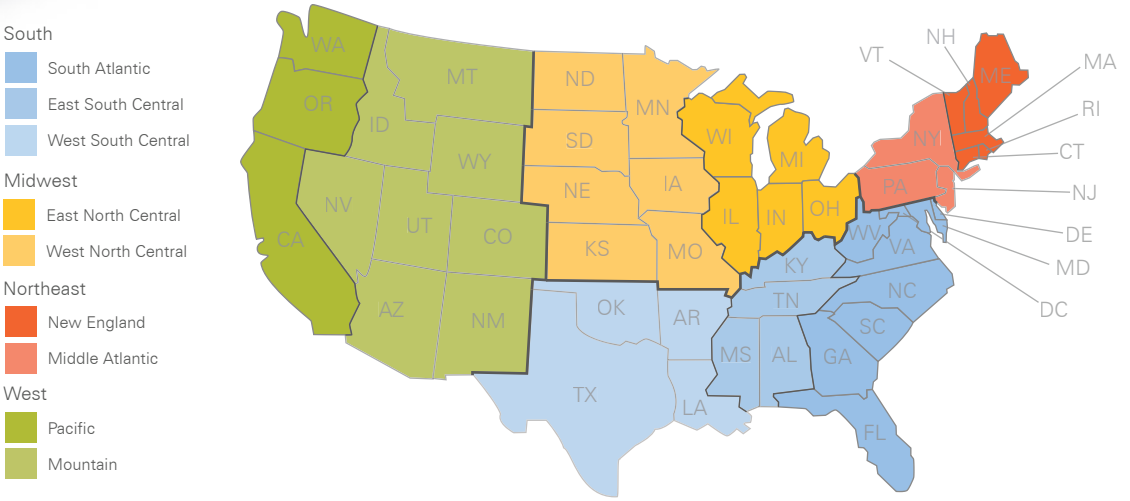
The Context

The 'context' encompasses all the external factors that influence a product. It is important to consider a broad range of topics to clearly understand the changes that are occurring with the market, the industry and, in particular, the customer. The largest consideration when evaluating the US market is geography. With the diverse nature of climate and geography within the US, it is important to understand the regional factors driving product selection and use. This is complemented by demographic and social statistics which provide an indication of some of the underlying changes within society that may impact on product use in the future.

Understanding how the industry is structured and how it functions indicates how a product could best be targeted and who it is best suited to. This ranges from large production enterprises to smaller custom builders and remodellers. Standards and compliance, whilst not dominant in the area of cladding, fascia and trim, need to be considered in order to ensure smooth implementation at a practical building level. An appraised low-risk product will provide an easier path to market, it is therefore important to understand what represents compliance and how it can be achieved for new and existing products.

The US market was broken up into key regions (defined in Figure 1) for assessment and definition. These regions were used to compile and analyse relevant information.

Figure 1. Regional Definition



A Growth Market?

The residential construction market in the US has seen a dramatic growth over the last few years, with the most rapid increase between the years 2000 and 2005.

Market development over the last 10 years on a regional level, is illustrated in Figure 2 below.

Recently the market has experienced a slow down due to economic factors such as increasing interest rates and an oversupply of housing stock as a result of a significant housing boom. The slow down is widely perceived to be a rationalisation and the general view is that growth will resume in 2008.

Figure 2. Growth in House Starts per Region

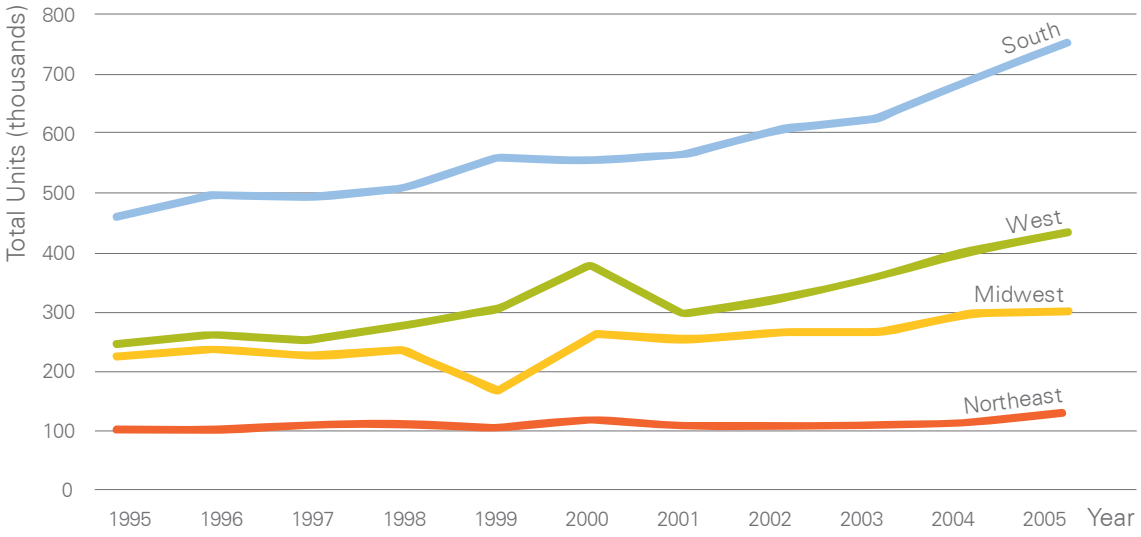
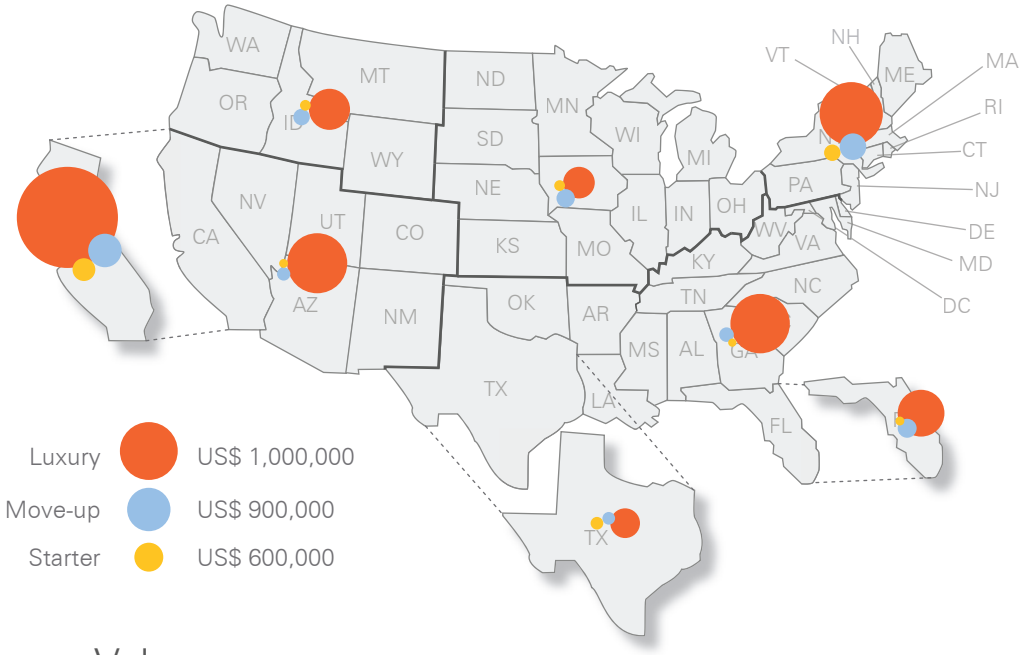


Figure 3. Average Price by Region and Home Type



Home Value

In the US, homes are typically categorised into three groups by value; 'starter', 'move-up' and 'luxury'. The terms describe the stage that the consumer is at within the home buying cycle. First home buyers typically purchase a 'starter' home, then step to a 'move-up' for their second home, whilst luxury homes are usually the preserve of established home owners.

The value of these categories varies widely regionally but the categorisation occurs on a national level. The national average for a move-up home is US$299,000, and a luxury home averages at US$655,000. Homes in California and the Northeast states are consistently higher than the national average. A luxury new home built in California is on average US$1,600,000.

A big factor in these costs is land, with demand outstripping supply. Regions with the highest build cost also have experienced sustained growth and large increases in land value. The wide range of home prices is illustrated in Figure 3 above.

As land has become increasingly scarce in city urban areas, developers have moved their focus to outlying suburban locations. Most single-family homes are now developed in either a close-in suburban or an outlying suburban location. Part of this trend is that larger developments represent better margins for building companies, with flatter land and the opportunity to create a total 'development'. An example of this is Riverpark development in Oxnard, Ventura County, in California where three to four production builders are building a large number of homes in one co-ordinated development.

Move-up and luxury homes have driven overall industry growth as they represent more than 80% of the total value of new single-family home construction in the US residential market.

Figure 4. Residential Construction per Value Segment

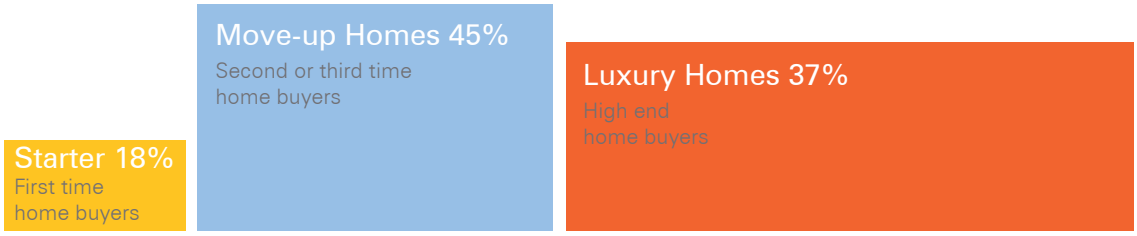
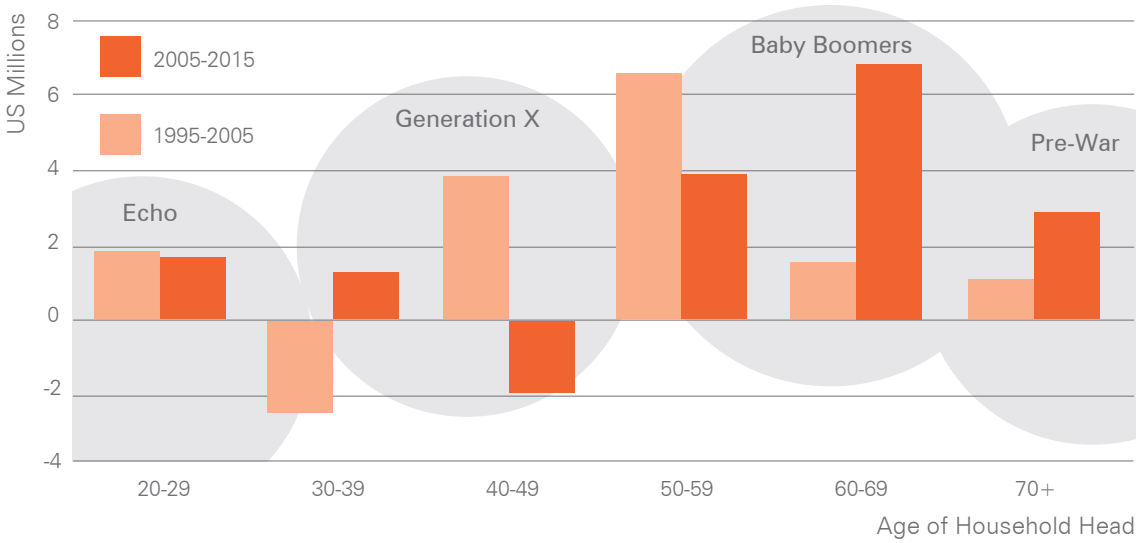


Figure 5. Future Impact of Generations - Household Growth by Age of Household Head



Changing Face

The traditional consumers are changing and along with them the industry. Studies from the NAHB as well as the Joint Centre of Housing Studies at Harvard University illustrate how home buyers are becoming more demographically and culturally diverse. This has resulted in a sophisticated consumer who is more educated in his/her decision making process. Building companies and product manufacturers now need to think about the socio-cultural context of their product offer within a much wider band of needs and desires.

