Market Viability Research
Sustainable Engineered Composite Panel with Post-Consumer Carpet

14th Annual CARE Conference
May 17-19, 2016
in Greenville, South Carolina.

UCONN
Engineering Research

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UConn Department of Chemical & Biomolecular Engineering
Institute of Materials Science
Medium Density Boards
With 5% MDI Binder

ANSI M2 Standard
Stiffness 2 Gpa
Strength 13 MPa

The 20% Shred is unseparated carpet, minimally processed.
The Effect of Density
(optimizing for different products)

**Stiffness**

- MOE (GPa)
  - y = 0.0708x - 1.2185
  - R² = 0.50696

**Strength**

- MOR (Mpa)
  - y = 0.6532x - 15
  - R² = 0.68701

UConn

4
Why Bother with Fire Retardant

Vertical flame test (7x1 inches, burn for 20s with Bunson Burner)

<table>
<thead>
<tr>
<th>Coated</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.jpg" alt="Coated Sample" /></td>
<td><img src="image2.jpg" alt="Control Sample" /></td>
</tr>
</tbody>
</table>

**Control sample** was **completely consumed**, and the burning lasted for **200 seconds** after removal of flame.

While the flame extended about **3 ½ inches** up the **coated sample**, it self-extinguished **4 seconds** after removal of ignition flame.
Current Events

• Experiment to perform sound damping experiments designed and equipment almost completed
• Negotiations underway with investors to build a small particleboard factory ($10^6$ boards/yr.) in Louisiana designed to use 20% PCC, or about $20\times10^6$ lb/yr.
Lab Scale Sound Dampening Experiment

Qualitative comparison to commercial materials, prior to spending for full scale testing.

Same strategy as formulation development for MOR/MOE
Engineering Summary and Future Work

• Demonstrated marketable PCC/biomass formulations
  • Shredded, unseparated carpet waste successfully used
  • Full scale industry prototypes passed M2 grade requirements
    • 20% PCC, 75% Bagasse, 5% pMDI binder
    • Got it on 1st try, but optimization can improve further

• Preliminary results with novel flame retardant
  • Excellent flame reduction
  • Reduction in mechanical properties below M2 standard
  • Optimization should give M2 standard properties

• Sound reduction experiment almost built in UConn lab
  • Completion expected by end of project
  • Data acquisition will require a no-cost extension
Market Research

Brian Brady, M.A.
Instructor in Residence
UConn School of Business

Vorakorn Thanaaudomsiri, MBA
Xinpeng Mu, MBA, MSBAPM
Primary Research

60 Industry & Subject Matter Expert Expert Interviews

- **Potential Customer Groups**
  - 15 Acoustic Solutions Providers
  - 10 Furniture Manufacturers
  - 7 Flooring Manufacturers
  - 5 Modular Home Manufacturers
  - 2 Registered Architects
  - 2 Automotive Manufacturers
  - 1 Fire Proof Materials Manufacturer

- **Cost and Competition**
  - 5 Composite Panel Industry Experts
  - 3 Carpet Recyclers (2 from Flooring)
  - 3 Natural Waste Experts
  - 1 Pricing Consultant

- **Certifications and Regulations**
  - 2 Green Product Certification Agencies
  - 1 Government Relations Expert
Subject Matter Experts

Flooring Manufacturers and Recyclers:
• CARE Board Members
• Industry Experts
  – Frank Endrenyi, Consultant and Care Board Advisor
  – Jay Henry, Director of Operations Support at Shaw Industries Inc.
  – David Moore, Corporate Innovation Manager at Shaw Industries Inc.
  – Kemp Harr, Publisher/Owner at Floor Focus Magazine

