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CIRCULAR ECONOMY PRINCIPLES APPLIED TO WOOD–BASED PRODUCTS IN CONSTRUCTION AND BUILDING MATERIALS SECTOR

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Abstract: Circular economy principles transform wood–based products in construction by emphasizing waste minimization, resource looping, and lifecycle extension. This abstract outlines a scientific paper exploring their application to sustainable building materials. Circular economy strategies prioritize designing out waste through reduce, reuse, and recycle hierarchies applied to wood products like cross–laminated timber (CLT) and engineered panels. Cascading uses extend wood's value from structural beams to secondary applications such as particleboard or bioenergy, minimizing landfill disposal. Design–for–disassembly enables modular wood components to be repurposed, reducing embodied carbon in new builds. Prefabricated wood systems cut onsite waste by up to 90% compared to traditional methods, supporting regenerative cycles where demolition wood feeds urban sawmills for standardized reuse. Innovations like wood–polymer composites from agro–waste enhance durability while aligning with circular carbon flows, closing loops from forest to building end–of–life. Lifecycle assessments confirm wood stores carbon long–term, outperforming steel or concrete in low–emission scenarios.
Keywords: circular economy principles, wood–based products, wood waste streams, cascading use, construction sector, building materials

1. INTRODUCTION

Wood is widely available, relatively abundant worldwide, renewable, lightweight yet strong, readily fashioned into useful products and aesthetically pleasing. A number of social, economic, and environmental factors that influence wood–use trends drives the desirability of specific wood properties. Wood is today, and has been for many centuries, the predominant material used in the construction [1–6]. The development of a number of new types of wood–based mass timber products has created opportunities for wood construction at greater heights while meeting other objectives, including addressing safety requirements. Over the past four decades, innovation in wood products has led to unprecedented changes in the possibilities for wood use in construction, particularly regarding its use in the construction. Many of these new products are structural wood composites, produced by assembling small wood pieces and particles or larger wood members, into much larger products with the capacity to be used in new ways as structural components of buildings. Recent efforts to promote the use of engineered wood products in the construction of tall buildings and supportive research findings may be changing perceptions and attitudes about the performance and benefits of wood structures [1–6]. Current uses of wood are projected to remain the dominant uses for decades to come, and many desirable wood properties recognized as important to today's products will continue to be important. As a building material, wood performs well relative to potential alternatives in a number of aspects [1–6].

Mass timber construction, which typically involves the use of CLT in combination with other structural wood composites, is increasingly finding application in large–scale structures, including multi–storey residential buildings, industrial and commercial structures as well as in the construction of civil engineering works. The transformation of construction techniques to incorporate greater use of wood offers opportunities to enhance circularity and sustainability throughout the built environment and related industries. Responsible wood use in construction is more circular and sustainable than use of other common building materials. Wood has inherent advantages and provides multiple benefits because it is a natural material, is renewable and can be fashioned into useful building components with minimal climate impact [1–6]. At the end of the useful life of a structure made wholly or partially of wood, building components may be recovered for reuse and recycling.

THE CIRCULAR ECONOMY is a sustainable economic model that contrasts with the traditional linear "TAKE, MAKE, DISPOSE" economy [7–19]. It focuses on designing out waste and pollution, keeping products and materials in use for as long as possible, and regenerating natural systems. This restores and regenerates resources rather than depleting them, aiming to reduce environmental impact and foster long–term economic and social benefits. The three core principles of the circular economy are:

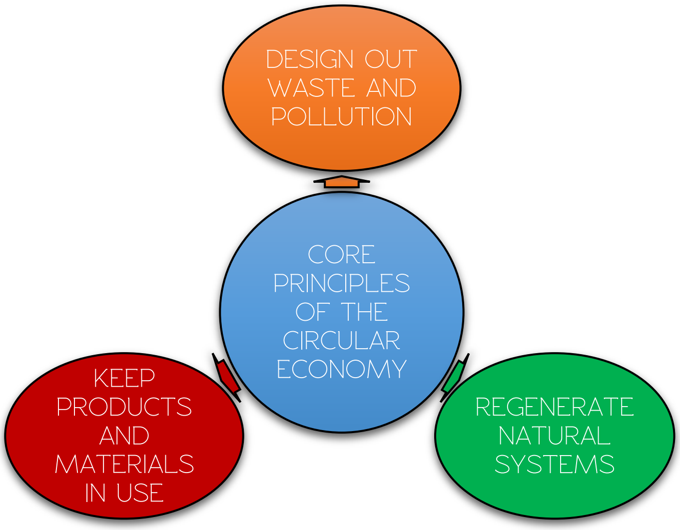


Figure 1. Core principles of the circular economy

- DESIGN OUT WASTE AND POLLUTION: Products and processes are designed to minimize waste generation and environmental harm from the start.
- KEEP PRODUCTS AND MATERIALS IN USE: This includes sharing, leasing, reusing, repairing, refurbishing, and recycling products to extend their lifecycle and resource productivity.
- REGENERATE NATURAL SYSTEMS: The economy not only avoids harm but actively works to restore ecological health, for example, by returning valuable nutrients to the soil or using renewable energy.