On a macro level, generational groupings have had an impact on the market.

Baby-boomers have changed the market due to their purchasing power and numbers driving the luxury end of the market, whilst Generation X has provided a strong basis for continual investment in the move-up segment. This has occurred through US residents and the more than one million young foreign-born adults arriving in the US each year.

Even with the recent housing market slow down, net inward migration combined with the aging of the baby-boomers and their increasing wealth could propel housing construction and improvement spending to new heights.

Contributing to the diversification of the customers are mortgage companies who have ridden the wave of rapidly increasing building market, and low US interest rates by offering 0% deposits and long-term loan structures. This has introduced a whole new clientele of home buyers to home ownership, and encouraged others into larger more luxurious dwellings.

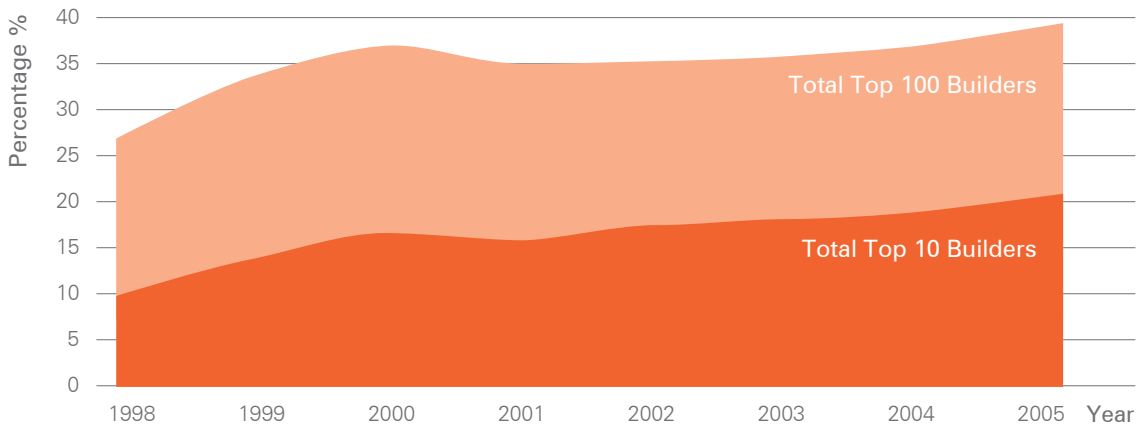
The impacts of Sub-Prime mortgages are harder to determine. These mortgages, which are offered at higher interest rates than prime banks, appear to have functioned effectively with record low interest rates. However, as the Federal Reserve has increased the monetary policy rate to limit inflation it will dramatically increase the exposure of companies and may impact on residential building growth by creating softness within the market.

Reconstructing the Industry

The favourable economic climate has attracted investment into the residential construction sector and contributed to the consolidation of a previously fragmented industry.

Publicly listed companies have expanded rapidly through acquisition of regional and local building companies to create large nationwide production building companies. This has been an effective strategy for gaining local knowledge, customers, and insights within target markets throughout the US. Product specification and distribution at a national level have had impediments due to large variations in regional preference, compliance issues and supply. Consolidation is most prevalent

Figure 6. Market Share of the Top 10 Builders



within the top 10 builders, and to a lesser extent with the top 100 builders. The top 10 builders have grown into a position where they now control almost 25% of the total new construction market.

This trend toward consolidation is contrasted by the fact that still over 50% of residential buildings are built by small to medium sized building companies, most of which are involved in custom building. The market downturn may further slow consolidation within the industry, creating a market that is still finely balanced between high volume production builders and low volume custom builders.

Individuality

The recent housing-boom has led to large uniform, pre-designed developments otherwise known as 'cookie cutter' houses. These 'Tract housing' developments represent whole communities which have been built in a homogeneous manner. The large production builders have adopted this strategy as a mechanism to provide a more fully featured home whilst being able to minimise cost increases and improve margins for shareholders.

In effect, good design has become a basic expectation of the home buyer even at a starter level. These homes require a greater level of design cost which building companies have amortised over a whole development. Consumers are now demanding more flexibility and options without a reduction in features and benefits, resulting in changing demands on building companies and product manufacturers.

Individuality = Flexibility

End consumers are looking for a more personalised product that allows them to express their individuality. At the front line of this trend are Generation X who want to express their individuality through their homes and their neighbourhoods, and demand products that allow them to move away from the mass-produced look of suburbia that has predominated over the last 5 years.

The trend has led to an increasing demand for products that offer greater design flexibility. This has developed into the demand for products that can be used in several different ways and can be applied to a range of designs and home-styles. This allows the builders or contractors to buy in bulk and simplify stock-handling to keep the costs down without compromising design.

Figure 7. Diverse Neighbourhoods

Production builders are also answering this demand by building variety into the community as a deliberate strategy. Even if the end consumers cannot alter the exterior look of their home, they get the opportunity to choose a range of different home layouts within the community with a wide range of interior options or packages. The builder makes sure that each street has an appropriate mix.

There has been a strong revival of more traditional styles, such as craftsman and country styles, equivalent to the 'comfort food' of homes. This trend has been referred to as 'Heritage Heart' and is where baby-boomers are enjoying the aesthetic style of good old times, and younger home buyers are exploring the styles of their childhood homes. Both these styles offer great opportunities for a timber product with their level of detailing and general preference for a natural look.

Home Size

Over the last 20 years the home size has increased dramatically and the average size of a home is now typically around 2,330 square feet. The increase in home size and cost has led to both builders and end consumers struggling with the problem of building the dream home while retaining some level of affordability.

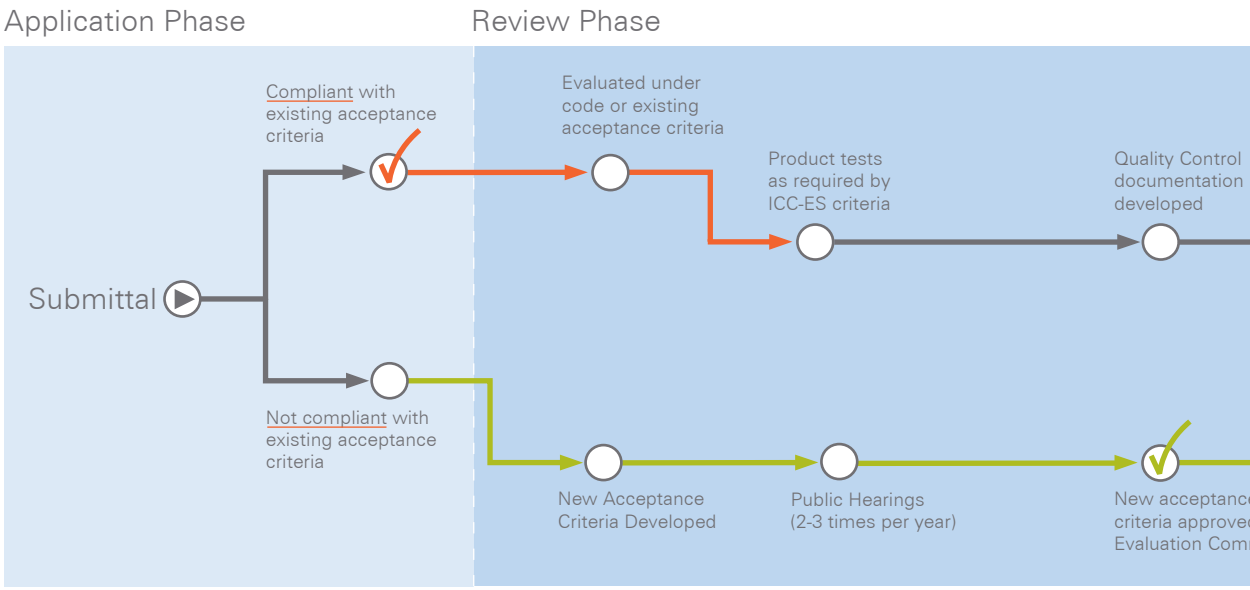
Customers are less prone to sacrifice quality amenities inside the house, but have been willing to sacrifice material cost on the exterior. This is driven by the immediacy of the interior surroundings therefore providing more of a status indicator when entertaining.

It has become common practice on the East coast to use the more expensive material such as brick for cladding the street frontage while the other three walls are clad in a more cost-effective option such as vinyl or fibre cement.

Figure 8. 'Craftsman' Details

Figure 9. Houses clad with a combination of more expensive materials and more cost-effective materials.

Figure 10. ICC-ES Appraisal Process



Standards & Compliance

Any new product or material introduced to the market has to comply with the relevant building codes. Generally trim and fascia have little difficulty entering the market as the code is primarily driven by '*life safety*' rather than the retention of product integrity and house value. Siding has a higher threshold as a quasi-structural material but still does not directly impact upon life safety. Fixing methods and weather (wind force) resistance appear more important than 'weather tightness' due to the nature of the construction environment.

The diverse nature of states, regions and counties within the US has seen a wide range of codes developed and approaches taken. There has, however, been ongoing consolidation and rationalisation under the International Residential Code (IRC).

The IRC is a residential building code and is descriptive in nature as it is designed to be a 'cook book' for homeowners, builders and contractors. This is different to the companion International Building Code (IBC) which governs commercial building and requires greater evidential support for design work. It is also more tightly regulated.

