

Summary

WBC Research Themes

Review & Update

Theme D

Theme D: Impact of Process

Portions of the manufacturing process can adversely affect wood quality and adhesive performance. The complexities of mechanical processing, moisture in wood, and pressing must be better understood to help manufacturers balance productivity and quality. Areas that could benefit from fundamental study include:

Subtheme D.1. *Moisture*

1. Impact of wood moisture levels on adhesive bonding and performance
2. Influence of steam on pressing and product properties
3. Influence of changing furnish moisture content on pressing and product properties

Subtheme D.2. *Hot Pressing*

1. Effect on press time and temperature on wood degradation
2. Understanding the complex interaction of press temperature and time on adhesive cure, properties and product performance

Subtheme D.3. *Emissions*

1. Process modifications to reduce formaldehyde emissions
2. Methods for reducing post-manufacture formaldehyde emissions

Subtheme D.4. *More efficient use of key raw materials*

No items

Subtheme D.5. *Novel process methodologies*

No items

Subtheme D.6. *Effect of refining technologies on fiber properties*

No items

Subtheme D.7. *Impact of resin blending technology on adhesive consumption and product performance*

No items

Subtheme D.8. *Influence of temperature and time during processing on adhesive bond performance*

No items

Subtheme D.9. *Effect of processing parameters on wood viscoelasticity*

No items

Subtheme D.10. *Reduced energy input into manufacturing of wood-based composites*

No items

Subtheme D.11. *Dynamics of the extrusion process*

No items

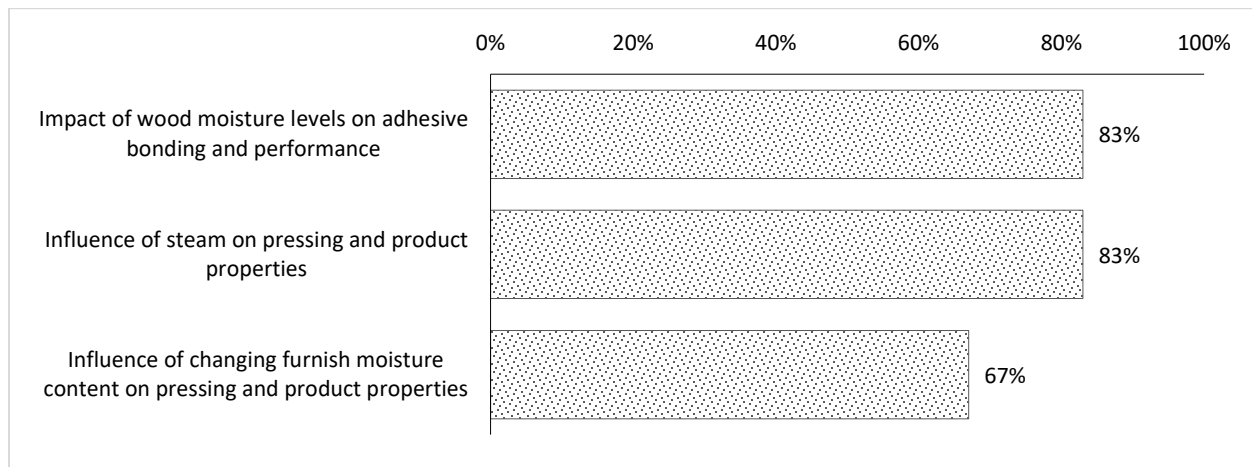
Theme D: Impact of Process

Response Rate 56%

Question 1. Subtheme D.1. Moisture contains several items, please choose the ones that are important/relevant for your field of work (check all that apply):

Items	Count	Percentage
Impact of wood moisture levels on adhesive bonding and performance	5	83%
Influence of steam on pressing and product properties	5	83%
Influence of changing furnish moisture content on pressing and product properties	4	67%