In fact, the circular economy promotes sustainability by reshaping production and consumption into a closed–loop system that prevents resource depletion, lowers waste and pollution, and supports environmental regeneration and resilient economic growth [7–19].

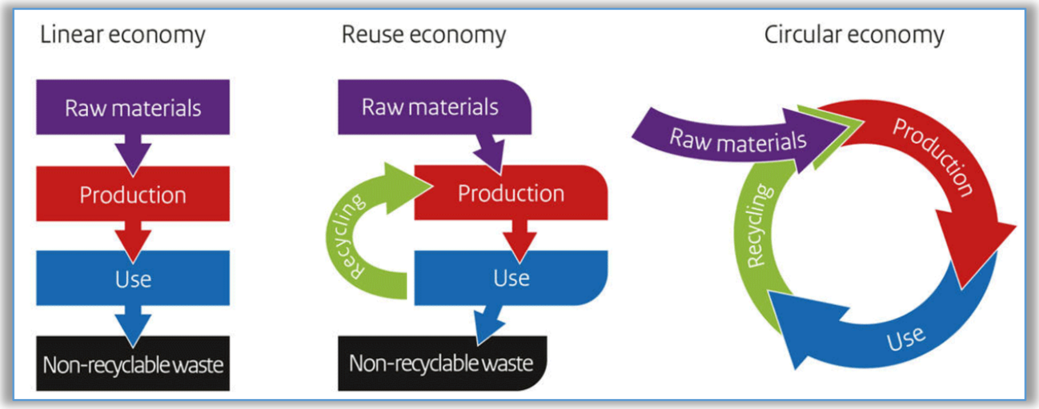


Figure 2. From a linear to a circular economy

The key differences between a circular economy and a linear economy lie in their approach to resource use, product life cycle, waste management, and environmental impact [9–12]:

- RESOURCE USE: Linear economy follows a "take–make–dispose" model where raw materials are extracted, used once, and discarded, leading to depletion of finite resources, while Circular economy emphasizes maximizing resource utility by keeping materials in use as long as possible through reuse, repair, and recycling, reducing the need for new resource extraction.
- PRODUCT LIFE CYCLE: Linear economy designs products with a short lifespan, leading to disposal after use, while Circular economy designs products for durability and longevity, encouraging repair, refurbishment, and extended use.
- WASTE GENERATION AND MANAGEMENT: Linear economy generates large amounts of waste sent to landfills or incinerators, contributing to pollution, while Circular economy minimizes

waste by creating closed–loop systems where waste is reused or converted back into raw materials.

- ENVIRONMENTAL IMPACT: Linear economy causes pollution, resource depletion, and climate change due to continuous extraction, production, and disposal activities, while Circular economy reduces environmental impacts by minimizing waste, promoting sustainable resource management, and regenerating natural systems.
- ECONOMIC AND SYSTEMIC MODEL: Linear economy focuses on short–term profit without considering sustainability or long–term environmental consequences, while Circular economy aims for long–term economic resilience by designing systems that keep resources circulating and promote sustainable growth.

In essence, the circular economy is a regenerative system designed to eliminate waste and continuously reuse resources, whereas the linear economy operates in a one–way flow ending with disposal and environmental depletion [7–19]. Valorization and uses include:

- Material Recycling (High Grade): Premium grades are processed into new materials, reprocessed into particleboard, MDF, or pulp for paper.
- Energy Recovery (Lower Grade): Combustion in biomass plants to generate heat and electricity. Approximately 65% of recycled wood is chipped for use as biomass fuel to generate electricity and heat.
- Composting / Mulch: Untreated wood waste can be composted or used as garden mulch.

In fact, Circular Economy supports keeping wood in continuous reuse. Two industries which benefiting most from switching to a circular economy include:

- Materials: Circular economy encourages bio–based, recyclable materials and industrial symbiosis where waste streams become inputs for other processes, reducing carbon footprint and waste.
- Construction: Focuses on sustainable materials, energy–efficient design, and buildings designed for repurposing or disassembly, reducing resource depletion and construction waste.

