

Supplementary file S1

Type and number of the analysed documents (n=106):

Scientific research papers	41
Books and book chapters	9
Non-academic reports, strategies etc.	24
Company annual and sustainability reports	13
Webpages	11
Press releases and other communications	8

References for the documents:

4evergreen Alliance (2021) Home - 4evergreen. <https://4evergreenforum.eu/>. Accessed 2 February 2022

Anon (2018) NGO recommendations for a sustainable EU bioeconomy. https://www.fern.org/fileadmin/uploads/fern/Documents/NGO%20recommendations%20for%20a%20sustainable%20EU%20bioeconomy_0.pdf. Accessed 4 March 2022

Anon (2021) NGO public reaction On the Corporate Sustainability Reporting Directive (NFRD reform) proposal: most promising changes and caveats. <https://www.finance-watch.org/wp-content/uploads/2021/04/NGO-Corporate-Sustainability-Reporting-Directive-CSR-D-NFRD.pdf>. Accessed 4 March 2022

Boons F, Lüdeke-Freund F (2013) Business models for sustainable innovation: state-of-the-art and steps towards a research agenda. *J Clean Prod* 45: 9–19. <https://doi.org/10.1016/j.jclepro.2012.07.007>

Business Finland (2020) Wood-based solutions from Finland - the Finnish forest industry builds future growth and sustainable welfare. https://www.businessfinland.fi/498e31/globalassets/julkaisut/bf_wood_based_solutions_2021_ww.pdf Accessed 2 February 2022

Cai Z, Rudie AW, Stark NM, Sabo RC, Ralph SA (2013) New Products and Product Categories in the Global Forest Sector. In: Hansen E, Panwar R, Vlosky RP (eds) *The global forest sector: changes, practices, and prospects*. CRC, Boca Raton, pp 129–149

CEPI (2014) Resource efficiency in the Pulp and Paper Industry – Making more from our natural resources. Confederation of European Paper Industries, Brussels, Belgium

CEPI (2021) Organisation - How CEPI works. <https://www.cepi.org/about-cepi/organisation/> Accessed 16 December 2021

CEPI (2021) Sustainable product pledge - securing a true circular economy for Europe. Confederation of European Paper Industries, Brussels. https://www.cepi.org/wp-content/uploads/2021/12/Cepi_Sustainable-Product-Pledge_17122021.pdf. Accessed 13 January 2022

- CEPI (2021) Cepi views on the new EU Forest Strategy for 2030. CEPI, Brussels. <https://www.cepi.org/wp-content/uploads/2021/11/Cepi-views-on-the-EU-Forest-Strategy-2030.pdf>. Accessed 14 January 2022
- CEPI (2021) Cepi's response to the public consultation on EU Biodiversity policy initiatives. CEPI, Brussels. https://www.cepi.org/wp-content/uploads/2021/04/Biodiversity_restoration.14th-April-2021.pdf. Accessed 14 January 2022
- CLIC Innovation (2020) Strategic Research and Innovation agenda - Forest-Based Circular Bioeconomy Added value materials and chemicals from wood fibres. CLIC Innovation Ltd. <https://clicinnovation.fi/wp-content/uploads/2020/11/CLIC-Bioeconomy-SRIA.pdf>. Accessed 1 February 2022
- CLIC Innovation (2022) CLIC Innovation - who we are. <https://clicinnovation.fi/company/>. Accessed 3 February 2022
- Costanza R, d'Arge R, de Groot R, Farber S, Grasso M, Hannon B, Limburg K, Naeem S, O'Neill RV, Paruelo J, Raskin RG, Sutton P, van den Belt M (1997) The value of the world's ecosystem services and natural capital. *Nature* 387: 253–260. <https://doi.org/10.1038/387253a0>
- D'Amato D, Korhonen J (2021) Integrating the green economy, circular economy and bioeconomy in a strategic sustainability framework. *Ecol Econ* 188: 107143. <https://doi.org/10.1016/j.ecolecon.2021.107143>
- D'Amato D, Korhonen J, Toppinen A (2019) Circular, Green, and Bio Economy: How Do Companies in Land-Use Intensive Sectors Align with Sustainability Concepts? *Ecol Econ* 158: 116–133. <https://doi.org/10.1016/j.ecolecon.2018.12.026>
- D'Amato D, Veijonaho S, Toppinen A (2020) Towards sustainability? Forest-based circular bioeconomy business models in Finnish SMEs. *For Policy Econ* 110: 101848. <https://doi.org/10.1016/j.forpol.2018.12.004>
- Diesen M (2007) Papermaking science and technology. 1, Economics of the pulp and paper industry, 2nd edition. Paperi ja Puu, Helsinki
- Dietz T, Börner J, Förster JJ, Von Braun J (2018) Governance of the Bioeconomy: A Global Comparative Study of National Bioeconomy Strategies. *Sustainability* 10. <https://doi.org/10.3390/su10093190>
- Dockry MJ, Bengston DN, Westphal LM (2020) Drivers of change in U.S. forests and forestry over the next 20 years. U.S. Department of Agriculture, Forest Service, Northern Research Station, Madison, WI
- EC (2015) Towards an EU Research and Innovation policy agenda for nature-based solutions & re-naturing cities. Final Report of the Horizon2020 Expert Group on Nature-Based Solutions and Re-Naturing Cities. European Commission, Brussels
- EC (2018) A sustainable bioeconomy for Europe: Strengthening the connection between economy, society and the environment: updated bioeconomy strategy. European Commission DG Research and Innovation, Brussels
- EC (2019) Communication from the Commission The European Green Deal. European Commission, Brussels. <https://eur-lex.europa.eu/legal->