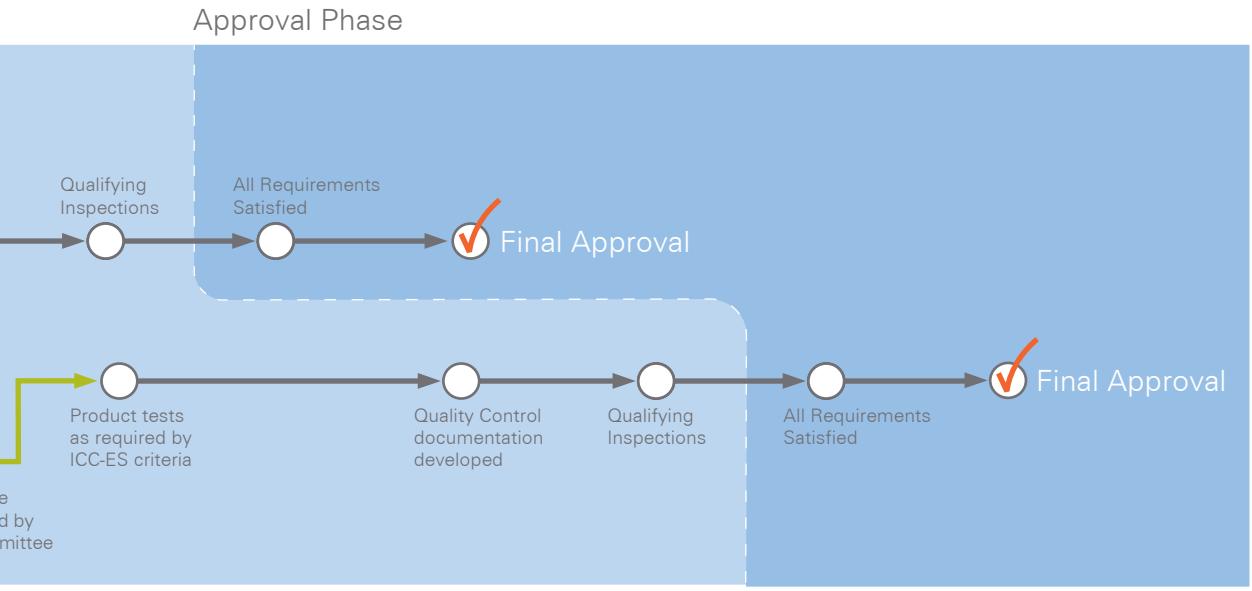
The IRC is still subject to interpretation at a local level by individual inspectors. As such it is useful to have a code compliant product that has been evaluated.

For a product to objectively prove its compliance with the code, it has to be evaluated and approved by the ICC Evaluation Service (ICC-ES).

The ICC-ES appraisal process offers two different pathways for approval of new products (Figure 10). This covers the introduction of a product that meets existing criteria and just needs to be tested to prove compliance, and the introduction of a product that does not fall within the existing criteria. If a product does not comply with existing parameters a new set of 'Acceptance Criteria' needs to be developed and notified through the International Code Council's public hearings that occurs three times a year.

Regional Selection

The housing industry in the US is fragmented by socio-cultural and geo-climatic issues related to each region. Research data such as demographics, income, housing sales, migration and material preference were logged on to a map of the US to aggregate the information and provide a visual assessment of where some of the 'hot points' and high scoring regions were. These 'layers' of information were compiled into a single view which gave a clear representation of information. The darker a region, the higher it scored across a range of statistics whilst a higher number of hot spots again signifies positive attributes for the region or state.



This visualisation was the primary mechanism utilised to select the key regions for the product-oriented research phase. The two regions that were selected for the in-depth research were the Pacific Northwest (Portland, Oregon) and the Northeast (Rockville, Maryland).

The Pacific Northwest was defined as a good target due to positive inward migration trends, high income levels, existing timber usage and the prevalence of traditional timber exterior siding and home styles. The low use of vinyl and the use of higher value materials like fibre cement and wood indicate good market opportunity. Western regions spend the most on residential improvement.

Evidence of an existing growing commitment to green building and 'sustainability' within the west coast communities was another compelling factor.

Whilst the Northeast does not score highly in timber preference there is a strong traditional link to the appearance of wood. Traditional home styles, like the colonial, use both weatherboards and brick. A compelling statistic in the Northeast is that 95% of exterior cladding (predominantly vinyl 83%) used is currently 'weatherboard' or siding style products.

Traditional home styles in the Northeast, like the colonial, use weatherboards and brick. The Northeast region has had great consistency in the number of single-family house starts over the last ten years, but from 2003 to 2005 they trended upwards to the highest level since the late 1980s.

The market in the Northeast has historically used timber siding, although its use decreased from 28% to 8% over the last 10 years.

The Northeast region is well over the national average on home value with some of the highest average income levels in the US. The move-up and luxury markets are thriving and there is increasing support for green building at a grass roots level.

The Southern regions were excluded mainly due to the fact there is little demand for timber siding style products. It is important to note, however, that with construction changes there is little climatic reason for timber siding products not being deployed within these markets.

The South features prominently in a number of statistics. The South and West regions have seen the largest growth in residential construction and have the highest number of single-family house starts. Arizona, Nevada, Florida and Georgia all showed a major growth in population in 2005. In 2003, the value of building permits in the South and the West increased at twice the pace of the Northeast and the Midwest.

Regional Selection

How the Diagram Works

The map is a geographic summary of information. A range of data layers were placed on top of each other to create a visual weighting system indicating a region's level of importance: the darker the colour the more important the region. Hotspots are locality-specific sound bites of relevant information. An area with a dark colour and a number of hotspots is one that needs to be evaluated. The full range of separate geo-informational graphs are annexed in the main report for your ease of reference.

This information was used to assist in defining the key regions on which to focus the product-oriented research component.

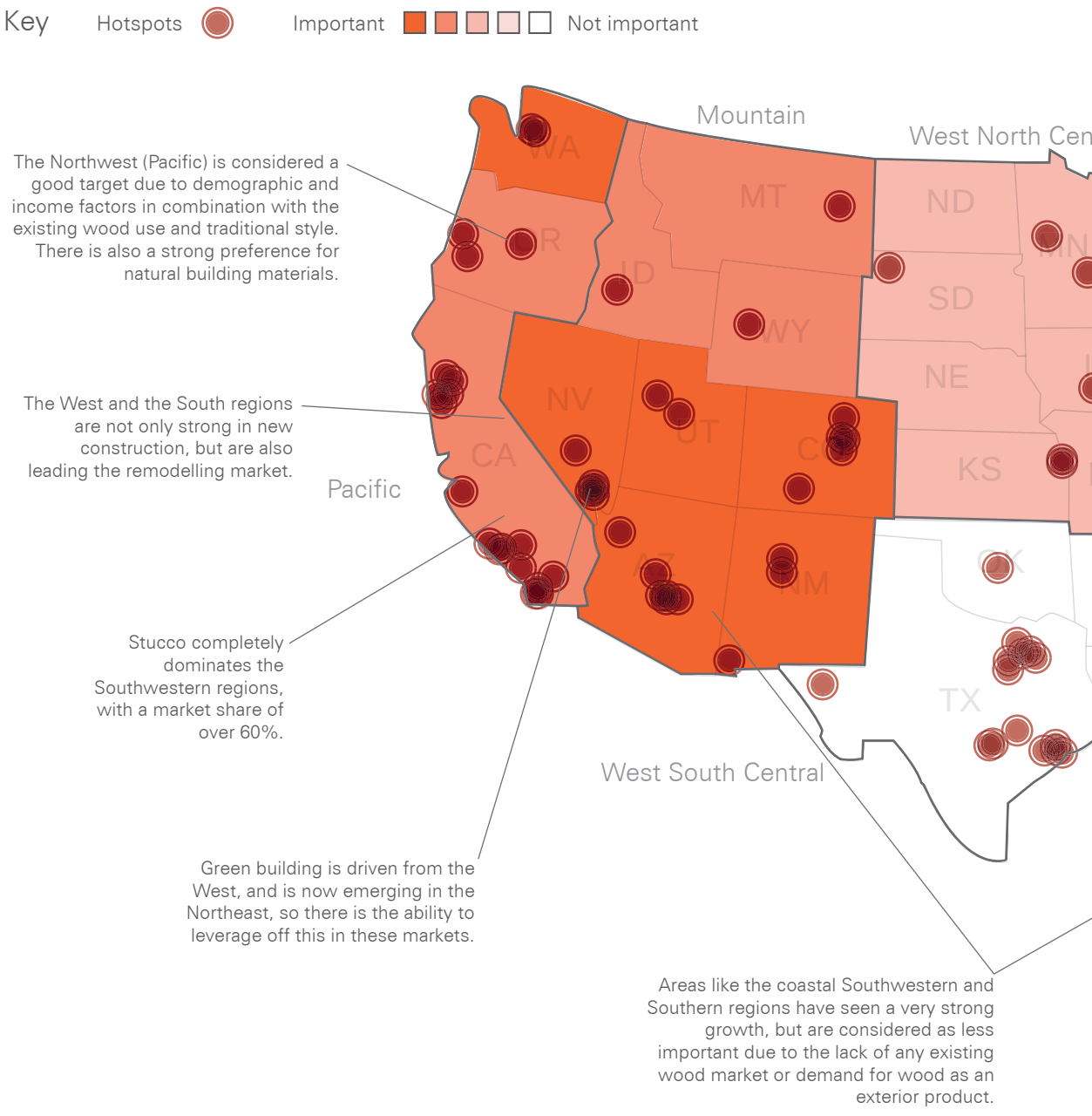
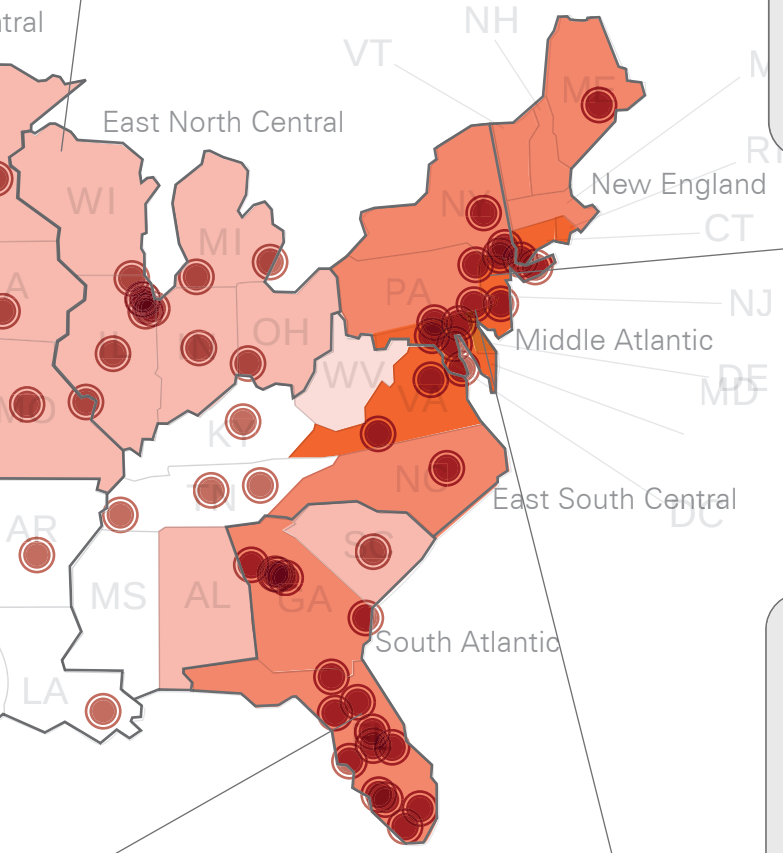
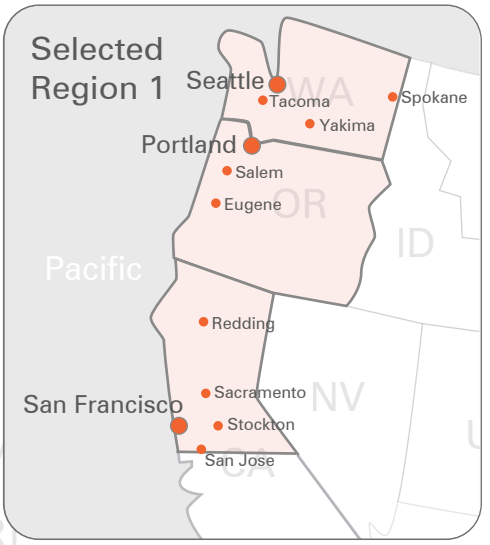


Figure 11. Regional Selection

The Northeast, Midwest and Northwest all have a traditionally strong preference for the appearance of timber. These markets are now dominated by vinyl and fibre cement which both imitate the natural appearance of timber.





