Hsu Consulting

Engineered Strand Products (Composites) & Applications

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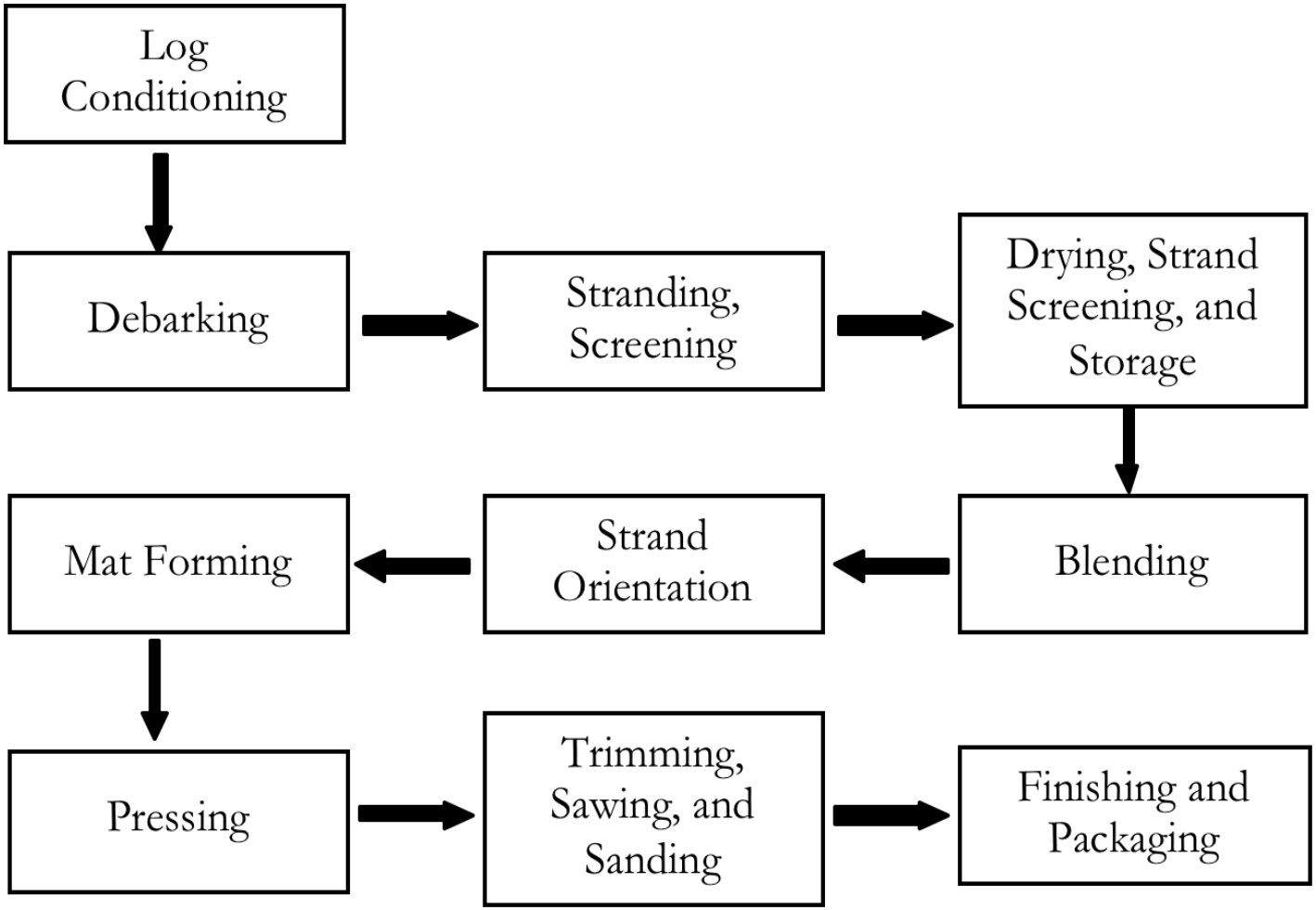
Flow chart of making Engineered Strand Products