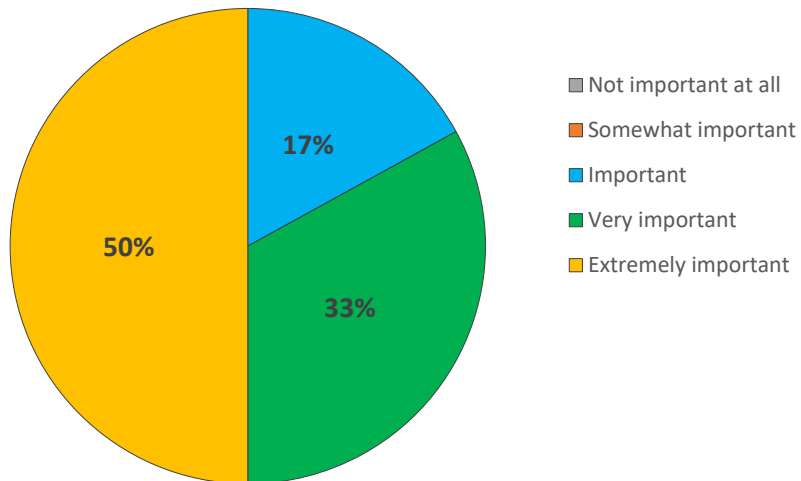
Subtheme D.1. Moisture Important/Relevant Items



Question 2. Please rate the importance of **Subtheme D.1. Moisture** for your field of work:

Level of Importance	Count	Percentage
Not important at all	0	0%
Somewhat important	0	0%
Important	1	17%
Very important	2	33%
Extremely important	3	50%

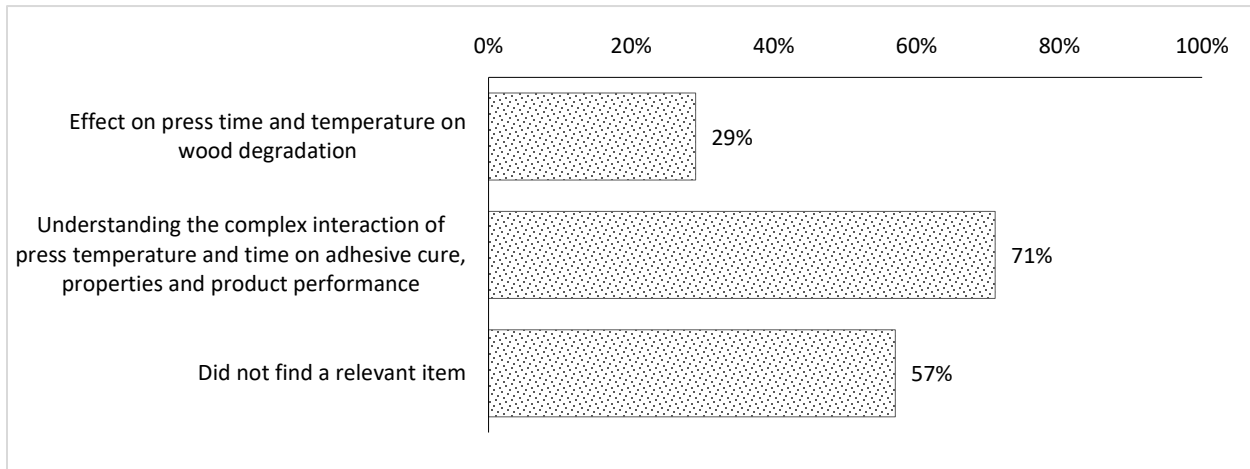
Level of Importance **Subtheme D.1. Moisture**



Question 3. **Subtheme D.2. Hot Pressing** contains several items; please choose the ones that are important/relevant for your field of work (check all that apply):

Items	Count	Percentage
Effect on press time and temperature on wood degradation	2	29%
Understanding the complex interaction of press temperature and time on adhesive cure, properties and product performance	5	71%
Did not find a relevant item	4	57%