Furniture Manufacturers
• Shawn Nelson, Founder and CEO at Lovesac
• James Bonito, CEO at Bonito Millwork Inc.
• Gerard Nadeau, Owner at Bills Bedding
• Diane Turnwall, Vice President of Materials Innovation at Herman Miller
• Amy Luthman, Core Team Leader at Herman Miller
• Marcia Fowler, Territory Manager at Herman Miller
• Rick Bryson, Material Development Manager at Ashley Furniture
• Chris Watt, Wood Commodities Manager at Ashley Furniture
• German Castellanos, Operations Manager at American Woodcraft
• Mike Zimmerman, R&D Research Manager at Sauder Woodworking Co.
Primary Research (cont’d)

Subject Matter Experts

Modular Home Manufacturers
• Jeffrey Reber, Co-founder at Apex Modular Home
• John Arpin, Owner at Arpin LLC
• John Colucci, VP of Sales & Marketing at Westchester Modular Homes Inc.
• Brent Wesley, Purchasing Manager at Apex Modular Home
• Bob, Home Consultant at Westchester Modular Homes

Registered Architects
• Jim Jamieson, AIA
• Philip H.Cerrone, AIA

Fire Proof Materials Manufacturer
• Jack Pinson, Product Manager, Flame Safe Chemical Corporation

Composite Panel Industry Experts
• Elliot Savage, President and CEO at SEEMAC
• Tim Dowding, CEO and President at Groupe Intermonde
• Graham Heslop, Managing Director at CompakUK
• Bob Clark, Market Development Specialist at Roseburg
• Thomas Wardach, Sales Manager at Roseburg
Subject Matter Experts

Natural Waste Experts
- Paul Bretels, Vice President of Production and Sustainability at NCGA*
- Larry Siegel, Managing Director at Florida Coconuts Inc.
- Don Day, Professor at Audubon Sugar Institute, Louisiana State University

Certification, Regulations and Pricing Experts
- Jennifer Mendez, Vice President at The Carpet And Rug Institute
- Dean DiPietro, Director of Certification Operations at USGBC**
- Edgar Deomano, Director of Technical and Certification Services at CPA***
- Bert Schefers, Managing Partner at Abbey Road Associates

Automotive Manufacturers
- Xiaoying Gan, Product Engineer at Volkswagen
- Qing Wang, Engineering at Volkswagen

*Abbreviation for National Corn Growers Association
**Abbreviation for United States Green Building Council
***Abbreviation for Composite Panel Association
Primary Research (cont’d)

Subject Matter Experts

Acoustic Solutions Providers
- Charles Moritz, Technical Director at Blachford Acoustics Group
- Justin Thomas O’Neill, CEO at O’Neill Industrial Co.
- Frank Plumadore, Product Manager at The E.J. Davis Co.
- Kevin McIver, Acoustical Sales Consultant at Acoustical Solutions
- Geoffrey Bartz, Sales Associate at Acoustical Surfaces, Inc.
- Howie Schommer, Owner at Schommer Construction Co.
- Peter Beckwith, Sales Specialist at Advantage Foam Installation
- Keith Doney, Owner at Doney Construction
- Tony Bottillo, Purchasing Agent at Acoustics Incorporated
- Mark Alesio, Owner at Acoustical Systems
- Rob Lapinsky, Sales Representative at Masco Contractor Services Inc
- Nicholas Montanarelli, Regional Sales Manager, Rmax Operating, llc
- Lucas Coelho, Product Manager at Banker Insulation Inc
- Sarah Hoff, Principal at Cerami & Associates
- Benjamin Houghton, Owner at Houghton Associates
Particleboard

Market Research
Wood Based Panel Market

- **Plywood and OSB** are categorized as structural panels used for roofs, sheathing, walls, flooring etc.
- **MDF and Particleboard** are categorized as non-structural panels used for interior projects such as furniture and cabinetry

### Global Market of Wood Based Panels (2015)

<table>
<thead>
<tr>
<th>Region</th>
<th>Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>187.2 million m³</td>
</tr>
<tr>
<td>Europe</td>
<td>72.1 million m³</td>
</tr>
<tr>
<td>North America</td>
<td>53.2 million m³</td>
</tr>
<tr>
<td>Commonwealth of Independent States*</td>
<td>20.0 million m³</td>
</tr>
</tbody>
</table>