content/EN/TXT/?qid=1576150542719&uri=COM%3A2019%3A640%3AFIN. Accessed 9 August 2021

EC (2021) EU Biodiversity Strategy for 2030 - Bringing nature back into our lives. Publications Office of the European Union, Luxembourg

EC (2021) EU Taxonomy, Corporate Sustainability Reporting, Sustainability Preferences and Fiduciary Duties: Directing finance towards the European Green Deal. European Commission, Brussels. <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:52021DC0188>. Accessed 2 February 2022

EC (2021) New EU Forest Strategy for 2030. European Commission, Brussels

Enso-Gutzeit (1996) Enso-Gutzeit Annual report 1995

ExpandFibre (2020) ExpandFibre Ecosystem. <https://www.expandfibre.com/ecosystem>. Accessed 3 February 2022

ExpandFibre (2020) From Wood and Straw to Your Wardrobe. <https://www.expandfibre.com/>. Accessed 2 February 2022

FAO (2021) Aspirational Principles and Criteria for a Sustainable Bioeconomy. FAO, Rome

Farcy C, Martinez de Arano I, Rojas-Briales E, Adam L (2019) Forestry in the midst of global changes. CRC Press, Taylor & Francis Group, Boca Raton

Folke C, Biggs R, Norström AV, Reyers B, Rockström J (2016) Social-ecological resilience and biosphere-based sustainability science. *Ecol* 21: 41. <https://doi.org/10.5751/ES-08748-210341>

Geissdoerfer M, Savaget P, Bocken NMP, Hultink EJ (2017) The Circular Economy – A new sustainability paradigm? *J Clean Prod* 143: 757–768. <https://doi.org/10.1016/j.jclepro.2016.12.048>

Gonzalez-Porrás L, Heikkinen A, Kujala J (2021) Understanding stakeholder influence: lessons from a controversial megaproject. *Int J Hum Resour Dev Manag* 21: 191–213. <https://doi.org/10.1504/IJHRDM.2021.116923>

Greenpeace (2019) Countdown to extinction: what will it take to get companies act? Greenpeace International, Amsterdam. https://www.greenpeace.org/static/planet4-international-stateless/2019/09/98db6c73-gp_cte_report_lowres.pdf. Accessed 4 March 2022

Guerrero JE, Hansen E (2021) Company-level cross-sector collaborations in transition to the bioeconomy: A multi-case study. *For Policy Econ* 123: 102355. <https://doi.org/10.1016/j.forpol.2020.102355>

Hansen E, Juslin H (2018) Strategic Marketing in the Global Forest Industries, 3rd edition. Oregon State University

Hetemäki L (2014) Future of the European forest-based sector: structural changes towards bioeconomy. European Forest Institute, Joensuu