Subtheme D.2. Hot Pressing Important/Relevant Items

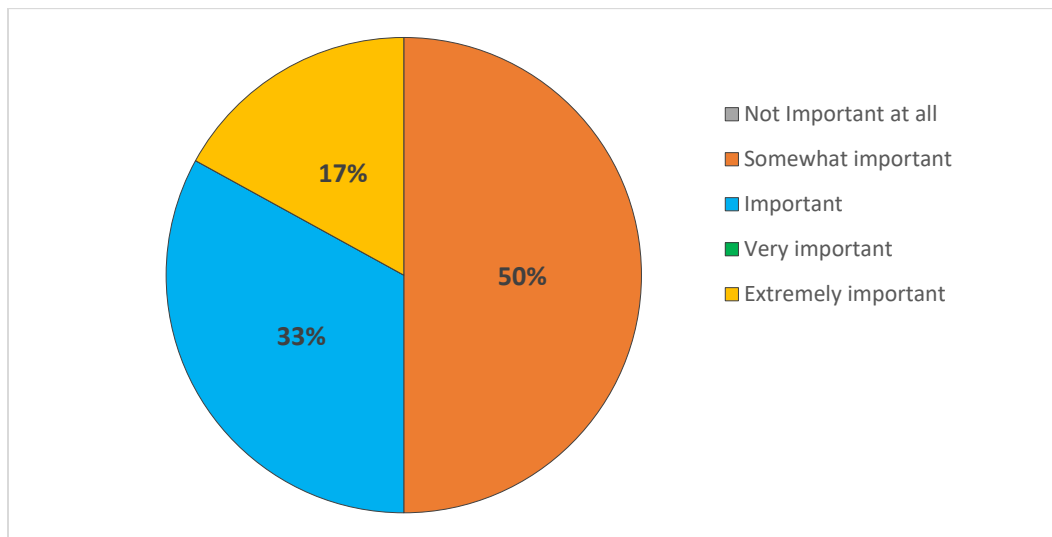


Question 4. Please recommend a new item(s) for **Subtheme D.2. Hot Pressing**. Please add a short definition for the item(s).

- *Effects of process parameters on product properties (as a broad theme) vs. focusing only on hot pressing.*
- *Effect of press strategy on final properties.*

Question 5. Please rate the importance of **Subtheme D.2. Hot Pressing** for your field of work:

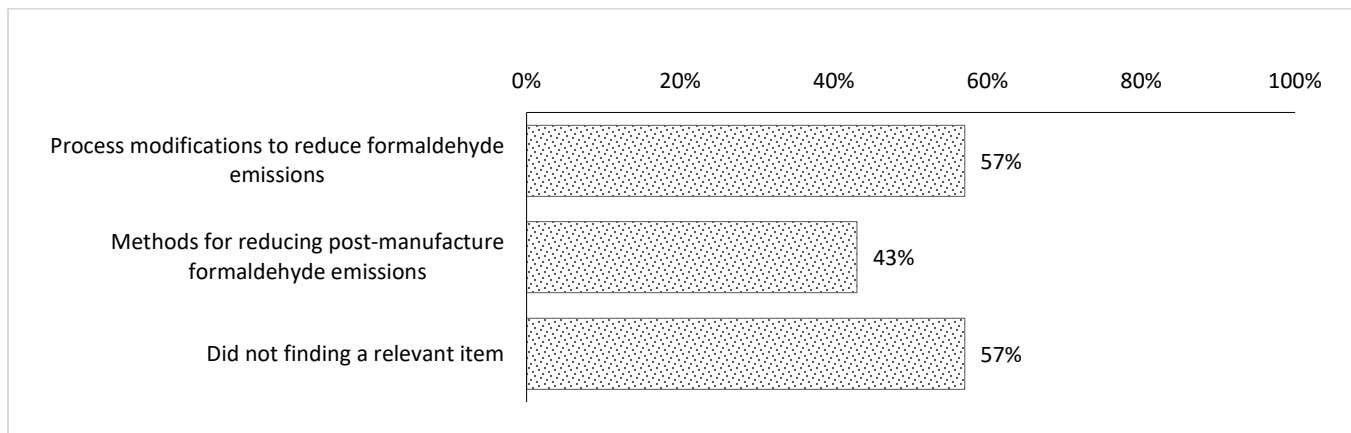
Level of Importance	Count	Percentage
Not important at all	0	0%
Somewhat important	3	50%
Important	2	33%
Very important	0	0%
Extremely important	1	17%