*Including 12 countries such as Russia, Ukraine, and Uzbekistan

Wood Based Panel Market

- U.S. Reconstituted Wood Products: $5.70 billion (2015)

<table>
<thead>
<tr>
<th>Reconstituted Wood Based Product Type</th>
<th>Market Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waferboard and OSB</td>
<td>$2.02 billion</td>
</tr>
<tr>
<td>Particleboard</td>
<td>$1.52 billion</td>
</tr>
<tr>
<td>Medium Density Fiberboard</td>
<td>$0.83 billion</td>
</tr>
<tr>
<td>Hardboard, Cellulose Fiberboard, Other Boards</td>
<td>$1.33 billion</td>
</tr>
</tbody>
</table>

- Estimated growth rate for reconstituted wood products from 2015-2017 is 2.7% annually.
- Estimated growth rate for hardwood, softwood, and plywood products from 2015 to 2017 is 3.4% annually.

Source: IBIS World
Wood Based Panel Market by Segment


- Hardwood, Softwood, and Plywood: 58%
- Waferboard and OSB: 15%
- Particleboard: 11%
- Medium Density Fiberboard: 6%
- Hardboard, Cellulose Fiberboard, Other Boards: 10%

Source: IBIS World
Particleboard Market

- **Market Value:** $1.56 Bn
- **Growth:** 2.7% annually from 2012 to 2017
- **Potential Markets:**
  - Furniture
  - Subflooring
  - Home Construction
  - Modular Homes

Source: Industry Experts from Composite Panel Industry, IBISWorld
Markets Characteristics

• **Furniture**
  • Price-sensitive
  • Value of formaldehyde-free tied to price

• **Subflooring**
  • Majority uses OSB/M3
  • Water Resistance

• **Home Construction**
  • Very Price-sensitive
  • Majority uses OSB and MDF

• **Modular Homes**
  • Price-sensitive
  • Majority uses OSB/M3
  • Declining Market

Source: Industry Experts, IBISWorld
Quantitative Survey to Understand Market Requirements

Distributed to the following professions:

- Architects: 4216
- Furniture manufacturers/dealers: 3662
- Construction contractors: 4110
Key Insights From Survey

Composite panels are mostly purchased from dealers/distributors/manufacturers

50% of the time architects/contractors specify sustainable products and 67% of the time specify formaldehyde free products
### Key Insights From Survey

#### Pricing

Architects/furniture manufacturers and construction contractors are willing to pay a maximum 10% premium above market price for the product.

**At what price the product (Post-consumer carpet composite panel board) is considered:**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>to be so expensive that you would not consider buying it? <em>(Too expensive)</em></td>
<td>10-30% above market price</td>
</tr>
<tr>
<td>to be so low that you would feel the quality couldn’t be very good? <em>(Too cheap)</em></td>
<td>50% below</td>
</tr>
<tr>
<td>to be starting to get expensive, so that it is not out of the question, but you would have to give some thought to buying it? <em>(Expensive/High Side)</em></td>
<td>10% above</td>
</tr>
</tbody>
</table>
## SWOT Analysis: Product Aspect

### Strengths
- Qualified for ANSI M2 standard
- Better performance in terms of **strength and stiffness**
- High fire retardant ability - in development
- **Sustainable** and green product
- CARB Compliant

### Weaknesses
- No established wholesale and distribution networks before
- No brand awareness among retail markets and end users

### Opportunities
- High demand from **construction** and furniture industries
- Sustainability and green **trend**
- **Possibility to get subsidies** by sourcing post-consumer carpet wastes
- Lack of **capacity for non-formaldehyde products in Europe**

### Threats
- Intensive price competition from import products due to **dollar appreciation**
- Uncertainty in sourcing natural wastes as main raw materials
- Higher natural waste cost due to new applications of natural waste