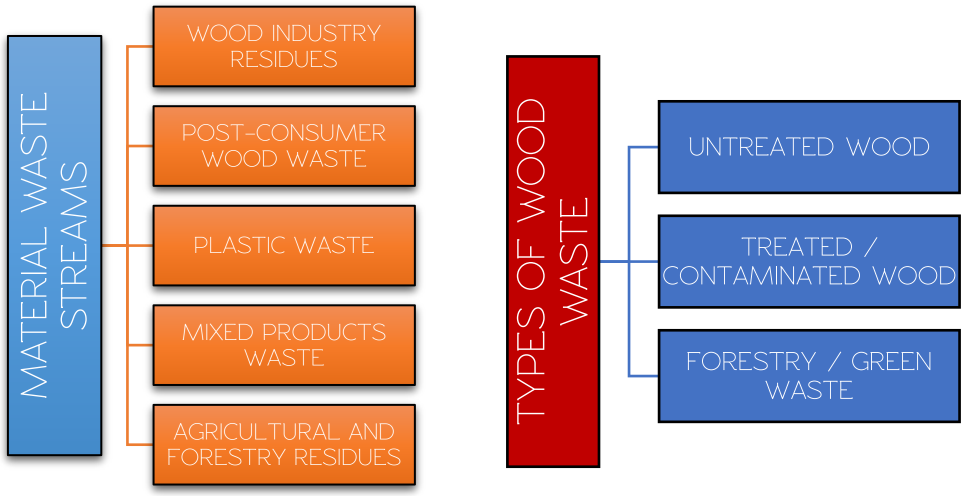
These industries see benefits such as improved resource efficiency, reduced waste, lower environmental impact, enhanced resilience to supply shocks, and new business opportunities fueled by sustainable innovation. Therefore, Industry sectors showing the highest economic gains from circularity include the construction and building materials. In this way, using recycled materials and designing buildings for disassembly cuts material costs and supports longer–term asset value. Studies indicate that Construction and Building Materials sector, due to material intensity, waste generation, and innovation potential, unlock one of the most substantial economic advantages from circular economy business models, including cost reduction, new revenue sources, and enhanced market competitiveness.

2. MATERIAL WASTE STREAMS AND MANUFACTURING STEPS

Wood waste streams are diverse, coming from construction/demolition, manufacturing (offcuts, pallets), packaging, and consumer goods (furniture), categorized by quality (untreated, treated, contaminated) for reuse in panel boards/paper, energy generation (biomass), or composting, with significant potential for valorization to reduce landfill and support circular economies. Material waste streams and manufacturing steps in wood construction generate significant residues at each stage, from raw log processing to onsite assembly, offering opportunities for circular economy recovery [20–29]. Material waste streams that can be solutions in the circular economy for manufacturing wood–based products include:

- WOOD INDUSTRY RESIDUES: Sawdust, wood chips, shavings, and offcuts generated during timber processing and wood products manufacturing can be shredded and reincorporated into new particleboard, MDF, or wood–plastic products (WPC).

— POST–CONSUMER WOOD WASTE: Wood from pallets, crates, furniture, construction and demolition debris, and landscaping waste can be sorted, cleaned, shredded, and recycled into products materials or used as biomass energy feedstock.
— PLASTIC WASTE: In wood–plastic products, recycled plastic waste streams (e.g., polyethylene, polypropylene) combined with wood fibers enable circular use of plastic components, reducing virgin plastic demand.
— MIXED PRODUCTS WASTE: Advanced sorting technologies employing deep learning, X–ray, and near–infrared (NIR) sensors enable separation of wood versus plastic and other products fractions for targeted recycling.
— AGRICULTURAL AND FORESTRY RESIDUES: Agro–waste such as cotton stalks, orange tree trimmings, and other lignocellulos materials can be processed into wood products feedstock, closing resource loops.



(a) (b)

Figure 3. Material waste streams and main types

Figure 4. Wood industry residues and post–consumer wood waste

Figure 5. Agricultural and forestry residues

Types of wood waste include [20–29]:
— UNTREATED WOOD (high quality): from packaging (pallets, crates), offcuts, and clean demolition wood.
— TREATED / CONTAMINATED WOOD (lower quality): painted, varnished, or composite materials like MDF/chipboard, often from construction/renovation.
— FORESTRY / GREEN WASTE: sawdust, bark, branches, and mill ends.