- Hetemäki L, Hänninen R, Moiseyev A (2014) Markets and Market Forces for Pulp and Paper Products. In: Hansen E, Panwar R, Vlosky RP (eds) *The global forest sector: changes, practices, and prospects*. CRC, Boca Raton, pp 99–127
- Hetemäki L, Hanewinkel M, Muys B, Ollikainen M, Palahí M, Trasobares A (2017) Leading the way to a European circular bioeconomy strategy. European Forest Institute, Joensuu
- Hurmekoski E, Jonsson R, Korhonen J, Jänis J, Mäkinen M, Leskinen P, Hetemäki L (2018) Diversification of the forest industries: role of new wood-based products. *Can J For Res* 48: 1417–1432. <https://doi.org/10.1139/cjfr-2018-0116>
- Jarre M, Petit-Boix A, Priefer C, Meyer R, Leipold S (2020) Transforming the bio-based sector towards a circular economy - What can we learn from wood cascading? *For Policy Econ* 110: 101872. <https://doi.org/10.1016/j.forpol.2019.01.017>
- Jonsson R, Rinaldi F, Pilli R, Fiorese G, Hurmekoski E, Cazzaniga N, Robert N, Camia A (2021) Boosting the EU forest-based bioeconomy: Market, climate, and employment impacts. *Technol Forecast Soc Change* 163: 120478. <https://doi.org/10.1016/j.techfore.2020.120478>
- Järvinen J, Ojala J, Melander A, Lamberg J-A (2012) The Evolution of Pulp and Paper Industries in Finland, Sweden, and Norway, 1800–2005. In: Lamberg J-A, Ojala J, Peltoniemi M, Särkkä T (eds) *The Evolution of Global Paper Industry 1800–2050: A Comparative Analysis*. Springer Netherlands, Dordrecht, pp 19–47
- Karvonen J, Halder P, Kangas J, Leskinen P (2017) Indicators and tools for assessing sustainability impacts of the forest bioeconomy. *For Ecosyst* 4: 103–122. <https://doi.org/10.1186/s40663-017-0089-8>
- Kellokumpu V (2021) The bioeconomy, carbon sinks, and depoliticization in Finnish forest politics. *Environment and planning: E Nature and space* 1–20. <https://doi.org/10.1177/25148486211049322>
- Korhonen J, Honkasalo A, Seppälä J (2018) Circular Economy: The Concept and its Limitations. *Ecol Econ* 143: 37–46. <https://doi.org/10.1016/j.ecolecon.2017.06.041>
- Korhonen J, Hurmekoski E, Hansen E, Toppinen A (2018) Firm-level competitiveness in the forest industries: review and research implications in the context of bioeconomy strategies. *Can J For Res* 48: 141–152. <https://doi.org/10.1139/cjfr-2017-0219>
- Korhonen J, Miettinen J, Kylkilahti E, Tuppurä A, Autio M, Lähtinen K, Pätäri S, Pekkanen T-L, Luhas J, Mikkilä M, Linnanen L, Ollikainen M, Toppinen A (2021) Development of a forest-based bioeconomy in Finland: Insights on three value networks through expert views. *J Clean Prod* 299: 126867. <https://doi.org/10.1016/j.jclepro.2021.126867>
- Kröger M, Raitio K (2017) Finnish forest policy in the era of bioeconomy: A pathway to sustainability? *For Policy Econ* 77: 6–15. <https://doi.org/10.1016/j.forpol.2016.12.003>
- Kymmene (1993) *Kymmene vuosikertomus 1992* [Kymmene annual review 1992]
- Köhler J, Geels FW, Kern F, Markard J, Onsongo E, Wieczorek A, Alkemade F, Avelino F, Bergek A, Boons F, Fünfschilling L, Hess D, Holtz G, Hyysalo S, Jenkins K, Kivimaa P, Martiskainen M, McMeekin A, Mühlemeier MS, Nykvist B, Pel B, Raven R, Rohrer H, Sandén B, Schot J, Sovacool B, Turnheim B,

Welch D, Wells P (2019) An agenda for sustainability transitions research: State of the art and future directions. *Environ Innov Soc* 31: 1–32. <https://doi.org/10.1016/j.eist.2019.01.004>