*Source: IBIS World*
## Possible Product Substitutes

Our product can be a substitute for other composite panels

<table>
<thead>
<tr>
<th>Product Type</th>
<th>Market size ($)</th>
<th>Retail Price Range</th>
<th>Requirements</th>
<th>Applications</th>
<th>Product Match</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSB</td>
<td>$2.02 Bn.</td>
<td>$16 - $27</td>
<td>Meet the strength and rigidity of OSB</td>
<td>Flooring, construction, Furniture, modular homes, freight</td>
<td>100%</td>
</tr>
<tr>
<td>MDF</td>
<td>$0.83 Bn.</td>
<td>$25 - $32</td>
<td>Smoother finish and appearance</td>
<td>Furniture, interior building components</td>
<td>50%</td>
</tr>
<tr>
<td>Particle board</td>
<td>$1.52 Bn.</td>
<td>$20 - $24</td>
<td>Meet ANSI standards</td>
<td>Kitchen cabinets, Furniture, sheeting</td>
<td>100%</td>
</tr>
<tr>
<td>Soundproofing</td>
<td>$4 Bn.</td>
<td>$32 - $1,500</td>
<td>Noise reduction coefficient of 0.8</td>
<td>Soundproof auditoriums, walls etc.</td>
<td>70%</td>
</tr>
<tr>
<td>Fire retardant material</td>
<td>-</td>
<td></td>
<td>Meet type-I standard</td>
<td>Fire retardant doors and other wood substitutes</td>
<td>80%</td>
</tr>
</tbody>
</table>

Source: IBIS World
Our Product: Preliminary U.S. Pricing

Based on Board Size: 4 ft. x 8 ft. x 3/4” (90 lb./board)

- Estimated cost: $11.95*
- Profit margin estimated: 35%
- Wholesale Price: $16.13
- Markup of Distributor: 10%
- Distributor Retail Price: $17.75
- Market Retail Price: $35.5 (Assuming 100% markup by retailer)**

- On an average, each board contains approximately 20% of PCC which is 18 lbs.
- 20 million lbs. of PCC will be used at an estimated production of 1,000,000 boards a year***
- Assumes no carpet subsidy of $ 0.20 /lb. !!!!!!!!!!!!!!!

** Retail price at Lowe’s
*** Source: Industry Experts from Composite Panel Industry, Dr. Tim Dowding
### Companies Requesting Samples

<table>
<thead>
<tr>
<th>Company</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaw Industries</td>
<td>Flooring Manufacturer</td>
</tr>
<tr>
<td>Lovesac</td>
<td>Furniture Manufacturer</td>
</tr>
<tr>
<td>Acoustical Solutions</td>
<td>Manufacturer and Distributor of Acoustical Products</td>
</tr>
<tr>
<td>Acoustical Surfaces</td>
<td>Manufacturer and Distributor of Acoustical Products</td>
</tr>
</tbody>
</table>
Soundproofing Material Market
Soundproofing Industry

Snapshot:

- small companies or independent operators
- Installation of soundproofing materials for residential, commercial, industrial, and institutional spaces

Soundproofing Contractors 2016

- Revenue of $4.24 bn
- Annual Growth (2014-2019) 3.0%

Source: IBIS World
Soundproofing Contractors

Attractiveness

• **Nature of the industry**: Customers approach the contractors or manufacturers for their noise solutions.
  The contractors and manufacturers are **consultants** providing professional solutions and products to fix customers’ problems.

• **High Profit margin**: ~45%

• Recycled materials are commonly used as raw materials in this industry.

• Product and environment sustainability is a concern in this industry.