These wastes help produce high–quality recycled wood products materials, reduce landfill disposal, lower virgin resource extraction, and support sustainable circular bioeconomy manufacturing practices [20–29]. Wood construction follows a linear sequence from forest to finished elements:

- harvesting / felling produces bark (5–15% waste);
- debarking and head–rig sawing yield slabs/edgings (20–30%);
- drying / planning generate sawdust/shavings (10–15%);
- machining / profiling create offcuts (5–10%).
- onsite cutting during framing/installation contributes trim ends (up to 30% total waste).

Engineered products like CLT add peeling/chipping steps, amplifying fines. Prefabrication cuts onsite waste 70–90% by optimizing factory cuts. Contaminants like resins, metals, and preservatives reduce cascade value, with fines (<5mm) comprising 40% of total waste but suitable mainly for bioenergy or combustion. Prefabrication minimizes trims by 50%, though current recycling recovers only 30–50% into secondary panels [20–29].

Waste streams ranked by suitability for wood–based products feedstock generally follow this order:

- Sawmill and wood processing residues: Includes clean wood chips, sawdust, and offcuts. These are highly suitable due to their consistent quality and low contamination risk, enabling direct reuse in products manufacturing.
- Untreated post–consumer wood waste: Such as pallet wood, crates, and construction debris free from paints or chemicals. Suitable after sorting and cleaning, provides a valuable secondary raw material.
- Treated wood waste with limited contamination: Includes painted or coated wood but with manageable contamination levels. Requires additional processing but still viable feedstock.
- Agricultural lignocellulos residues: Such as cotton stalks, straw, or other bio–based fibrous materials. Good alternative feedstock but requires pretreatment to fit products processing.
- Mixed or heavily contaminated wood/plastic products: Lower suitability due to difficulty in separation and risk of quality degradation; advanced sorting technology is required.
- Hazardous or chemically treated wood waste: Unsuitable or highly restricted due to leachate and toxic emissions risks, requiring specialized disposal.

This ranking balances availability, processing requirements, contamination risk, and compliance with recycling standards, directing industrial focus on maximizing use of clean, untreated residues for circular wood products feedstock.

Key waste streams in engineered wood manufacturing arise during processing of products like CLT, glulam, LVL, particleboard, and MDF, generating fines, offcuts, and rejects that represent 15–35% of input mass depending on the product [20–29]. The main product–specific streams are:

- CLT/LVL: Press trims and fingerjoint rejects (10–15%), often structurally sound for downcycling.
- Particleboard/MDF: Excess mat material and blow–line fines (15–25%), resin–laden and energy–intensive to recover.
- Plywood: Core veneers and edge scraps (20%), contaminated by glues limiting clean reuse.

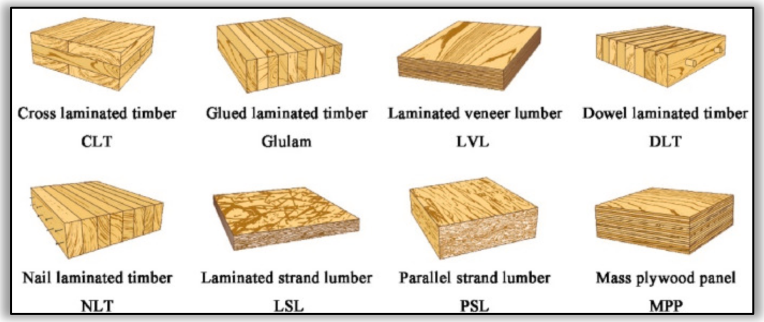


Figure 6. Gama of laminated timber and strand lumber products

Figure 7. Particleboard/MDF/Plywood

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Wood–based products enable circular economy gains at multiple manufacturing steps:

- Raw Material Sourcing: Using sustainably managed forest wood and by–products (sawdust, chips, and shavings) reduces virgin material demand and supports renewable resource cycles.
- Material Preparation and Preprocessing: Efficiently collecting and sorting wood residues minimizes contamination and improves recycling feedstock quality.
- Products Manufacturing: Utilizing bio–based adhesives and designing for disassembly enhances material recyclability and reduces hazardous emissions.
- Waste Minimization: Implementing lean manufacturing and standardized component dimensions reduces offcuts and rejects, limiting waste.