Whilst the Northeast does not score highly in wood preference, the strong tradition and the highly valued appearance of wood should be considered. The widespread use of vinyl siding proves that the 'wood-style' appearance is still preferred.

The Northeast has some of the highest income levels in the US, as well as the highest average home prices. The move-up and luxury markets are thriving.

The Product System

A product operates as part of a system involving the factors that influence the product's manufacture, specification, sale, use and disposal or reuse.

A central part of this system encompasses the definition of who the customer is and what their key requirements are. The customer in effect makes up the market, so defining this provides an effective picture of the market and its key drivers.

These 'soft' requirements are contrasted by the 'hard' technical or measurable requirements of a product. The technical requirements are the means with which we can measure the effective performance of a product.

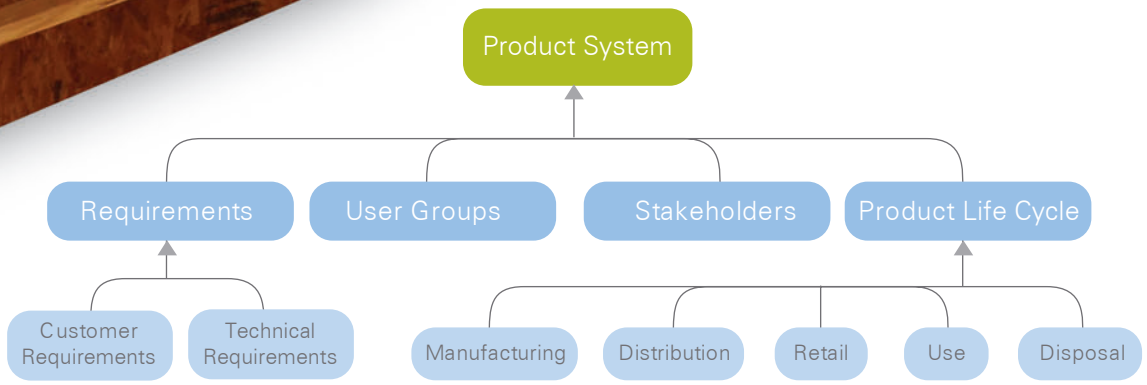
A key part of the method used in the compass study is the combination of both customer and technical requirements into a matrix that enables the creation of a set of prioritised technical requirements. This enables product development to be more effectively structured around what customers are looking for.

Investigating and interpreting the features, benefits, strengths and weaknesses of competing products provides a practical view of what products are succeeding and why.

It is important to understand the 'product life cycle' including all phases from extraction to manufacture, supply, use, service and the end of life. A defined product life cycle enables relative assessment of environmental impact. It also clarifies the supply and distribution chains and how users interact within the life cycle phases.

Together this range of factors builds an accurate picture of the product and the system that it operates within.

Figure 12. Product System



The Customer

The customer is made up of different sub groups which have competing requirements that need to be balanced. These requirements have been formed through literature research, discussions, workshops and surveys with specific groups.

Breaking down and describing the special characteristics of the different types of customer sub groups such as users and end consumers enables evaluation of the key elements that influence each group.

Deconstructing the Customer

The customer groups for siding, fascia and trim were delineated into two groups within the US Market.

- The 'Users'; those that use the product or information about the product such as builders, contractors, & specifiers.
- The 'End Consumers'; those that purchase the end product, for example the homeowner or investor.

NAHB research indicates that it is the 'Users' (particularly builders and contractors) that have the most direct influence on the selection and use of exterior siding, fascia and trim products. It is therefore critical to address their needs and requirements directly to drive uptake of the product. End consumers play an obvious role, but this group is more interested in appearance and does not exert a strong influence in material selection. Technical products which exhibit little variation in their appearance such as trim appear to be primarily driven by sub contractor and builder's decision making.

Within the identifiable customer groups, contractors and specifiers are subordinated to the builder as their involvement in the building process is in most cases initiated by the builder. The builder was isolated as the critical user group and so it is important to understand the key characteristics of the builder types, as their ways of doing business are very different. There are three types of home building companies: the production builder, the custom builder and semi-custom builder.

Figure 13. Primary User Groups

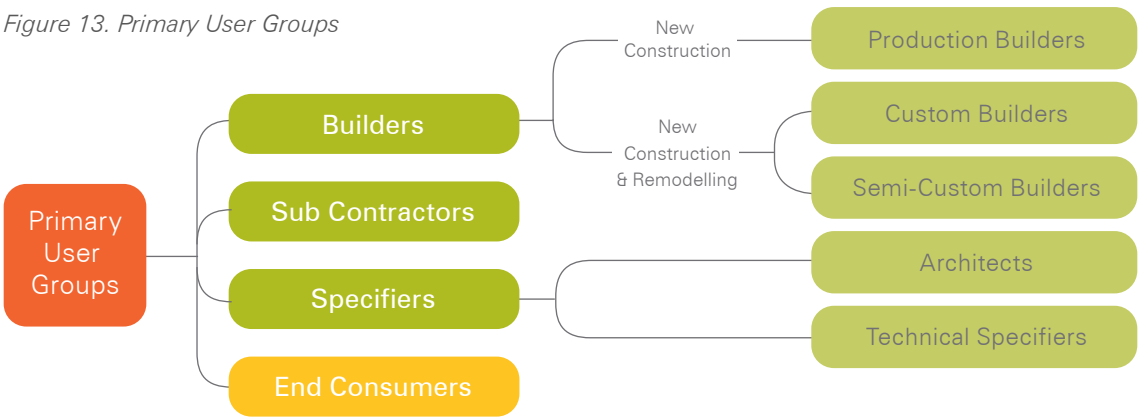


Figure 14. Characteristics of Different Builder Types

Production Builders	Custom Builders	Semi-Custom Builders
◢ Generally takes ownership of homes ◢ Process focus ◢ Business orientation ◢ Emphasis on efficiency ◢ Minimizes choices in design and materials selection	◢ Typically act as general contractor to the customer ◢ Product focus ◢ Craftsman or architectural orientation ◢ Emphasis on satisfying customer wants/needs ◢ Maximizes choice in design and material selection	◢ Business structured more like a production builder ◢ Allow greater choice than production builder

Customer Requirements

Customer requirements reveal the intangible or 'soft' aspects of a product such as 'curb appeal'. These requirements are determined by the customer through qualitative research methods to form the 'customer's voice'. A goal of this type of research is also to qualify what the customer requirements mean and how important they are. The compass research project adopted an inclusive approach by involving both users (specifiers, builders, contractors) and end consumers (home owners) in the customer workshops and quantitative questionnaires.

The question of 'What is important to you?' was answered over a period of six months through on the ground research involving informal discussions, structured workshops and quantitative questionnaires. The outcome of this was a wide range of requirements which were reduced into a final set of key requirements after a process of prioritisation.

End consumers, builders, contractors and specifiers all make different demands on the product, according to their own special needs. Once the final requirements were established customers were asked to rank the requirements according to their importance to them. A quantitative questionnaire method was used with 300 builder respondents and 150 end consumers. Figure 15 below shows the top ten requirements divided up for end consumers and the industry-related groups.

It becomes clear that there is an intrinsic difference between the end consumer's and the user's way of looking at a product. The end consumer describes the type of scenario that they seek when living in the house. They are looking for something that will last throughout their ownership of the home; they value factors that affect their economy, such as longevity and energy efficiency; and they make it clear that they wish for something that requires little maintenance.

Users link their requirements more closely to their daily work as well as how it impacts on their business and how attractive it is to the end consumer.

Figure 15. Top 10 Requirements of End Consumers and Industry

Ranking	End Consumer	Ranking	Industry (Builders, contractors & specifiers)
1	Weather tightness	1	Weather tightness
2	Durability	2	Mould/mildew resistance
3	Quality	3	Reliability
4	Longevity	4	Guarantee
5	Decay resistance	5	Quality
6	Reliability	6	Cost of maintenance
7	Energy efficiency	7	Durability
8	Stability	8	Reliable manufacturer
9	Low maintenance	9	Longevity
10	Climate tolerance	10	Curb Appeal

Appearance, Value & Maintenance

At the time of selection, the end consumer is primarily concerned about three things; the appearance, value, and maintenance of the product.

Specific style or appearance requirements depend greatly on the dominant regional style. But generically it is important for the product to add some 'curb appeal' to the home so that it stands out in the neighbourhood and to *'simply make it look great'*. What this specifically means depends on the individual customer, as well as the prevalent regional style.

Value for the end consumer is usually made up of a combination of factors, as a workshop participant in Washington DC states *'Value to the consumer is always related to something else, other than just the price'*. What makes a product valuable, apart from the up-front cost, is something builders refer to as *'perceived value'* involving total performance and delivery of the product. A product that manages to make the customer's home look great and will endure, is perceived as valuable by the customer even if it comes at a higher price.

Business Friendly Product

Users link their requirements closely to 'use' as well as to how the product contributes to their business. They seek a product that enables them to run a cost-effective operation as well as deliver a desirable end product to their customers. Builders and contractors need products that handle well on site, are easy to fabricate and install, and reduce cost without impacting on value.

Both builders and specifiers emphasise 'design flexibility' which is the ability of a product to adapt to different home styles and applications as this will enable larger purchase volumes and keep procurement cost down. If a product can be applied to several different regional styles as well as different climate conditions, this will further strengthen the purchasing case.

During research builders referred to curb appeal and the importance of creating *'memory points'* for their customers. In an increasingly competitive market they need to be able to add 'that little extra' to their houses ensuring theirs will stand out and make their customer feel at home. This concerns not only the aesthetic part of the home, but also the performance attributes. Delivering a product that has longevity creates a feeling of security for the end consumer.