Engineered Strand Products

- Oriented strand board (OSB)
- Waferboard, randomized strand board (RSB)
- Oriented strand lumber (OSL)/Laminated strand lumber (LSL)

- Strength and stiffness:
  - in length, LSL > OSB > RSB
  - In width, RSB > OSB . LSL

Applications

- Sheathings, rim board, and staircase for residential buildings
- Decoration panels
- Core stocking of decoration panels
- Furniture frames or stringers
- Core stocking for Truck and container floors

Properties Required for Applications

- Bending Properties
- Nail or screw withdrawal strength in different directions
- Surface smoothness and appearance
- Edge machine ability
- Surface integrity and glue ability for overlaying or lamination.
- Different types of strand products can be designed to have adequate properties for different applications.

Manipulation of variables

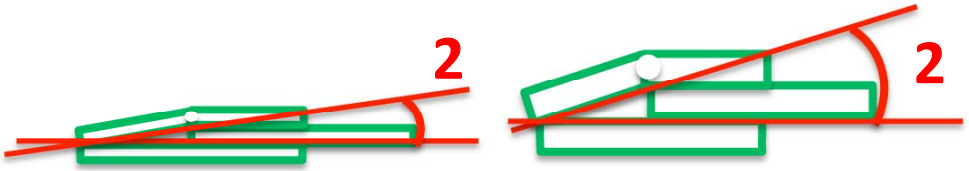
- Strand geometry,
- Strand orientation in each layer,
- Strand geometry distribution in thickness,
- Location of fines,
- Resin content and distribution in each layer
- Vertical density profiles,
- These variables can be manipulated to make products with suitable properties for applications.

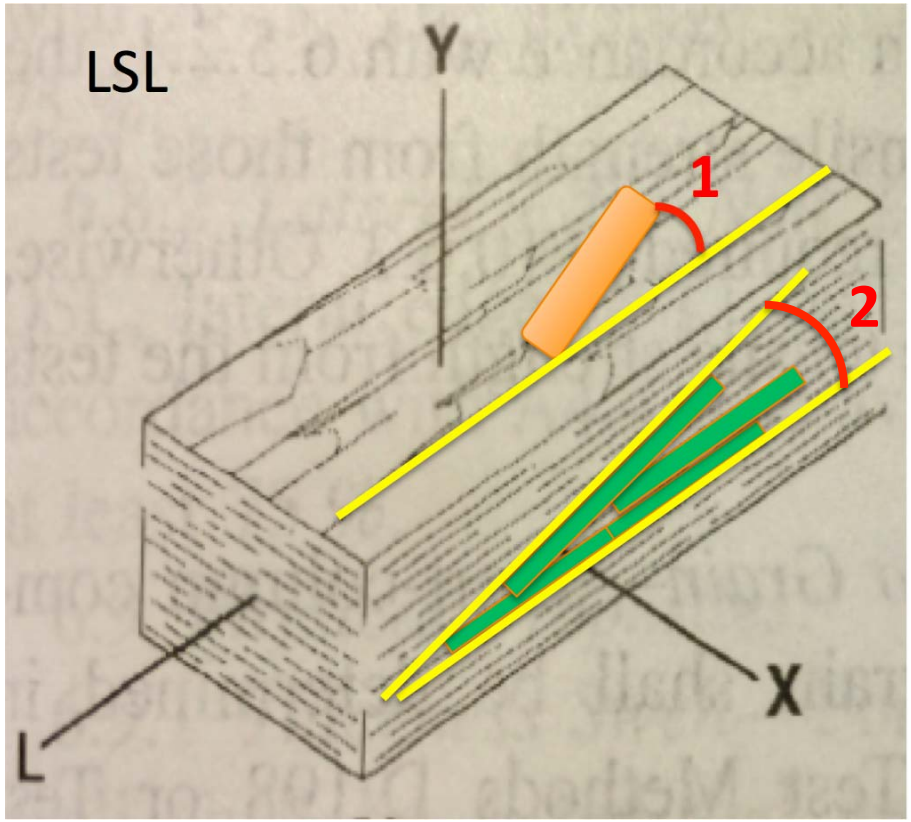
Strand Geometry

- Strand geometry affects every aspect of processing and properties. It can be thick or thin, long or short, wide or narrow, as well as many combinations of different thicknesses, widths, and lengths.