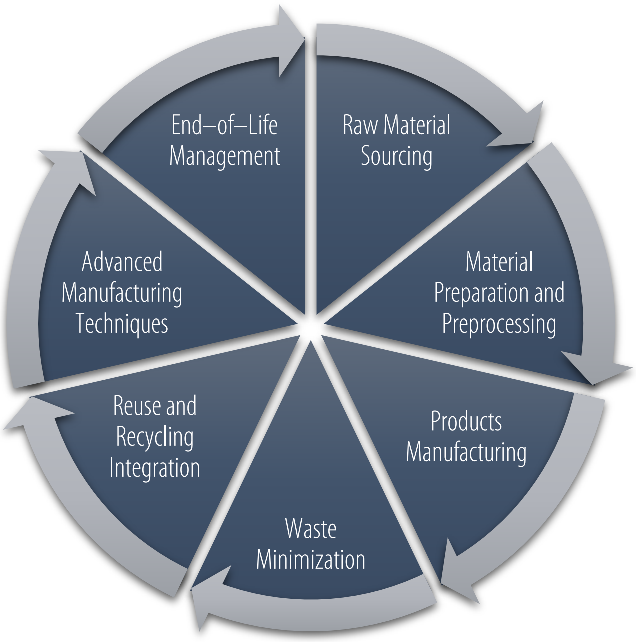

Figure 8. Multiple manufacturing steps

- Reuse and Recycling Integration: Reincorporating production offcuts and post–consumer wood waste into products manufacturing closes material loops and reduces landfill.
- Advanced Manufacturing Techniques: Additive manufacturing and digital process control optimize material use, reduce scrap, and enable on–demand production.
- End–of–Life Management: Designing for easy deconstruction, fiber recovery, and energy recovery from residuals extend material lifecycle and resource use efficiency.

At each manufacturing step, these circular strategies lower environmental impacts, improve resource efficiency, and foster sustainable production aligned with climate goals.

3. CIRCULAR ECONOMY PRINCIPLES APPLIED TO WOOD–BASED PRODUCTS

Circular economy principles applied to wood–based products in construction and building materials emphasize resource efficiency, waste minimization, and lifecycle extension, yielding significant environmental and economic gains [7–19].

- ENVIRONMENTAL BENEFITS: Wood products store carbon throughout their lifecycle, reducing greenhouse gas emissions compared to concrete or steel, while enabling sequestration in buildings. Reuse and recycling of timber, such as through design–for–disassembly in cross–laminated timber (CLT), diverts waste from landfills and lowers embodied carbon via repurposing into new products or energy sources. Energy–efficient production and natural biodegradability further minimize environmental impacts, supporting biodiversity through sustainable forestry.
- ECONOMIC ADVANTAGES: Circular practices like urban sawmills transform construction wood waste into high–value products such as particleboard or glulam, creating jobs and reducing raw material costs. Modular timber designs facilitate disassembly and resale, extending material value and cutting replacement expenses over decades. Scalable recycling into wood–plastic products boosts resource productivity and market competitiveness for manufacturers

Circular economy implementation in wood–based products for construction focuses on strategies like reduce, reuse, recycle, and recover to minimize waste and maximize resource loops throughout the material lifecycle [7–19].

- DESIGN STRATEGIES: Modular and prefabricated systems, such as cross–laminated timber (CLT) and glued–laminated timber (glulam), incorporate design–for–disassembly features like standardized connections for easy deconstruction and material recovery at end–of–life. Digital

tools for material passports track wood origins and enable traceability, supporting reuse in new projects or conversion into secondary products like particleboards.
- REUSE AND RECYCLING PRACTICES: Construction wood waste from formwork or demolition is repurposed into particleboards, cement–bonded boards, or additives in mortars and concrete, reducing landfill use and raw material demand. Urban sawmills and bio–refineries process offcuts into engineered wood products or bio–coal for energy recovery

Implementing circular economy principles in wood–based products manufacturing involves several strategic actions:
- MATERIAL OPTIMIZATION AND WASTE REDUCTION: Efficiently use lignocellulose raw materials and optimize processing to minimize waste generation at the source. Reduce reliance on synthetic adhesives by developing bio–based or binderless panels, lowering emissions of hazardous compounds like formaldehyde.
- REUSE AND RECYCLING OF WOOD RESIDUES: Integrate post–production wood residues and end–of–life wood waste into manufacturing cycles by recycling into particleboard or other bio–products, applying cascading use to maximize value and carbon storage.
- DEVELOPMENT OF CIRCULAR FEEDSTOCKS: Employ alternative renewable feedstocks, including agricultural residues and recovered materials, to reduce virgin resource dependency and promote upcycling.
- ECO–DESIGN AND PRODUCT LIFE EXTENSION: Design wood products for durability, reparability, and disassembly to enable reuse and recycling, supported by material traceability and eco–labeling.
- RESEARCH AND INNOVATION: Support advanced recovery technologies (e.g., bio–refining, pyrolysis), low–emission adhesives, and manufacturing methods such as additive manufacturing that minimize resource use and facilitate end–of–life processing.
- AWARENESS AND TRAINING: Facilitate knowledge transfer and industry adoption through training on circular economy benefits and best practices.
- POLICY AND MARKET DEVELOPMENT: Encourage supportive regulatory frameworks, standardization, and market creation for recycled wood–based products and bio–based adhesives, fostering a level playing field for sustainable products.
- ENERGY RECOVERY INTEGRATION: When materials cannot be reused, sustainably recover energy from residues and waste in alignment with regional infrastructure and sustainability goals.