Question 6. **Subtheme D.3. Emissions** contains several items; please choose the ones that are important/relevant for your field of work (check all that apply):

Items	Count	Percentage
Process modifications to reduce formaldehyde emissions	4	57%
Methods for reducing post-manufacture formaldehyde emissions	3	43%
Did not find a relevant item	4	57%

Subtheme D.3. Emissions Important/Relevant Items

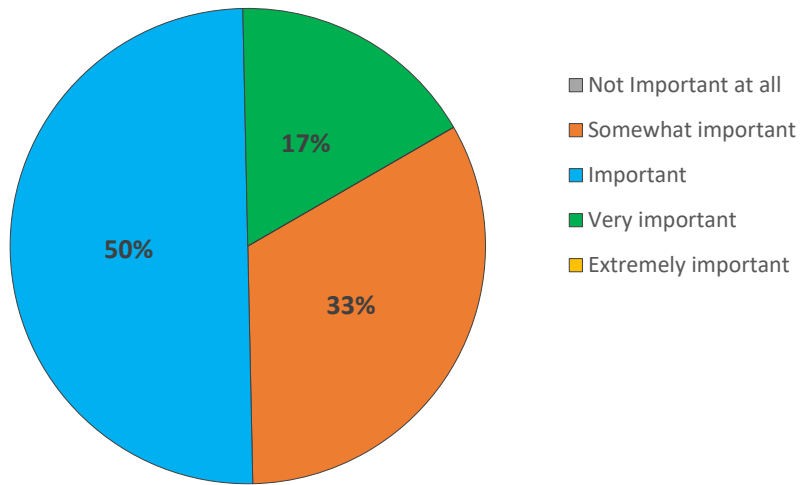


Question 7. Please recommend a new item(s) for **Subtheme D.3. Emissions**. Please add a short definition for the item(s).

- *Total VOC emissions instead of just formaldehyde emissions would be better for the topics.*
- *Natural formaldehyde versus process formaldehyde*

Question 8. Please rate the importance of **Subtheme D.3. Emissions**. for your field of work:

Level of Importance	Count	Percentage
Not important at all	0	0%
Somewhat important	2	33%
Important	3	50%
Very important	1	17%
Extremely important	0	0%



Question 9. **Subtheme D.4. More efficient use of key raw materials** does not contain items, please recommend a new item(s) for this subtheme if necessary or leave blank if there is insufficient information about this subtheme.

- *Maintaining fine size during strand production and handling, producing and maintaining strand geometry throughout the process.*
- *Fines reduction in strand production and handling, producing and maintaining strand geometry throughout the process.*

Question 10. Subtheme D.5. *Novel Process Methodologies* does not contain items, please recommend a new item(s) for this subtheme if necessary or leave blank if there is insufficient information about this subtheme.

NA

Question 11. Subtheme D.6. *Effect of refining technologies on fiber properties* does not contain items, please recommend a new item(s) for this subtheme if necessary or leave blank if there is insufficient information about this subtheme.

- *Seems like a subtheme for #5 (Novel process methodologies)*

Question 12. Subtheme D.7. *Impact of resin blending technology on adhesive consumption and product performance* does not contain items, please recommend a new item(s) for this subtheme if necessary or leave blank if there is insufficient information about this subtheme.