This is particularly important to large production and custom builders as their public image is a major decider in repeat sales, and therefore impacts on their long-term viability.

Technical Requirements

Technical requirements document and communicate the 'measurable' aspects of a product. The technical requirements are determined by the product manufacturer — typically referred to as the 'company's voice', as opposed to the 'customer's voice' that creates the customer requirements. These two opposing sets of requirements are coupled together through the established Quality Function Deployment (QFD) method. This methodology creates a relationship between what the customer thinks and the measurable product requirements which enables the company (manufacturer) to distill a set of technical product requirements.

Figure 16 below is the outcome of the exercise for this project and lists the key focus points for the development of a siding, trim or fascia product for the US market. The items are ranked in order of priority.

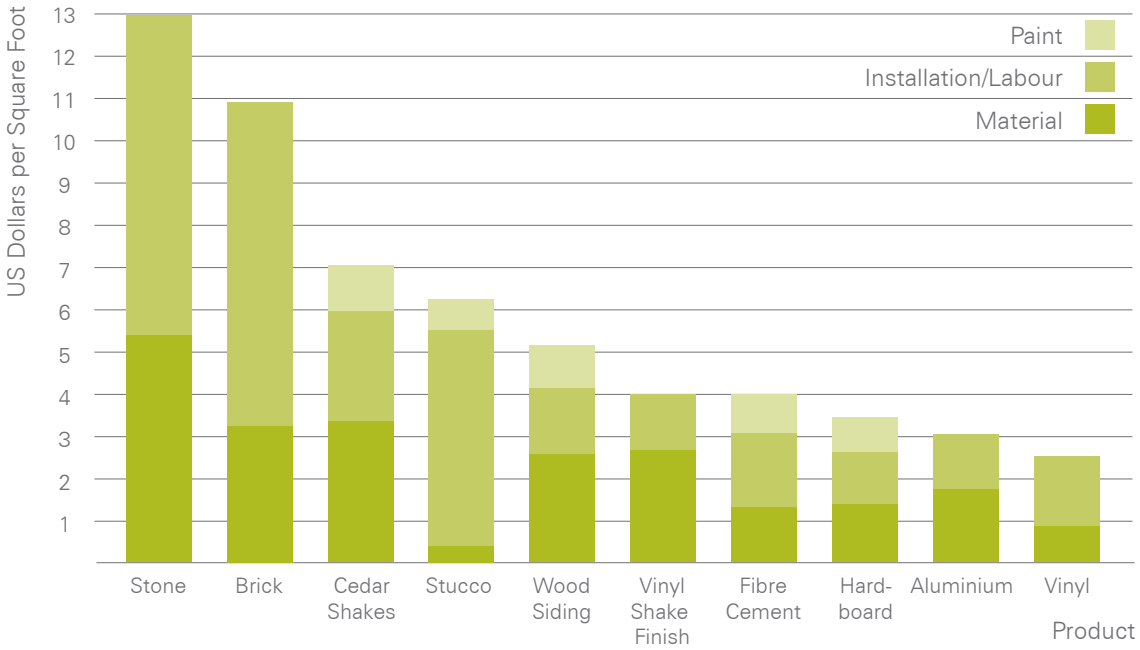
The top-ranked requirement of coat durability reflects the importance of maintenance issues. Timber products that have to be painted and maintained more frequently than their key competitors represent a key technical challenge for exterior timber siding, trim and fascia products.

The requirements define the key technical challenges for a product to be responsive to both end consumers and users. The next step would

Figure 16. Key Technical Priorities

Ranking	Technical Priorities
1	Coat Durability (years)
2	Seasonal Movement
3	Weather Tightness
4	Decay - ASTM log type scale (1 to 10)
5	UV Resistance
6	Total Product Lifespan (years)
7	Installation Cost (Total)
8	Initial Distortion - Twist
9	Initial Distortion - Bow
10	Initial Distortion - Cup
11	Initial Distortion - Crook
12	Installation Time (hours/m^2)
13	Product Weight

Figure 17. Cost Comparison - National Average of Product Cost per Square Foot



be to benchmark the measures against the key competing products such as fibre cement and vinyl to provide a clear picture of comparative performance in the key indices.

This would target the technical areas that could frame short, medium and long term product development strategy.

The Competition

In the US, competition amongst products is driven by some strong regional variables such as locality of dominant material manufacturers, regional style preferences, and climate.

Timber's market share has dropped significantly over the last 20 years. This is as a result of the emergence of a wide range of new alternative materials and products with improved features and benefits and in some cases lower costs.

Fibre cement has become a key competing product having established a 12-15% share of the new construction market within the siding category. It is marketed as having the appearance of timber but with greater durability, termite-resistance, fire resistance, and an extended 50-year warranty. It has strong market share in the Southern and Western regions and is becoming more popular in the Northeast, where it is often used in combination with brick and stone. The cost of fibre cement is comparable to mainstream timber siding products, and it competes in the same niche for sales.

Vinyl sheet cladding is a dominant product within some regions. It has enjoyed strong growth to assume over 30% of the total national cladding market. As opposed to the board type of structure of a solid siding product, vinyl's sheet form dramatically cuts installation time and cost. It has traditionally been the choice for middle to lower cost homes. However, because builders struggle to contain costs with the growth in home size it is now found on higher-level homes. It is strongest in the Northeast and Midwest which have a strong history of colonial siding style homes.

Brick is a traditional building material but has managed to retain its 20% market share more effectively than timber. It has its stronghold in the Southern regions but is also widely used in the Northeast, especially in combination with siding. It is marketed as a product that is largely maintenance free. Brick houses are energy efficient and hold value when it comes to re-sale as they generally sell for 6% more than other homes. As a result consumers believe that building with brick pays off even with a higher up-front cost.

Stucco has about 20% of the total market, but almost 60% of the market in the Western regions. The architecture has evolved from solid plaster Spanish and Mexican home styles which are suitable for a hot dry climate. Stucco has made its way into non-traditional markets with the revival of the 'Craftsman' home in which several different materials are used in combination with one another.

So, What's the Cost?

Material and installation costs within the US vary dramatically so each region should be assessed carefully for effective price points, independently of national averages.

The relationship between the cost of cladding and home size should be considered. An example of the relative cost for cladding a 3000 square feet luxury home in siding was provided by an east coast builder. Timber was estimated at $28,000, fibre cement at $24,000 and vinyl at $6,000. This is a wide range considering these products impart the same stylistic appearance.

Trim presented an opposing picture with the estimated total trim cost for Azec PVC approximately $15,000, compared to $3,000 to $4,500 for primed timber. This paints an inconsistent image and suggests the perceptions are not indeterminably linked to material. This example illustrates that although PVC siding is a low cost material, solid-cellular PVC trim can exist alongside it as a premium product. It suggests that the contractors are strongly considering performance in their purchasing behaviour. and that targeted 'branded' marketing could be effective to build a strong market position.

The final cost of a product includes the cost for the material and labour, as well as painting if required. Figure 17 illustrates how the final cost is affected by these different elements. Timber siding places in the middle of the field, not far away from fibre cement. Vinyl is the lowest cost material due to its thin wall, sheet format and easy installation.

Vinyl has created market share by delivering a traditional, colonial style at a very low cost that has appealed to production builders. This market is cost sensitive and the use on multi-storey townhouses and connected units would represent an installation challenge for current solid siding products.

These factors considered together suggest that to be more competitive with other products then it will be necessary to offer a product with enhanced performance and benefits such as a lower level of maintenance, easier and quicker installation, and an improved product warranty.

Product Life Cycle

(Specification, Installation & Use)

It is becoming increasingly important, not only to deliver a technically sound product, but also to meet and exceed the customer's service requirements. Manufacturers need to provide effective service before, during and after product sale to establish the consumers' trust and build credibility within the market.

An effective way to do this is to document the product life cycle and where the users and end consumers interact with the product and its manufacturer.

Key Service Targets

Warranty and customer service availability are considered key service requirements. Emphasis should be on creating a 'hassle free' experience for the customers where they feel that products are backed by the manufacturer during the process. Through workshops and site visits with builders and contractors, it is apparent that it is not the total length of the warranty that matters, but the efficacy and reliability of it. Users prefer that the timeframe is not overestimated and that claims are handled rapidly and smoothly.

Service targets are closely connected to costs, where lead time and field support are important measures to ensure efficient and cost-effective installation.

Figure 18. Key Service Priorities

Ranking	Service Targets
1	Warranty
2	Customer Service Availabilty
3	Field Support
4	Lead Time
5	On-site Delivery Time

Selection & Purchase

The home buyer and DIY customer of today love to shop around for the best option available for their specific needs. The internet is now one of the most effective conduits for product information. Customers want to be able to easily source product information and benchmark against other products. The importance of being able to visualise the final result in comparing different alternatives was noted by end consumers.

This could be done through computer programs that easily let you scan a picture of your own home and then experiment with different style and colour options. Another great visual aid in-store is 'cut-out wall' sections that compare the applications of different systems.

The most important factor for builders during selection of a product is the 'availability' of the material and trained installers. Builders do not like to specify a product and then find there are

constraints in sourcing it for a job, or that skilled installers are not readily available.

Contractors stress the importance of being able to source materials from wherever you are. They identified frustration specifically around products that can only be obtained through a small selection of retail stores, as this created issues with their flow of work.

Installation & Handling

A key to product success is making the product time and cost effective. A product that is easier to handle, safe to work with and allows smooth workflow onsite is more inclined to be used.

From when the product reaches the site and through to a completed installation, the contractor's and builder's requirements on the product get more specific. For the installation of the product, installation methods and guidelines have to be intuitive. Systems that are complex will have a hard time achieving acceptance in the generic market, mainly due to the educational threshold for the installers. Installation instructions are commonly translated into Hispanic due to the large number of contractors and labourers from this ethnic background.

It is very important for the builder to be able to get effective and prompt technical support and adequate back-up from the manufacturer to resolve any issues during the construction. For new products this is especially important as builders will not take the risk of having to deal with installation issues unless they are reassured that assistance is available.

Lifespan & Use

Once the product is installed the interaction moves to the end consumers. As a service to their customers, many builders make it their responsibility to resolve any issues arising within the first 6-12 months of ownership simply as an extended form of customer service.

The builders and contractors emphasise the importance of realistic and reliable warranties. If claims are not handled rapidly and appropriately there is a risk of creating a dissatisfied customer. It is important for the builder to be able to rely on the quality of the product as well as on the manufacturer. Often, end consumers take the fact that a builder has made the decision to use a product as an endorsement of quality. The builder is then put in a situation of being expected to stand behind both the product and the manufacturer. Because of this, in many cases the builder's reputation rides on the reliability of the product, as a Portland builder states;

"One unhappy customer can cost you a hundred times more problems than ten happy customers".

Reliability and security are key messages that need to be ingrained in communication and marketing to end consumers, builders and industry groups.