These steps collectively aim to transform wood products manufacturing into a low–carbon, waste–minimizing, resource–efficient industry aligned with circular bioeconomy goals addressing climate and sustainability challenges.

Implementing circular economy in wood–based products manufacturing involves systematic integration of the 4R principles—REDUCE, REUSE, RECYCLE, and RECOVER—across design, production, and end–of–life stages [7–19].:
- REDUCE WASTE AT SOURCE: Employ efficient design and manufacturing techniques to minimize raw material use and scrap generation. Utilize digital fabrication and additive manufacturing to optimize material utilization and reduce offcuts.
- REUSE OF WOOD RESIDUES AND WASTE: Capture and reincorporate sawdust, chips, and offcuts back into production streams or secondary products like particleboard, minimizing virgin resource extraction.
- RECYCLING TECHNOLOGIES: Develop and apply advanced recycling methodologies to process engineered wood waste into new materials, focusing on removing hazardous adhesives and preserving fiber quality.

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- ECO–DESIGN FOR CIRCULARITY: Design products for disassembly and recyclability, using bio–based adhesives, modular designs, and clear material labeling to facilitate end–of–life recovery.
- ENERGY RECOVERY FROM RESIDUALS: Optimize energy recovery from wood waste that cannot be recycled, ensuring that biomass residues contribute to renewable energy production without compromising recycling streams.
- TRAINING AND AWARENESS: Increase industry and workforce knowledge of CE principles, benefits, and technical methods through education and collaboration.
- POLICY AND STANDARDS: Advocate for supportive regulations, standards, and economic incentives that encourage circular practices and infrastructure investment for wood products recycling and reuse.
- COLLABORATION ACROSS VALUE CHAIN: Foster cooperation between forestry, manufacturing, construction, and recycling sectors to close material loops and innovate circular supply chains.

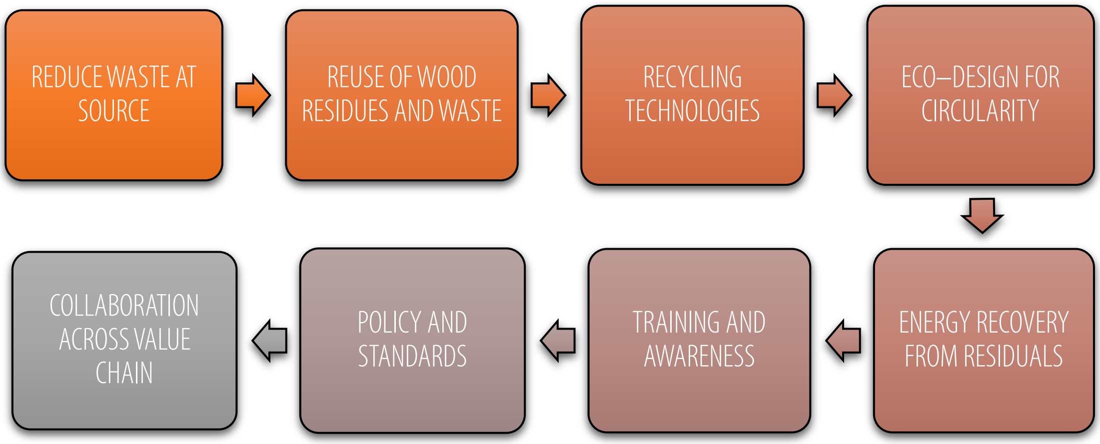

Figure 9. Implementing circular economy in wood–based products manufacturing

Collectively, these steps transition wood products manufacturing from a linear to a circular model, reducing environmental impacts, preserving resources, and creating economic value aligned with sustainability goals [7–19].