Source: Industry Experts
Soundproofing Market by Category

$4.24 bn

- Sound Blocking: $1.48 bn (35%)
- Sound Damping: $0.42 bn (10%)
- Sound Absorption: $2.33 bn (55%)

Source: Industry Experts
Soundproofing Materials

Sound Proofing

Sound Blocking
- Insulation
- Barriers

Sound Absorption
- Cotton / Foam

Sound Damping (Acoustic Treatment)
- Baffles / Partitions
- Foam / Baffles

Source: Industry Experts
Customers Preferences:
• Recycled Materials such as cloth and cotton
• Formaldehyde Free
• High Flammability Rating, Preferably A Level
• Higher NRC/STC but Lower Thickness
• Innovative and Customized Products
Soundproofing Materials

By Application

- Ceilings / Floors: 50%
- Factory Equipment / Machines: 30%
- Walls: 15%
- Other Applications: 5%

By Building Type

- Commercial: 35%
- Industrial: 24%
- Institutional: 22%
- Residential: 16%
- Other Types: 3%

Source: IBISWorld
## Soundproofing Materials

<table>
<thead>
<tr>
<th>Category</th>
<th>Retail Price</th>
<th>Requirements</th>
<th>Attributes</th>
<th>Installations</th>
<th>UConn Technical Feasibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sound Blocking</td>
<td>$40 - 400</td>
<td>At Least 25 STC Value</td>
<td>Hard, Heavy, Bendable</td>
<td>Broadcast Studios, Theaters, Multi Family Dwellings, Offices, Restaurants</td>
<td>80%</td>
</tr>
<tr>
<td></td>
<td>$40 - 400</td>
<td></td>
<td></td>
<td>Automotive: Trunk Liners, Floor Pan Liners</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Marine Industry: Cabin Carpet Underlayment, Cabin Wall Liners, Hull Liners</td>
<td></td>
</tr>
<tr>
<td>Sound Absorption</td>
<td>$70 - 300</td>
<td>At Least 0.7 NRC Value</td>
<td>Light, Porous, Soft</td>
<td>Auditoriums, Broadcast Studios, Call Centers, Compressor Enclosures, Computer and Server Rooms, Entertainment Facilities, Industrial Facilities, Machine Enclosures, Manufacturing facilities, Offices, Utility Rooms</td>
<td>70%</td>
</tr>
<tr>
<td>Damping (Acoustic Treatment)</td>
<td>$100 – 800</td>
<td>STC/NRC (Improve Overall Acoustic Performance of a Space)</td>
<td>Various</td>
<td>Recording Studios, Broadcast Studios, Music Clubs, Theaters, Conference Rooms, Vehicles</td>
<td>60%</td>
</tr>
</tbody>
</table>

Source: Industry Experts
Geographic Distribution of Sound Proofing Contractors

Soundproofing services are located in proximity to construction markets

Source: IBISWorld
Soundproofing Survey Results
Soundproofing Survey Results

As of: May 14, 2016
Number of emails deployed: 13,600
Number of responses: 86
Response rate: 0.63%

Professions Of The Responders

- Carpenter / Subcontractor: 52%
- Contractor / Home builder: 23%
- Others: 14%
- Sound proofing manufacturers: 1%
- Sound proofing consultant: 9%
- Architect: 1%
Soundproofing Survey Results

- In the past 12 months, 85% of total responders purchased or specified sound proofing materials to the customers or contractors for the projects.
- Sound proofing materials are used for all three applications with similar proportions.

![Applications Pie Chart]

- Sound absorption: 35%
- Sound blocking: 31%
- Sound damping: 33%
- Others: 1%
Soundproofing Survey Results

- 38% bought sound proofing materials from distributors
- 37% bought directly from manufacturers.
- 36% used sound proofing materials made from fiberglass
- 21% used those made from other raw materials (water felted ceiling tile, mineral fiber for rock wool, steel and rubber for RSIC clips, polyurethane spray foam, etc.)
Top Purchasing Factors

- 57% of the total responders specified or purchased formaldehyde free products at least 50% of the time.