Strand Orientation Angle

- There are two different kinds of strand orientation angle.
  - ***Angle 1*** -- strand orientation angle in Y-plane in relation to longitudinal (L) axis
  - ***Angle 2*** -- strand bending angle in X-plane in relation to longitudinal (L) axis





Strand Orientation Angle

- Small strand orientation angle 1 and Angle 2 along the length provides high bending, tension, and compression in length.
- Randomized strand orientation can provide equal properties in length and width, i.e., two-way action capabilities.

Strand Geometry Distribution

- For smooth surfaces:
  - Form a mat in such a way that the larger strands are placed toward the center plane and the smaller strands and fines are toward to the surface layer. This approach is just opposite to the approach of making structural OSB

Strand Geometry Distribution (Cont'd)

- High flat-wise bending: The larger strands are formed toward surfaces
- High edgewise bending, tension, core shear, and compression properties: Strand geometry are uniformly distributed through the product.

Location of Fines

- Fines in the surfaces can provide smooth surfaces,
- Fines through the whole product can minimize the adverse effect of fines on edge properties,
- Fines in the surface layers can adversely affect flat-wise bending properties,
- No fines stratification should be formed.

Resin Content in Each Layer

- Bonding strength
- Performance of each layer
- Density required for each layer
- Product durability

Vertical density Profile

- Higher density in outer surface layers and uniform density for the rest -- balance the flat-wise bending properties and IB strength, and smooth and tight surfaces for overlaying;
- Sharp vertical density profile -- high flat-wise bending properties but relatively low edgewise bending, tension, and compression properties, as well as low IB strength;
- Uniform vertical density profile -- higher edgewise bending than flat-wise bending, as well as high tension, compression and shear.

Can Structural OSB Compete with Other Core Stockings

- Likely, it cannot.

OSB Prospects in China

- International Market:
  - Opportunity for exporting OSB to Korea and Japan as building materials,
  - Will face a stiff competition from low cost OSB from Canada and the USA.
- Domestic Market:
  - Packaging material;
  - Decoration and furniture material;
  - Core stocks for truck and container flooring, and decoration panels;
  - Building material for wood structural houses;
  - Specialty OSB: e.g., siding for housing, partition wall for ships