Key barriers include the supply chain fragmentation hinders tracing wood origins, complicating reuse logistics across borders. Contamination from paints, glues, or metals in recovered wood also reduces recyclability for high–value cascades. Higher collection and processing costs make virgin wood cheaper short–term, deterring investment without incentives. Market volatility in wood prices and lack of standardized quality specs for recycled material limit demand. Also, moisture damage and degradation in stored wood shorten viable reuse windows, requiring advanced sorting tech not yet scaled. Shortage of specialized facilities for deconstruction and upcycling persists in many regions. Therefore, measures to promote cascading use of wood products must include policy incentives, technical standards, and market mechanisms that prioritize material reuse over energy recovery. In this sense, the waste hierarchy enforcement classifies post–consumer wood reliably for reuse, with end–of–waste criteria easing recycling flows. Investments are needed in sorting, cleaning, and deconstruction facilities enable residue recovery, supported by wood flow analyses for optimized chains.

4. CASCADING USE OF WOOD PRODUCTS

Circular economy principles revolutionize wood–based products in construction by minimizing waste, enabling resource loops, and extending material lifecycles through strategies like cascading uses and design–for–disassembly [30–42]. Wood products align perfectly with circular economy tenets—designing out waste, prioritizing reuse over recycling, and maximizing value retention—reducing construction sector emissions by up to 45% compared to steel or concrete alternatives. Prefabricated systems like cross–laminated timber (CLT) cut onsite waste by 90%, while urban sawmills transform demolition wood into standardized beams for new builds [30–42].

Cascading use of wood products maximizes resource efficiency by sequentially applying biomass through multiple material stages before energy recovery. Cascading uses for wood products extend the material's lifecycle through sequential applications, prioritizing material reuse over energy recovery to maximize resource efficiency. Cascading use involves processing wood into products that serve multiple functions over time before final energy recovery, such as converting logs first into construction timber, then reusing scraps for furniture or panels, and finally burning residues for heat [30–42]. This approach boosts efficiency to 46% compared to 21% for single–use scenarios by reducing demand for virgin wood and preserving carbon storage.

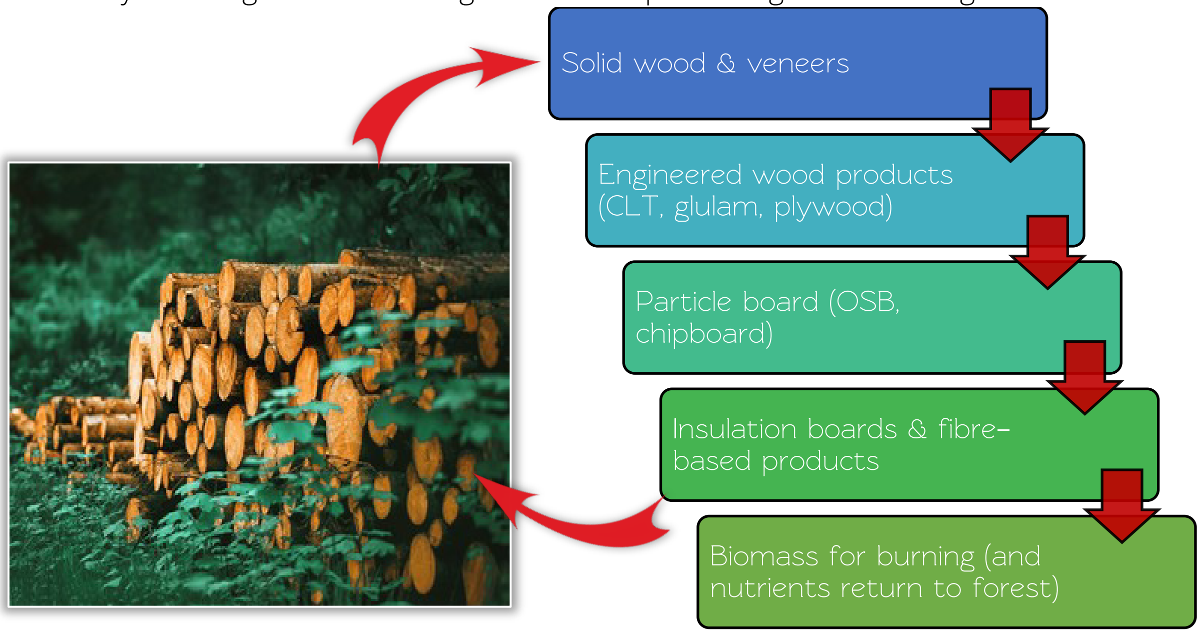

Figure 10. Cascading use of wood products

Cascading prioritizes high–value material uses—like sawn timber for construction—followed by secondary products such as particleboard from offcuts, and ends with bioenergy from residues. This extends biomass availability within systems, contrasting single–use disposal [30–42]. Some examples include:

- High–value structural uses: Roundwood becomes sawn lumber for buildings or cross–laminated timber (CLT) in construction.
- Medium–value products: Offcuts or demolition wood turns into particleboard, MDF panels, or furniture slats.
- Low–value applications: Final residues produce wood pellets, biochar, or fuel for energy, only after material exhaustion.