- Top 5 factors below required while selecting sound proofing materials

<table>
<thead>
<tr>
<th>Question</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree nor Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noise Reduction Coefficient (Sound Absorption)</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>8</td>
<td>23</td>
<td>4.69</td>
</tr>
<tr>
<td>STC (Sound Blocking)</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>7</td>
<td>23</td>
<td>4.66</td>
</tr>
<tr>
<td>Price</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>15</td>
<td>12</td>
<td>4.22</td>
</tr>
<tr>
<td>Thickness</td>
<td>0</td>
<td>1</td>
<td>6</td>
<td>16</td>
<td>9</td>
<td>4.03</td>
</tr>
<tr>
<td>Fire retardant/ Flammibility</td>
<td>1</td>
<td>1</td>
<td>7</td>
<td>15</td>
<td>8</td>
<td>3.88</td>
</tr>
<tr>
<td>Frequency distribution of noise</td>
<td>0</td>
<td>2</td>
<td>8</td>
<td>14</td>
<td>8</td>
<td>3.88</td>
</tr>
<tr>
<td>Density</td>
<td>0</td>
<td>2</td>
<td>12</td>
<td>10</td>
<td>8</td>
<td>3.75</td>
</tr>
<tr>
<td>Formaldehyde free</td>
<td>1</td>
<td>2</td>
<td>12</td>
<td>9</td>
<td>8</td>
<td>3.66</td>
</tr>
<tr>
<td>Toughness (failure to crack)</td>
<td>1</td>
<td>4</td>
<td>8</td>
<td>15</td>
<td>4</td>
<td>3.53</td>
</tr>
</tbody>
</table>

- Factors that influenced to consider sustainable products are 1) requirements from customers 2) technical specification 3) price.
Soundproofing Survey Results

Application of Our Product

- 78% of total responders would be likely or more likely to adopt this product
- 42% of total responders would use the product for sound absorption
- 25% of total responders would use the product for sound damping
- 17% of total responders would use the product for sound blocking

Post-consumer carpet sound proofing material is a formaldehyde free sustainable sound proofing material (sound proofing, sound blocking, and sound damping) made from post-consumer carpet and natural wastes such as sugar cane wastes and coconut fibers.
Soundproofing Survey Results

• The product is considered to be a good value if the price is about the same as the market price - $96-$320 for 4 ft. x 8 ft. panel. (Great Opportunity)

• 31% of the total responders state that the product is too expensive to be priced at the market price.
This market is promising because

• Our product meets customer preferences
  • Recycled Materials
  • Formaldehyde Free
  • High Flammability Rating
• Profit Margin: 45%

Assumptions (4ft x 8ft panel)
Our Cost: $11.95*1.5=$17.92
Retail Price Range: $96-$320

Source: Industry Experts
Soundproofing in Automotive Industry

Market Expectation of Soundproofing Materials

• High flame retardant coefficient
• High inflammation point
• Low density
• High Temperature Range (-50 to 210 degrees Fahrenheit)
• Low thermal expansion coefficient.
• Low water swell ratio
• Formaldehyde free and environmental friendly

Source: Industry Experts
Soundproofing in Automotive Industry

- In a personal car, \(32\) ft\(^2\) of sound proofing materials are used.
- In a truck, \(65\) ft\(^2\) of sound proofing materials are used.
- For the first quarter of 2016
  - The sales of domestic cars in US market is \(505,181\) units inferring that \(16\) million ft\(^2\) of sound proofing materials were used.
  - The sales of domestic trucks in US market is \(1,369,579\) units inferring that \(89\) million ft\(^2\) of sound proofing materials were used.
Questions
Appendix
## Product Composition & Cost of Raw Materials

<table>
<thead>
<tr>
<th>Raw material</th>
<th>Proportion</th>
<th>Cost/lb.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post consumer carpet (PET, PTT)</td>
<td>15-90%</td>
<td>$0.08</td>
</tr>
<tr>
<td>Bagasse/Coconut Husks</td>
<td>0 – 80%</td>
<td>$0-$0.02</td>
</tr>
<tr>
<td>Binder (PMDi)</td>
<td>5-10%</td>
<td>$1</td>
</tr>
</tbody>
</table>

- The portion of carpet used in the board can be varied between 15%-90%.
- The portion of resin binder can be ranged between 5%-10%.
- Price estimates for Bagasse and Coconut Husks based on international sources.