- *Seems like a subtheme for #4 (More efficient use of key raw materials)*

Question 13. Subtheme D.8. *Influence of temperature and time during processing on adhesive bond performance* does not contain items, please recommend a new item(s) for this subtheme if necessary or leave blank if there is insufficient information about this subtheme.

- *Adhesive reliability in field conditions.*

Question 14. Subtheme D.9. *Effect of processing parameters on wood viscoelasticity* does not contain items, please recommend a new item(s) for this subtheme if necessary or leave blank if there is insufficient information about this subtheme.

- *Influence of process parameters (strand geometry out of strander, temperature and time in dryer, etc.) on preserving strand integrity and minimizing breakage.*

Question 15. Subtheme D.10. *Reduced energy input into manufacturing of wood-based composites* does not contain items, please recommend a new item(s) for this subtheme if necessary or leave blank if there is insufficient information about this subtheme.

NA

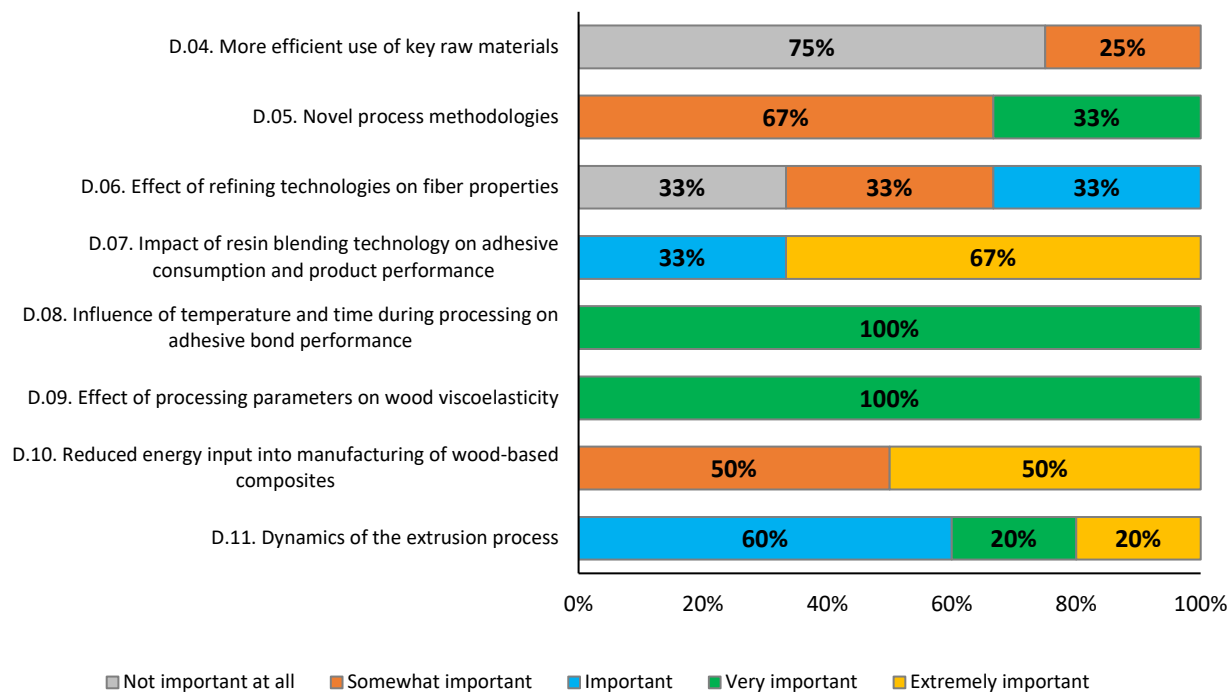
Question 16. Subtheme D.11. *Dynamics of the extrusion process* does not contain items, please recommend a new item(s) for this subtheme if necessary or leave blank if there is insufficient information about this subtheme.

NA

Question 17. Please rate the importance/relevance of subthemes D.4 - D.11 for your field of work.