Material Specification & Purchase

Production Building

It is not uncommon for land developers to make the decisions for the overall look and feel of a new community. The developer will provide the builder with a range of alternatives for the materials that will need to be used for exterior finishing.

The builder then makes the final decision (within the developer's guidelines) together with his purchasing office and the architect.

In this case, sub-contractors and home owners have no say in the material selection. Homeowners can choose from different types of interior finishing such as the floor layout, quality of finish and colour schemes, but have very limited input on the exterior of homes.

Large production builders have enormous purchasing power and can to a certain extent dictate their own terms. Bulk supplies are often purchased straight from the manufacturer, eliminating middle men. In this case product manufacturers liaise directly with the production builder's purchasing office in order to introduce a new product.

The other option is to purchase the material from a pro-dealer or merchant. The pro-yard offers a more industry-targeted range of services and provides a generally more knowledgeable service along with a more industrial approach, including site delivery of materials. Some pro-yards also offer installation services for specific products, and will sub-contract crews to the builders to do this.

Custom Building

In custom building, material specification is a collaborative task between the builder, architect and homeowner. In many cases the builder and architect recommend a few alternatives and leave the final decision with the homeowner.

The custom builders are much more personal and hands-on than the production builders. They will create a strong bond with their customer and the relationship can remain close years after completion.

Due to their size and types of projects, custom

builders are seldom able to buy in bulk. Most material is purchased through pro-dealers and, depending on location of the projects, material is topped up during the process via a pro-dealer or large retail store.

Do-It-Yourself (DIY)

The end consumer has complete control of the material selection process in the DIY market. Contractors may have input and make recommendations on selection in some cases. DIY supplies are predominantly purchased through large retail outlets like Home Depot and Lowe's. These stores also offer some training and support for the customer. DIY is predominantly utilised in remodelling. The remodelling market makes up an estimated 40% of the total residential construction market of which approximately 27% of the expenditures are on DIY.

Homeowners contribute over 75% of all remodelling expenditures. The largest part of this is spent on "do-it-yourself" or "buy it yourself" projects, and payments to professional contractors for improvements. Kitchen, bathroom and interior remodels dominate the total spend with more that 50% of the total remodelling budget. Despite representing just one in four homeowners, top-income households were responsible for more that half of all improvements in 2003.

In addition to product cost and performance the market is becoming increasingly sensitive to the environmental cost and impact of the material specification. The US industry is slowly adapting to a greener way of thinking about their building.

Environmental

Considering the environmental aspects of a product involves objectively understanding the product life cycle and what its environmental impact is through a quantitative method such as Life Cycle Assessment (LCA). This provides a company with critical knowledge about their own product and can assist in targeting areas for improvement.

It is also important to understand how the market perceives sustainability and what level of information the consumer is given so they can make adequately informed choices.

A Greening Market

In the US consumers are becoming increasingly exposed to 'sustainability' both in relation to the health of their home (toxicity) and the impact of products on the environment. The US consumer is slowly becoming more educated on subjects like environmental impacts and toxicity. Environmental factors, like waste reduction, recycling, energy efficiency, renewable (bio) resources, low-level toxicity were amongst the top ranked requirements from discussion and workshops with all the customer groups.

A survey by the NAHB indicates that builders as well as consumers show an increased interest in building green. The number of home builders producing green, environmentally responsible homes increased by 20% in 2005 and is estimated to grow another 30% this year.

Builders list 'the right thing to do' as a big reason for going green, along with;

- Lowering lifecycle costs, such as energy efficiencies and productivity increases
- Staying ahead of the competition, or expanding business with customers who are interested in green building
- Limiting exposure to liability on such issues as water leaks and mould

Figure 19. Environmental Impact Descriptions

GWP 100	Global warming potential 100 Years (GWP100) is caused mainly by CO_2 and CH_4 emissions. These emissions enhance the natural greenhouse effect and lead to an increase in global temperature. During the 20th century, the average global temperature increased by about 0.6°C due to the enhanced greenhouse effect.
EP	Eutrophication potential (EP) refers to an increase in biomass production due to addition of nutrients, mainly nitrogen and phosphorus, to soil or water. It leads to reduction in species diversity, often accompanied by massive growth of dominant species "algae bloom".
AP	Acidification potential (AP). The most well-known effect of acidifying emissions, acid rain, is caused mainly by SO_2 and NOx emissions to air. Emissions of SO_2 and NOx can result in strong acids which can have a damaging effect on plants and buildings, but can also influence the soil conditions.

The Western states led by California were the first regions to pick up the importance of green building. There is now growing momentum at a nationwide level. Industry is still trying to understand what this means to the consumer and how they can position their products to take the best advantage of the trend. Many companies have seen the sustainability trend as a means of differentiating their product from others in the market.

This is an intermediate step which may lead to the adoption of code compliance to agreed environmental performance indicators.

Almost half of homeowners and new-home buyers are willing to pay a higher price to incorporate green-building materials and products in their homes. The survey also showed that even consumers who don't plan on investing in green or energy-efficient products say it's mainly due to lack of knowledge about their options.

Education has been driven by organisations like the US Green Building Council (USGBC) through the 'Leadership in Energy and Environmental Design' (LEED) programme. LEED is effectively a rating scheme based on the total impact of a building, including how it operates during use. The scheme has operated in the commercial building domain but has moved into the residential home building industry with a series of LEED certified pilot homes under construction and a report due out in July 2007.

The USGBC acknowledged that life cycle assessment (LCA) as a methodology will become more important as the requirement of objective and accurate data increases with the uptake of green building.

In some areas tax-breaks are offered by regional councils for choosing more energy-efficient building methods and/or products and therefore contributing to a healthier living environment. Builders have noticed how an energy-efficient home, or accreditation, has become a very strong selling point. In the remodelling market in particular, builders have also experienced an increase in the demand for green practice and building materials from their customers.

Environmental Requirements

In an increasingly green market it is important to investigate, document and clearly understand the impact of a product. A screening life cycle assessment (LCA) was undertaken to focus on the supply chain and the impact of transport to quantify the energy consumption and emissions of greenhouse gases for a range of different transport scenarios.

The primary transport scenarios investigated included both Tenon's and Pan Pac's current supply chains into the US market.

- Containership transport from NZ to East Coast – close to market
- Containership transport from NZ to the West Coast, Road transport across the US – further to market.
- Road Transport across the US to Market to simulate a US based manufacturer.

LOSP preservative treatment is assumed for all six scenarios, along with New Zealand forestry base data. The core measure or 'functional unit' for the analysis was '1m^2 of product for cladding, from cradle to installation'. The six scenarios are compared with each other based on their total

Figure 20. GWP of Different Scenarios

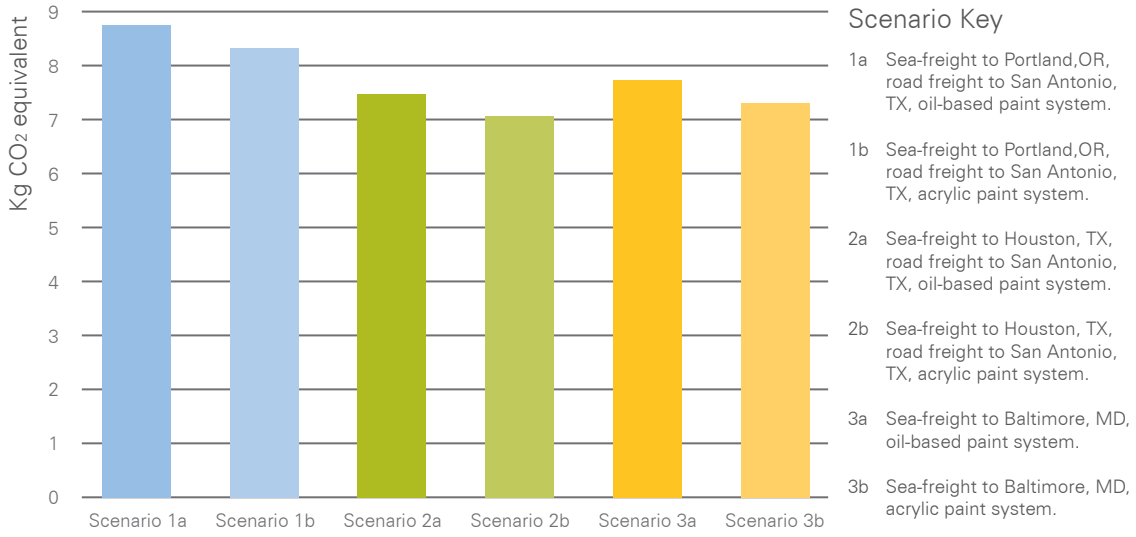
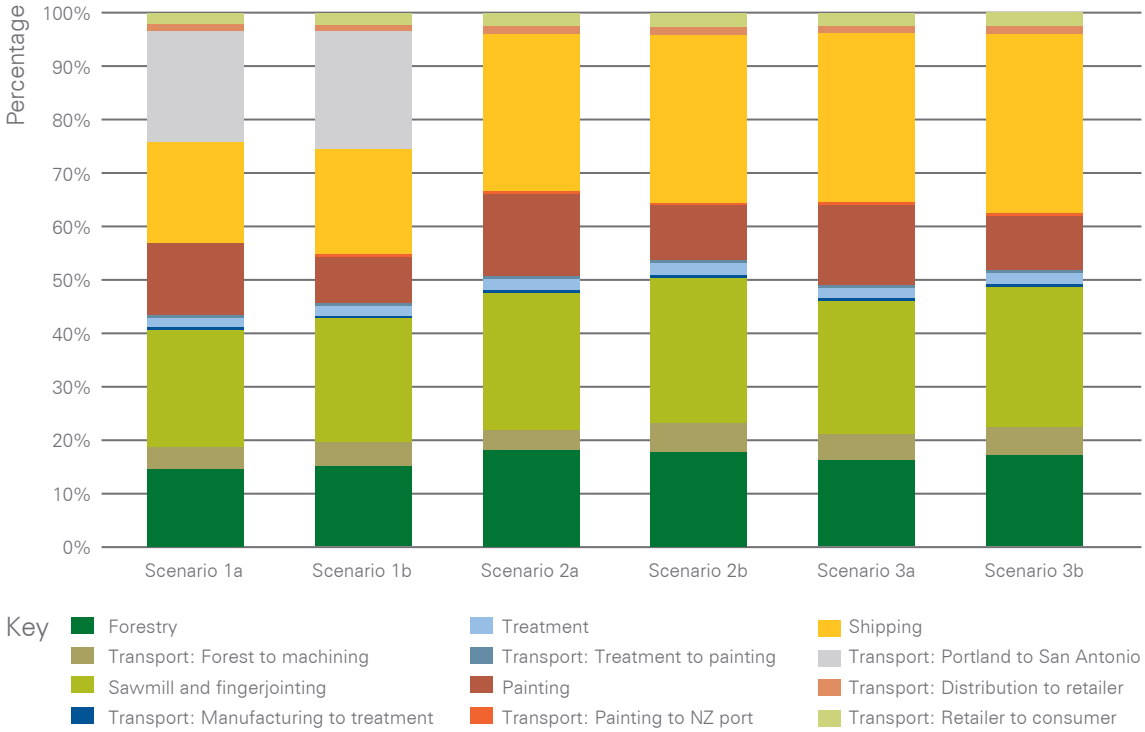


Figure 21. Life Cycle Greenhouse Gas Emissions



energy consumption, contribution to climate change, acidification and photochemical ozone creation.