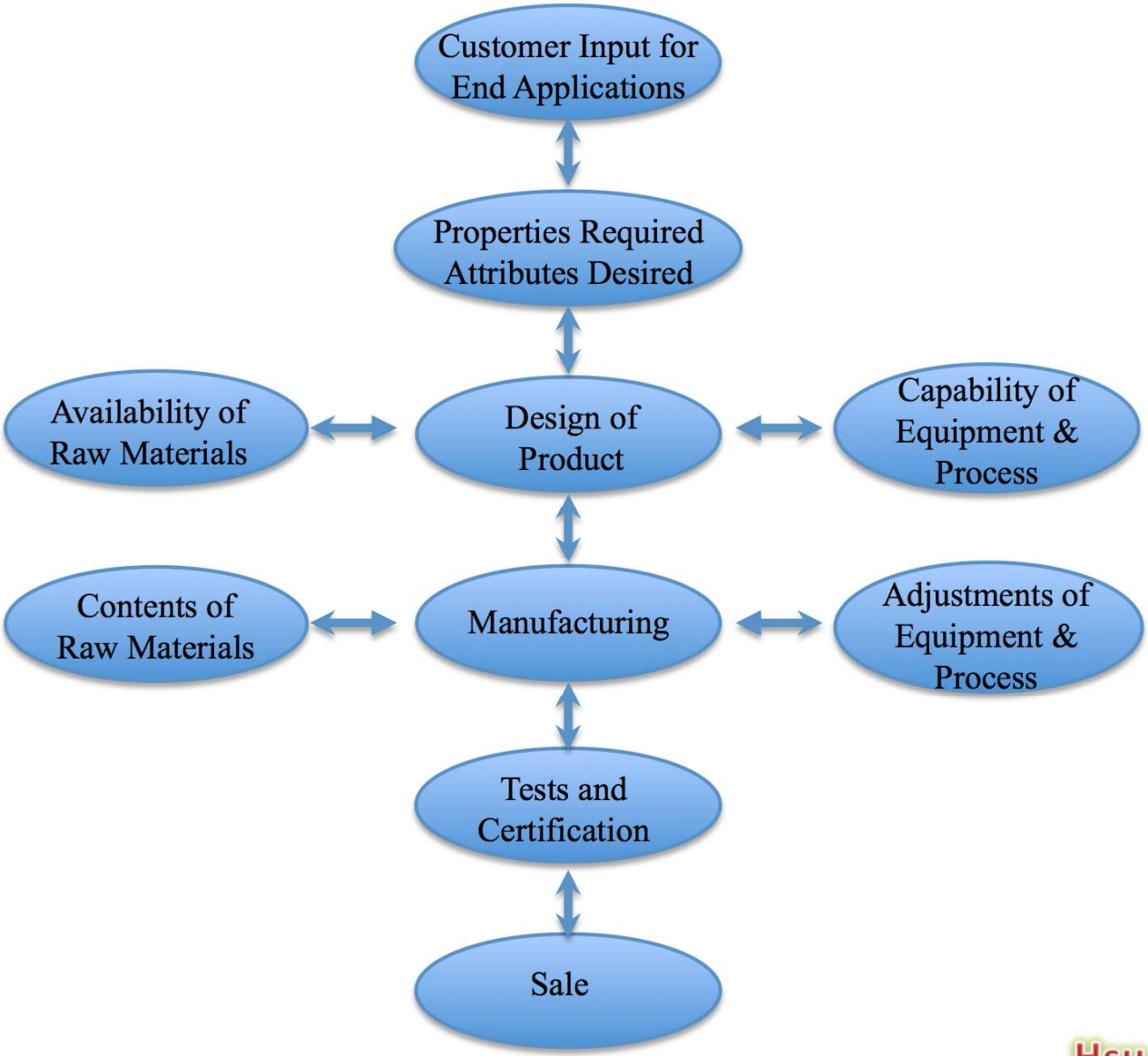
Challenges for OSB Producers in China

- Need to have a high product-to-log input ratio due to high wood cost in China.
- Be versatile to produce various products having different properties to meet the requirements for various applications.
- Enable to produce low cost, quality product to compete with blockboard or MDF or particleboard in price and performance.