Cascading use of wood refers to the sequential, efficient utilization of wood biomass across multiple rounds of material applications before final energy recovery or disposal. This process maximizes biomass availability by incorporating residues and recyclates, quantified via cascade factors that rise with each reuse cycle. In fact, multiple material stages (single or multi) before energetic end–use, emphasizing resource efficiency. The cascading principle prioritizes wood uses through a strict hierarchy that favors material applications over energy recovery to maximize resource efficiency. Wood starts with high–value products like construction timber or furniture, then shifts to extending service life via maintenance. Next comes reuse of whole components, followed by recycling into lower–grade materials such as particleboard from offcuts. Energy recovery (bioenergy) and disposal rank last [30–42].

Core principles applied are the strategies follow Ellen MacArthur Foundation frameworks adapted for wood: reduce virgin inputs via engineered panels from residues, reuse structural elements through modular connectors, and recycle into particleboard or insulation [30–42]. Therefore, cascading prioritizes high–value uses.

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As with any resource, it is imperative that the raw materials are produced and used to ensure sustainability. One of the greatest attributes of wood is that it is a renewable resource. If sustainable forestry management and harvesting practices are followed, the wood resource will be available forever. Efficient, durable, and useful wood products produced from trees range from a minimally processed log at a log–home building site to a highly processed and highly engineered wood composite manufactured in a large production facility.

5. CONCLUSIONS

Engineered wood enables circular building systems with standardized connections for easy reuse, turning structures into "material banks." Innovations in bio–based adhesives and digital tracking enhance traceability from forest to end–of–life, aligning with EU policies on sustainable construction. For sustainable materials researchers, these approaches integrate well with valorization of agro–forestry residues into wood–based products for construction.

Wood–based products can significantly help the circular economy in manufacturing by providing renewable, low–carbon, and recyclable material solutions. Key contributions include:

- Carbon Storage and Climate Mitigation: Wood–based products store biogenic carbon during their lifecycle, reducing net greenhouse gas emissions compared to fossil–based materials.
- Renewable Resource Use: Wood comes from sustainably managed forests requiring much less energy to produce than steel or concrete. Its production relies on renewable biological inputs like sunlight and water.
- Efficient Material Cycles: Manufacturing processes can integrate wood residues and by–products, minimizing waste and enabling cascading use where wood is reused multiple times before disposal.
- Low Waste and Energy Demand: Wood products manufacturing generally generates minimal waste that can't be recycled or converted to energy, reducing environmental impacts and reliance on fossil fuels.
- Innovative Products and Applications: Advances in engineered wood products expand the scope of wood products in high–performance, durable applications, supporting material longevity and circular design.
- Supporting Sustainable Economy: The wood–based sector fosters rural development, creates skilled green jobs, and promotes circular business models through recycling and reuse industries.

By utilizing wood products in circular manufacturing, industries benefit from reduced raw material consumption, decreased emissions, efficient resource use, and alignment with sustainable development goals.

Innovative wood construction methods have been developed with economic pragmatism in mind, intuitively applying sustainability and circularity principles at the same time. New technologies incorporating a high degree of prefabrication are employed that speed construction processes, provide for precision sizing of modules and connections – thereby promoting the energy efficiency of completed buildings, greatly reducing waste and protecting prefabricated modules from the effects of weather. Wood use in construction is more circular and sustainable than the use of other common building materials. Wood has inherent advantages and provides multiple benefits because it is a natural material, can be fashioned into a diverse array of building components with minimal climate impact and can be incorporated into buildings. Although wood use in construction offers substantial sustainability and circularity benefits, additional innovation is needed. Currently, waste from building deconstruction is not being recovered effectively. Designing for building adaptability, disassembly and effective material recovery would improve the circularity of wood in the construction sector. The greatest opportunity for improved circularity of wood in existing buildings is in the RECOVERY, REUSE and/or RECYCLING of wood waste streams.

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