Transport

The supply chain analysis has shown that the Pan Pac scenario which ships to Portland and then road freights to San Antonio contributed the highest emissions. This transport contributes 15% to the total energy consumption over the whole life cycle. In comparison to this the shipment from Napier to Portland contributes 13.8%. Generally the differences in the greenhouse gas emissions are less significant than the differences in the energy consumption.

Paint Systems

The scenarios based on waterborne paint use generally less energy than those based on solvent-based paint. However, it is important to note that the results are based on generic paint systems rather than house paint specifically. The paint production in the case of the waterborne paint contributes 8% to the total energy consumption in the life cycle; in the case of solvent-based paint it is 17%.

Important Considerations

The product miles related to shipping do not dominate the life cycle in terms of energy consumption and green house gas emissions. However, with regard to acidification the shipping has a significant contribution to the life cycle impacts.

All transports together have a significant contribution to all environmental impacts. Waterborne paint has a lower impact than solvent-based paint in terms of photochemical oxidant formation, energy consumption and greenhouse gas emissions.

The impact of the Light Organic Solvent Preservative (LOSP) system was unable to be evaluated in the context of this study but for several reasons requires considerable thought.

Workshop participants indicated a strong awareness of 'toxicity'. LOSP contains potentially toxic components to humans due to solvent emissions. It also releases a significant level of volatile organic compounds (VOCs) through the release of residual solvent into the atmosphere with current technology.

Vinyl has recently been demonstrated through an in-depth study undertaken for the USGBC to be toxic to human health. The elimination of toxicity within timber products would represent a significant marketing opportunity for the product to potentially displace vinyl in a range of applications as a more environmentally appropriate choice.

Insights & Opportunities

Understanding the US market is a challenging research inquiry. There are wide geographic and demographic differences along with specific regional requirements. This meant that a key initial goal would be to select regions that were compatible with finger jointed and pre-primed exterior timber products.

These regions were evaluated in detail to elucidate the specific customer requirements and distill them into a targeted range of technical measures that could be improved. During this investigation a range of qualitative information was drawn out and subsequently formed into a body of knowledge and insights that can assist with strategic decision-making and new product development.

There are several variables that have a strong influence on a product and its relative position and success within the market. Answering these questions clarifies the effective target market for timber products:

- Is the target new construction or remodelling or both?
- Is there a focus custom building or production building companies?
- What home value segment is the product best suited to?

New construction and remodelling have both enjoyed strong growth throughout the last five years. However the slowdown in the market has resulted in a drop in new home starts whereas remodelling has remained more constant. Remodelling is less sensitive to the fluctuations in the economy than to the new construction market and is more stable within a slowing market. The growth of housing stock also suggests an underlying remodelling market growth that is not tied to new house starts.

Remodelling is predominantly undertaken by custom builders who are smaller scale operators. Custom builders would generally work across both remodelling and new home building sectors and have a focus on higher value homes in more established residential areas.

Production builders are not generally active within the remodelling market, as it does not offer them economies of scale.

Production builders can offer the advantage of national sales agreements and endorsements of product from a centralised headquarters. Many purchasing decisions are still regionally driven. Their customer relationships are close to sale and don't involve extensive contact over time. The products these companies require have to be system oriented and cost effective.

Custom builders have stronger relationships with their customers, creating more of a dialogue.

In addition to this, custom builders are creating higher value homes that can utilise more varied and specialised products.

A focus on custom builders (both remodelling and new home building) that operate within the move-up and luxury end of the market as the key target market would be an effective strategy for exterior timber products within the US market.

Timber cladding, fascia and trim products have lost significant market share over the last 30 years. This has been through the productionisation of the building industry and the introduction of new products such as vinyl and fibre cement. These products have provided an aesthetically similar style while delivering perceived improvements in performance and reduced cost.

The impetus for cost reduction has been driven partly through the steady increase in home size, with the key area for cost reduction being the exterior. There is, however, a commonly held opinion that home size has reached a plateau and there is a trend toward a reduction in size linked to an increase in material quality.

To create a change in perception it is important to critically analyse some of the key reasons behind the decline in timber usage.

Maintenance & Longevity

Low maintenance and longevity are two of the most desirable product features for the end consumer. Builders report that many consumers raise the question of maintenance, even before discussing cost or style options. People do not want to spend their weekends maintaining their home and iterate how they want the product to last over time and endure the impact from the elements. As one end consumer states 'I only want to do it once. If I put new windows in the house I want to live in the rest of my life, they should last my time out'.

Timber trim has approximately 70% of the market

Figure 22. Market Share per Builder Type

share nationally with the remaining 30% made up of newer polyvinyl chloride (PVC) or 'Vinyl' products like 'Azec' trim. PVC products are steadily increasing their market share at the expense of timber products. The main reason for this is low perceived maintenance requirement and extended warranty period. PVC trim products are almost three times more expensive than timber trim, something that illustrates end consumers and builders are prepared to pay a premium for higher performance.

Within the siding product category PVC and fibre cement have grown significantly to take a large market share. PVC competes on cost, offering a low cost cladding option in a traditional style. Fibre cement does not compete on price but offers lower maintenance and greater durability for a similar price to timber.

Improving the durability and maintenance level of timber products would deliver an improved market perception and potentially increase sales. A point of difference from lower performing timber products can be achieved through brand position and communication with the building community.

Perception of Timber

Timber products have not been responsive to the incoming threat of new materials that offer consumers improved properties and users easier installation along with advanced documentation and technical support.

Exterior timber products have gained a poor reputation, with some builders and contractors from the consumer workshops indicating they categorically would not use timber products in exterior applications.

Analysing the reasons behind this reveals that untreated timber (increasingly not so durable species) has been used readily in exterior applications leading to in-market product failure. This affects merchants and retailers along with builders, leading to a perception problem for timber products.

The prevalence of untreated products requires treated products to create a stronger point of difference in the market and to educate the consumer more clearly on the differences between treated and untreated product. In addition to this, more comprehensive and readily available information needs to be provided to assist in this process.

It is also important that a programme of property enhancement and improvement is undertaken to effectively 'future proof' the product against new products and improvements to other existing products. In effect, timber needs to re-position itself as a market leader, one that leads in the areas of performance and quality.

Climate & Geography

Climate is a consideration in the US market due to significant regional variation. Every part of the country has its particular conditions and characteristics, and a product has to be able to adapt to them all in an efficient way.

Regions with a very high humidity tend to veer away from timber products as they believe that they are less suitable. They are believed to be more prone to rotting, cracking, and termite infestation. There may be opportunities to engineer products that respond directly to specific regional issues.

Changing Construction

Structurally cladding has become a 'veneer' that operates as a moisture barrier rather than a structural part of the building. The dominant construction format uses treated Oriented Strand Board (OSB) and house wrap as the bracing and primary protection of the frame and internal structure, with cladding playing the role of a primary barrier.

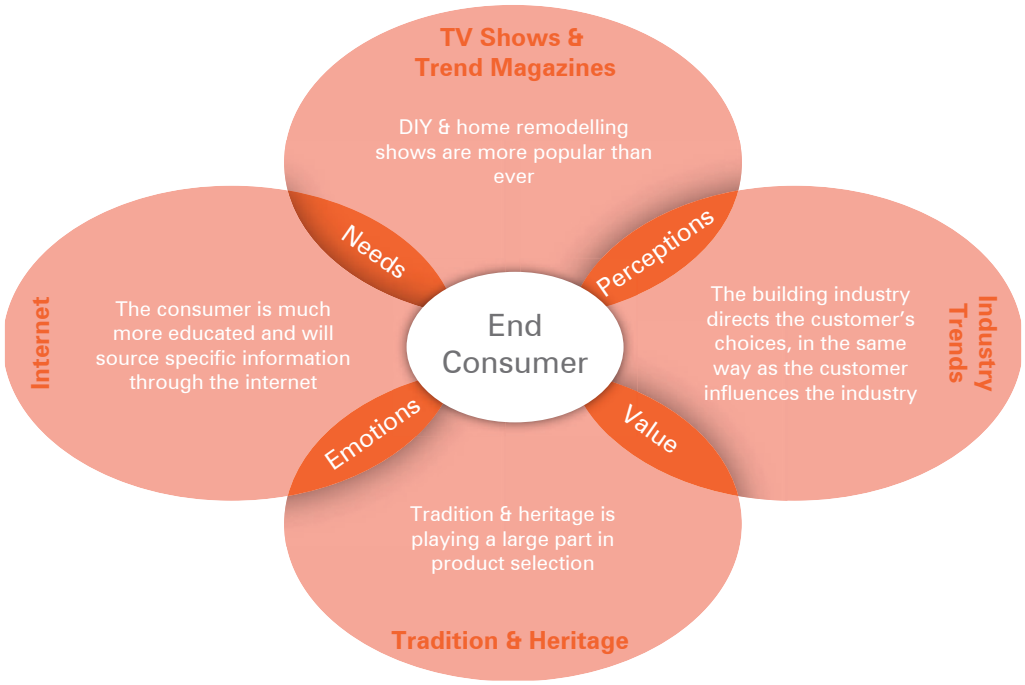
This structural change is fundamental to the introduction of vinyl cladding. As this product has no structural integrity and cannot provide real weather resistance it is reliant on the prevalent OSB-house wrap construction method. The 'sheet' nature of the product provides low installation and production costs.

Another contributing factor to the growth of products such as vinyl is the orientation of the standards toward 'life safety'. As siding, fascia and trim are not life safety issues they aren't as heavily regulated or performance oriented.

There are several responses to this. One approach accommodates the construction method whilst another riskier strategy would be to provide an alternative construction method that best uses the advantages of timber.

Reducing the wall thickness of existing lumber cladding products may increase cost competitiveness whilst increasing margin. A more systematized approach which encompassed installation could cut down on on-site time and improve handling and therefore reduce cost. Improved materials handling would deliver better product performance aiding customer perception of the product.

Figure 23. Influences & Drivers - End Consumers



If a product is going to compete directly with vinyl it is critical to develop and productionise a sheet based product with an advanced installation system. This may be possible with emerging developments in fibre plastic and bio-polymers which would enable staying within the existing material base of timber or timber derived materials.

Change the Market

According to the current construction methods, the OSB sheeting provides the structural component. A proprietary semi-structural system could be introduced that completely eliminates the need for OSB. Solid cladding could easily provide a bracing element for the structure. This may reduce the installation time and economic and environmental costs.

This approach would need careful assessment due to the production oriented nature of the US construction sector and would require significant user re-education.