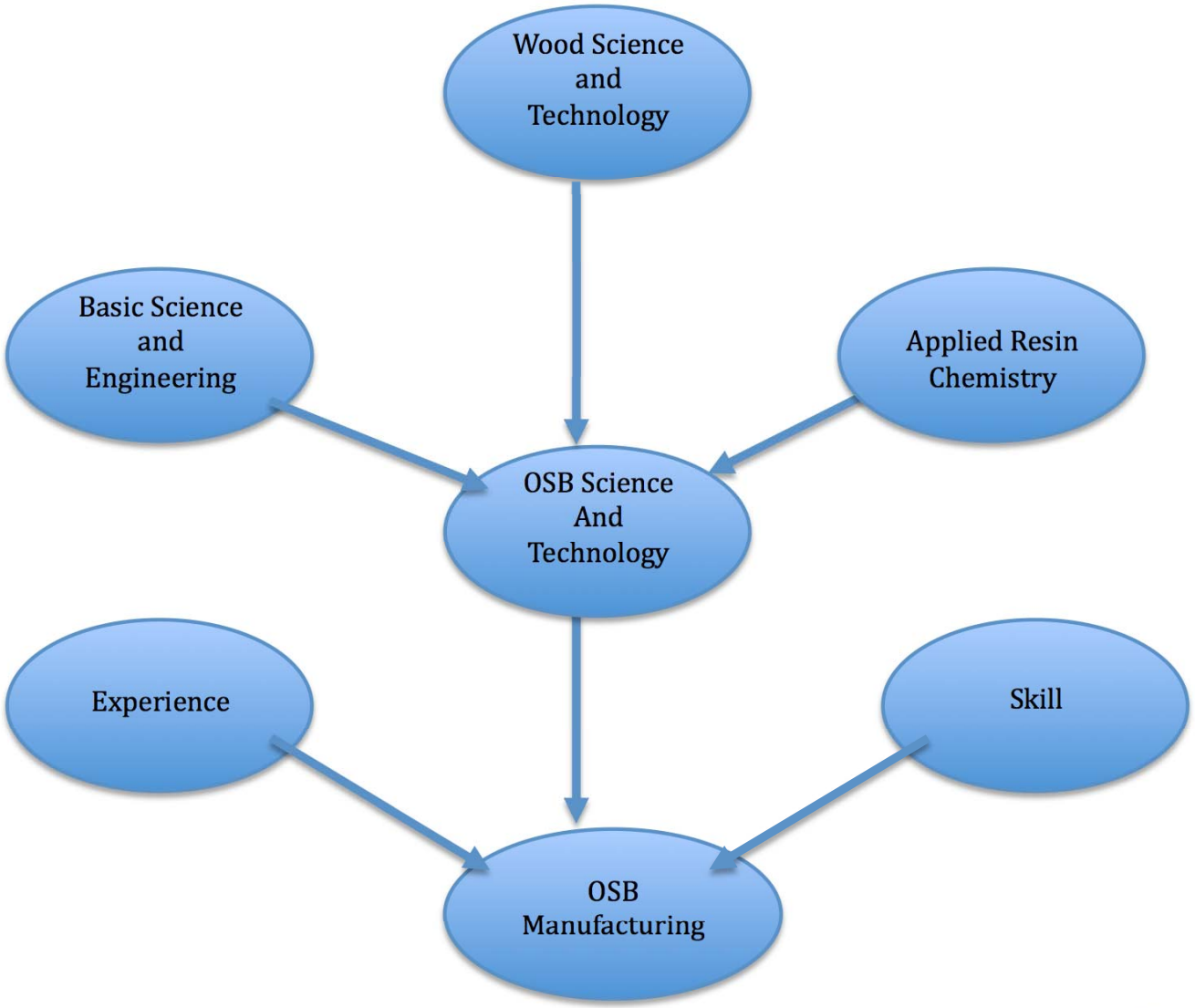
Opportunities for OSB Producers in China

- Huge demand for industrial panels and engineered strand lumber;
- Design and manufacture different engineered strand products for different applications;
- Increase competitive edges over the competitors
  - Improvement in production efficiency
  - Reduction in production variables cost

Engineering and Re-Engineering Products



Cross-Function Knowledge



What is the Ideal Core Stocks?

- For decoration panels
  - Uniform density through the whole panel,
  - Smooth surface
  - No notorious big voids.
  - Light in density
  - Dimensionally stable in three principal axes
- For truck and container flooring
  - High in mechanical properties
  - High in dimensional stability
- No single universal recipe can be used to manufacture a product for all applications

Matching of Products and Applications

- OSB Sheathings -- good for residential buildings
- Randomized strand board -- preferred for core stocking of decoration panels with thick veneer overlay
- OSB or randomized strand board -- for core stocking of decoration panels with thin overlay
- LSL -- for core stocking of track and container floorings.

Summary

- The main applications of engineered strand products in China are different from those in NA.
- The products for China market must be designed to match their applications. Otherwise, the products may be too expensive to compete with other products.

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