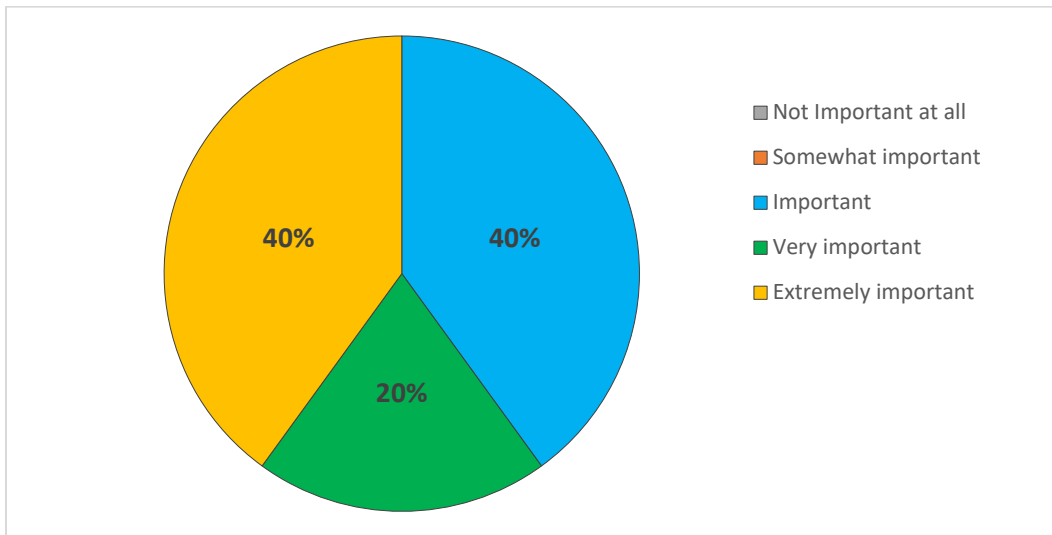
Subthemes	Not important at all		Somewhat important		Important		Very important		Extremely important	
	Count	%	Count	%	Count	%	Count	%	Count	%
D.04. More efficient use of key raw materials	0	0%	0	0%	3	60%	1	20%	1	20%
D.05. Novel process methodologies	0	0%	1	50%	0	0%	0	0%	1	50%
D.06. Effect of refining technologies on fiber properties	0	0%	0	0%	0	0%	1	100%	0	0%
D.07. Impact of resin blending technology on adhesive consumption and product performance	0	0%	0	0%	0	0%	1	100%	0	0%
D.08. Influence of temperature and time during processing on adhesive bond performance	0	0%	0	0%	1	33%	0	0%	2	67%
D.09. Effect of processing parameters on wood viscoelasticity	1	33%	1	33%	1	33%	0	0%	0	0%
D.10. Reduced energy input into manufacturing of wood-based composites	0	0%	2	67%	0	0%	1	33%	0	0%
D.11. Dynamics of the extrusion process	3	75%	1	25%	0	0%	0	0%	0	0%

Subthemes D.4. - D.11. Importance/Relevance



Question 18. Overall, please rate the importance of theme **Theme D: Impact of Process** for your field of work:

Level of Importance	Count	Percentage
Not important at all	0	0%
Somewhat important	0	0%
Important	2	40%
Very important	1	20%
Extremely important	2	40%



Suggestions & Comments

Suggestions

Please provide suggestions to improve and update research theme **Theme D: Impact of Process**, subthemes, and items. In **purple** items modified or eliminated, in **blue** items added:

~~D. Impact of Process~~ Impact of Process Parameters

~~Portions of the manufacturing process can adversely affect wood quality and adhesive performance. The complexities of mechanical processing, moisture in wood, and pressing must be better understood to help manufacturers balance productivity and quality. Areas that could benefit from fundamental study include:~~