Influences & Drivers

What drives and influences the customer varies greatly between the Users and End Consumers.

End consumers are driven by their feelings and emotions. One of the key insights derived from workshops with the end consumer is how important perceptions are. Comments like: "It has to feel…" & "As long as it looks like…" were very common. The perceived value of the product is made up of several factors including the up front cost, appearance, and performance. Products like fibre cement and vinyl are perceived as valuable simply because they directly address end consumers needs, such as providing a lower cost, lower maintenance and increased durability.

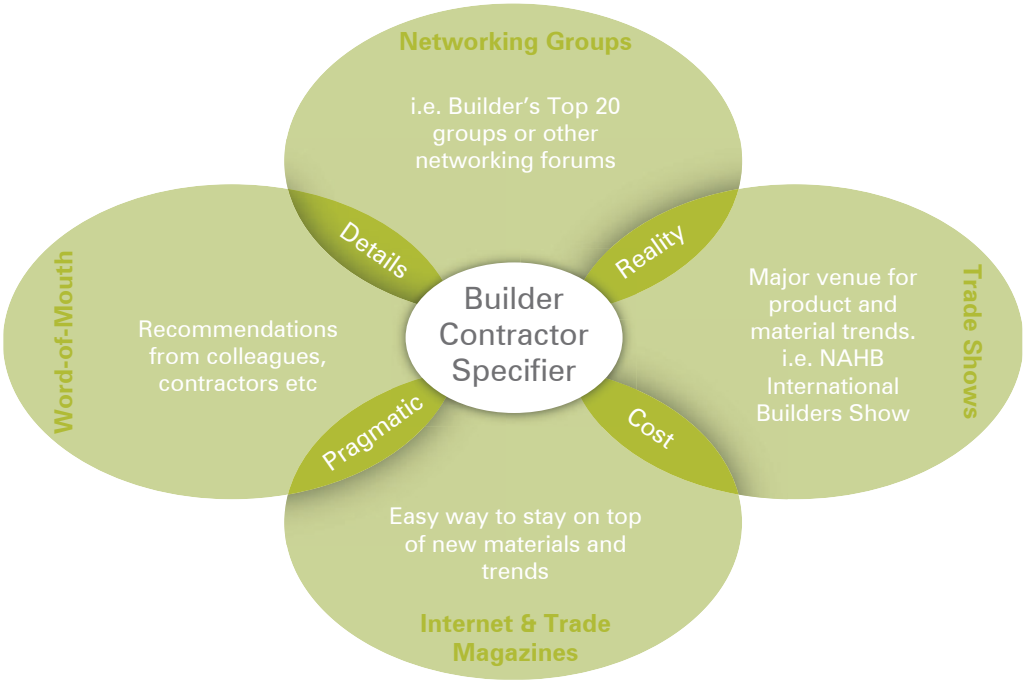
It is important to provide a tangible point of difference through the product offer that appeals to the consumer.

The industry customers or users are much more pragmatic in their product selection and tend to be more interested in the detail of the products. The product has to work well with the builder's own programme and work flow.

While the end consumer is strongly influenced by the trends communicated by media like homebuilding shows and magazines, builders and contractors tend to be more conservative with their product choices and are using a few common tools to keep up to date with material and product trends. Figures 23 and 24 illustrate the key influences and drivers on end consumers and the professional groups.

Trade shows, like the NAHB International Builders Show, are a major forum for networking and picking up new trends. Many builders consider this a time saving, one-stop location to get a good feel for the direction of trends and to pick up new

Figure 24. Influences & Drivers - Builders



materials at least once a year.

Field research with builders on both coasts reveals how they will typically exchange information on different products. One of their most credible sources of information is personal recommendations or previous experience. The fact that a colleague (builder) has actually used a product provides reassurance.

The builder describes how they are expected to stand behind and endorse the product by the customer. Any product failure will be directly associated with failure of the builder's work, so trust needs to be established with the building community.

As a contractor in Washington DC states "The best kind of testing is to see something that works, rather than read about it". The end consumer also reiterates the importance of being able to actually see and feel a product on show homes rather than in catalogues.

Getting the product out into the market by building show homes and spreading the word amongst the industry should be an effective method to increase uptake.

Wood needs to be re-affirmed and repositioned in the market through continuous promotion and an increased level of engendered product support, enabling credibility to be built to enable adoption by the mainstream within the US.

Design Flexibility

The competition in the homebuilding market is very strong. Manufacturers and merchants are experiencing the pressure from builders to keep costs down and the supply of products effective. Diversity in the market in the form of a wide range of different climates and traditional style preferences puts further pressure on the product for regional compatibility.

This has developed into the demand for products that can be used in several different ways and can be applied to a range of designs and home-styles. Builders or contractors can therefore buy in bulk and simplify stock-handling to keep the costs down without compromising design.

The field research revealed how a weatherboard product can be applied to several different build styles and value segments. It was found on colonial homes, in combination with brick work on more traditional homes on the East coast and combined with stone, shingles or stucco on craftsman homes in the Western regions.

Timber products would be applicable to a larger part of the market by providing a systematised solution that offers compatibility with a range of home styles.

Exciting the Exterior

Design attention and material selection is focused on the interior of the home. To increase the value of exterior products the exterior needs to provide more design choice and excitement for the end consumer.

Homeowners are looking for a more personalised product that allows them to express their individuality. They are becoming more sophisticated in their desires and are growing increasingly tired of the standard 'cookie-cutter' look of suburbia that has been the norm over the last few years. The re-emergence of traditional homebuilding styles, like 'the craftsman', requires the natural look of timber.

There will be an increasing demand for products that let the customer express their own individuality. This could provide opportunity for a distinctive, high-value and stylish product that makes the outside of the home more interesting. Wood holds a unique position because of its versatility, machinability and design flexibility. Investigating these styles and tailoring products that can work effectively in this context may provide new avenues for providing a complete package.

Timber is one of the few products that can offer products effectively across the whole spectrum; this is currently not marketed or promoted as an advantage.

Figure 25. Relationship between general style preference and leading cladding manufacturer's headquarter locations.

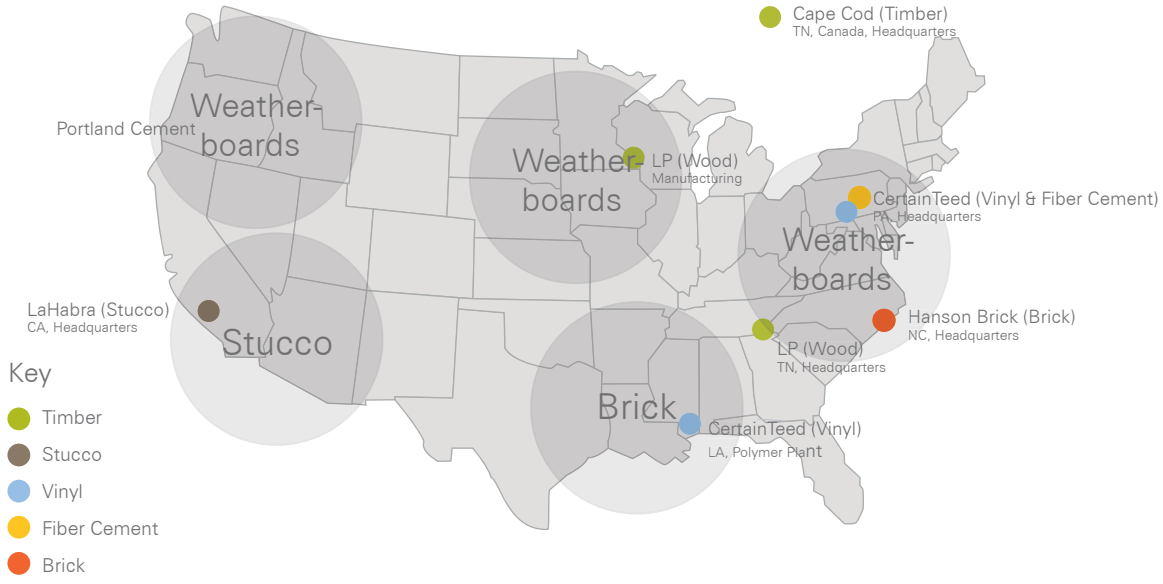
Sustainable Opportunities

Even with green building in its infancy it appears to be a long-term trend that is driven by the consumer. It is likely that green building will become more entrenched. Builders are slowly becoming more sensitive to green building and the end consumers are increasingly seeing the importance of building an environmentally healthy home. Discussions from the customer workshops revealed that the use of sustainable resources and minimising of human toxicity were important issues to the consumer.

Timber products possess some unique advantages when it comes to sustainability. The life cycle of the product includes the absorption of carbon dioxide and the output of oxygen during the trees' growth. This carbon within the product is then effectively 'locked in' during the life of the product. The value of this story, in combination with the accepted market accreditation offered by FSC, creates compelling competitive advantages.

In some respects this has led to complacency on the behalf of manufacturers, which needs to be rapidly and comprehensively addressed. The impacts of transport, solvent emissions, paint and the end of life are all causes for concern as they undermine the green foundation that sustainably managed plantation forestry provides.

Within the US market the FSC accreditation has strong market recognition and is currently the only environmental system acknowledged by the USGBC through the LEED rating scheme. The FSC mark provides both market and standard based acceptance within the US, making it worthwhile within the US context.



Key Conclusions

- Timber products should focus on the **custom homebuilder in the upper end of the market**, move-up and luxury homes, marketing to both new home building and remodelling.
- **Durability & low maintenance** are critical performance factors that need to be improved.
- Timber has suffered a significant loss, and has to be **repositioned as a market leader** through style and innovation.
- An opportunity may exist to engineer products that directly respond to **regional demands.**
- **Changes in house construction** represent an opportunity to develop a new siding product that is specifically designed to provide a primary barrier, rather than provide bracing.
- The **perceived value** of the product is very important to the end consumer, as their decisions are primarily driven by emotions and perceptions.
- It is crucial to establish a practical **credibility** amongst the pragmatic builders.
- A product needs to offer **design flexibility.**
- Timber products hold a unique position because of their versatility and machinability, flexibility and resilience.
- There is increasing demand and opportunity for a truly **sustainable product.**
- Addressing the key environmental impacts of exterior timber products is critical to enabling the green benefits of timber to be effectively marketed.

Figure 26. Customer Requirements Matrix

The Compass project was initiated to explore opportunities for adding value to exterior radiata products, in particular cladding, trim and fascia, in the US residential housing market.

Over a period of a year, the market and the drivers within have been studied carefully from a product perspective. Several site-visits to construction sites and workshops with users and consumers were conducted to get closer to the customer and develop a better understanding of the challenges and opportunities for the products.

This is the Product Framework booklet, one of three parts of the Compass Research Package. The Product Framework aims to communicate the key insights and factors that affect the product.

The Product Framework is created around the 'Product System', where the customer and technical requirements, user groups, stakeholders and the product life cycle play key roles, and aims to clearly illustrate the environment that the product operates within.

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