Source: Industry Experts from National Corn Growers Association, Audubon Sugar Institute
Cost Assumptions from Market

Estimated cost of $11.95/board

<table>
<thead>
<tr>
<th>Raw Material</th>
<th>lb/board</th>
<th>Cost ($/lb...)</th>
<th>Total Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-Consumer Carpet</td>
<td>15</td>
<td>0.08</td>
<td>1.20</td>
</tr>
<tr>
<td>Resin Binder Cost</td>
<td>5</td>
<td>1.00</td>
<td>5.00</td>
</tr>
<tr>
<td>Coconut Husks</td>
<td>75</td>
<td>0.01*</td>
<td>0.75</td>
</tr>
<tr>
<td>Production &amp; Transportation Cost</td>
<td></td>
<td>5.00</td>
<td></td>
</tr>
<tr>
<td><strong>Total Cost</strong></td>
<td></td>
<td><strong>11.95</strong></td>
<td></td>
</tr>
<tr>
<td>Subsidies</td>
<td>15</td>
<td>0.17-0.23</td>
<td>3.00**</td>
</tr>
</tbody>
</table>

- Production costs include energy cost, labor cost, maintenance cost, supplies cost, depreciation, etc.
- * Average price of Coconut Husks in Brazil
- ** Average subsidies: $3.00 (20 cents/lb.)

Source: Experts from composite panel industry
Post-consumer Carpet Recycling

- On an average, each board contains approximately 20% of PCC which is 45 lbs.

- 25 million lbs. of PCC will be used at an estimated production of 1,000,000 boards a year*

- Assumes no carpet subsidy of $ 0.20 /lbs.

* Source: Industry Experts from Composite Panel Industry, Dr. Tim Dowding
Soundproofing Technical Specifications

Testing Standards:
ASTM E413 Classification for Rating Sound Insulation
ASTM C423 - 09a
Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

Other Standards:
ISO 10140-2:2010
Laboratory measurement of sound insulation of building elements
ISO 354:2003
Measurement of sound absorption in a reverberation room
ISO 717-1:2013
Rating of sound insulation in buildings and of building elements

Fire Retardancy Standards:
ASTM E84 and NFPA 255 for surface burning and meet "Class A" or "Class 1" standard.
Soundproofing Materials

Attractiveness

- **Nature of the industry:** Customers approach the contractors or manufacturers for their noise solutions.
- The contractors and manufacturers are **consultants** providing professional solutions and products to fix customers’ problems.
- **High Profit margin:** ~45%
- Recycled materials are commonly used as raw materials in this industry.
- Product and environment sustainability is a concern in this industry.

Source: Industry Experts
Soundproofing Materials

Competitive Landscape

• Low market share concentration → top four companies ~ 10.0% of the industry
• Small, numerous companies compete for small-scale projects
• High competition and the trend is steady
• Firms compete on price, service, and quality of products and installations
• Word of mouth referrals are important
• Low barrier to entry in this industry
• Often establish agreements with upstream manufacturers to get discounts

Source: IBIS World / Industry Experts
## Soundproofing Materials

### Buyer Potential

<table>
<thead>
<tr>
<th>Key External Drivers</th>
<th>Expected Trend</th>
<th>Industry Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of private nonresidential construction</td>
<td>Increasing</td>
<td>🌻</td>
</tr>
<tr>
<td>Industrial production index</td>
<td>Increasing</td>
<td>🌻</td>
</tr>
<tr>
<td>Value of residential construction</td>
<td>Increasing</td>
<td>🌻</td>
</tr>
<tr>
<td>Prime rate</td>
<td>Increasing</td>
<td>🧢</td>
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</tbody>
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Source: IBIS World