The manufacturing process affects wood-furnish quality, adhesive performance, and finished product properties. A better understanding of mechanical processing, wood drying, and composite pressing will help manufacturers increase productivity, improve product quality, save energy, and reduce process/product emissions. Areas of fundamental study are:

Current	Suggested
Theme C: Adhesive Technology	Theme C: Adhesive Technology
D.1. Moisture <ol style="list-style-type: none"> 1. Impact of wood moisture levels on adhesive bonding and performance 2. Influence of steam on pressing and product properties 3. Influence of changing furnish moisture content on pressing and product properties 	D.1. Mechanical Processing <ol style="list-style-type: none"> 1. Assessing the impact of processing parameters on wood-furnish and product performance. 2. Studying the effects of processing parameters on adhesive bonds. 3. Determining the effects of treatment prior to processing on 1 and 2.

<p>D.2. Hot Pressing</p> <ol style="list-style-type: none"> 1. Effect on press time and temperature on wood degradation 2. Understanding the complex interaction of press temperature and time on adhesive cure, properties and product performance 	<p>D.2. Wood Drying/Preparation</p> <ol style="list-style-type: none"> 1. Investigating the effects of wood moisture levels on adhesive bonding, furnish properties, and product performance.
<p>D.3. Emissions</p> <ol style="list-style-type: none"> 1. Process modifications to reduce formaldehyde emissions 2. Methods for reducing post-manufacture formaldehyde emissions 	<p>D.3. Composite Pressing</p> <ol style="list-style-type: none"> 1. Studying the influence of furnish moisture content pressing. 2. Understanding the interaction of press parameters on adhesive cure, wood properties, and product performance. 3. Evaluating the impact of different resin curing techniques (hot press, steam injection, microwave, and radio frequency) on adhesive bond, product performance, and wood quality.
<p>D.4. More efficient use of key raw materials</p> <p><i>No items</i></p>	<p>D.4. Emissions</p> <ol style="list-style-type: none"> 1. Evaluating the effects of process modifications on formaldehyde emissions. 2. Developing methods for reducing post-manufacture formaldehyde emissions. 3. Maintaining fine size during strand production and handling, producing and maintaining strand geometry throughout the process. 4. Fines reduction in strand production and handling, producing and maintaining strand geometry throughout the process.
<p>D.5. Novel process methodologies</p> <p><i>No items</i></p>	<p>D.5. Novel process methodologies</p> <p><i>No items</i></p>

D.6. Effect of refining technologies on fiber properties <i>No items</i>	D.6. Effect of refining technologies on fiber properties <i>Seems like a subtheme for #5 (Novel process methodologies)</i>
D.7. Impact of resin blending technology on adhesive consumption and product performance <i>No items</i>	D.7. Impact of resin blending technology on adhesive consumption and product performance <i>Seems like a subtheme for #4 (More efficient use of key raw materials)</i>
D.8. Influence of temperature and time during processing on adhesive bond performance <i>No items</i>	D.8. Influence of temperature and time during processing on adhesive bond performance <i>Adhesive reliability in field conditions.</i>
D.9. Effect of processing parameters on wood viscoelasticity <i>No items</i>	D.9. Effect of processing parameters on wood viscoelasticity <i>Influence of process parameters (strand geometry out of strander, temperature and time in dryer, etc.) on preserving strand integrity and minimizing breakage.</i>
D. 10. Reduced energy input into manufacturing of wood-based composites <i>No items</i>	D. 10. Reduced energy input into manufacturing of wood-based composites <i>No items</i>
D.11. Dynamics of the extrusion process <i>No items</i>	D.11. Dynamics of the extrusion process <i>No items</i>

Comments

Please comment on how to improve and update research **Theme C: Adhesive Technology**, subthemes, and items.

How well does this theme fit within the WBC in its current form? Do we have the expertise and resources needed to perform projects in this area? This seems to be more aligned with equipment manufacturers. Are we of the opinion that this theme (and associated projects) will attract additional members from this background that we can leverage to collaborate on this work?