Laakkonen A, Hujala T, Pykäläinen J (2022) Defining the systemic development of the Finnish pulp and paper industry's business network. *Silva Fenn* 56, article id 10599. <https://doi.org/10.14214/sf.10599>

Lamberg J-A, Laurila J, Nokelainen T (2017) Institutional Path Dependence in Competitive Dynamics: The Case of Paper Industries in Finland and the USA: Institutional Path Dependence in Competitive Dynamics. *Manage Decis Econ* 38: 971–991. <https://doi.org/10.1002/mde.2839>

Lovrić N, Lovrić M, Mavsar R (2020) Factors behind development of innovations in European forest-based bioeconomy. *For Policy Econ* 111: 102079. <https://doi.org/10.1016/j.forpol.2019.102079>

Ludvig A, Sarkki S, Weiss G, Živojinović I (2021) Policy impacts on social innovation in forestry and back: Institutional change as a driver and outcome. *For Policy Econ* 122: 102335. <https://doi.org/10.1016/j.forpol.2020.102335>

Luhás J, Mikkilä M, Uusitalo V, Linnanen L (2019) Product Diversification in Sustainability Transition: The Forest-Based Bioeconomy in Finland. *Sustainability* 11: 3293. <https://doi.org/10.3390/su11123293>

Markard J, Raven R, Truffer B (2012) Sustainability transitions: An emerging field of research and its prospects. *Res Policy* 41: 955–967. <https://doi.org/10.1016/j.respol.2012.02.013>

Markard J, Geels FW, Raven R (2020) Challenges in the acceleration of sustainability transitions. *Environ Res Lett* 15: 081001. <https://doi.org/10.1088/1748-9326/ab9468>

Martinez de Arano I, Maltoni S, Picardo A, Mutke S (2021) Non-wood forest products for people, nature and the green economy. Recommendations for policy priorities in Europe. A white paper based on lessons learned from around the Mediterranean. The European Forest Institute and the Food and Agriculture Organization of the United Nations, Barcelona

Matagne J, Fastrez P (2019) Communicating to Support the Comprehension of Forest-Related Issues by Nonexpert Audiences. In: Farcy C, Martinez de Arano I, Rojas-Briales E, Adam L (eds) *Forestry in the midst of global changes*. CRC Press, Taylor & Francis Group, Boca Raton, pp 167–182

Mery G, Katila P, Galloway G, Alfaro RI, Kanninen M, Lobovikov M, Varjo J (2010) *Forests and Society – Responding to Global Drivers of Change*. International Union of Forest Research Organizations (IUFRO), Vienna

Metsä Group (2015) *Metsä Group Sustainability Report 2014*

Metsä Group (2021) *Metsä Group intensifies its research and development activity*. <https://www.metsagroup.com/en/media/all-news/Pages/News.aspx?EncryptedId=BA9027D3DF9574C7&Title=MetsaGroupintensifiesitsresearchanddevelopmentactivity>. Accessed 6 July 2021

Metsä Group (2022) *Metsä Group Annual Review 2021*

Metsä Group (2022) *Metsä Group Sustainability Report 2021*

- Metsä Spring (2018) Metsä Spring An Innovation Company. <https://metsaspring.com/>. Accessed 6 July 2021
- Metsä Spring (2018) Textile fibre from paper-grade pulp. <https://metsaspring.com/project/textile-fibre-from-paper-grade-pulp/>. Accessed 3 February 2022
- Metsä Spring (2018) Wood-based 3D packages. <https://metsaspring.com/project/wood-based-3d-packages/>. Accessed 4 February 2022
- Metsäliitto-Yhtymä (1993) Metsäliitto-Yhtymä Vuosikertomus 1992 [Metsäliitto-Yhtymä Annual report 1992]
- Metsäliitto Group (2010) Metsäliitto Group Annual Report 2009. Metsäliitto-konserni
- Mustalahti I (2018) The responsive bioeconomy: The need for inclusion of citizens and environmental capability in the forest based bioeconomy. *J Clean Prod* 172: 3781–3790. <https://doi.org/10.1016/j.jclepro.2017.06.132>
- Myllylä S, Takala T (2011) Leaking legitimacies: the Finnish forest sector's entanglement in the land conflicts of Atlantic coastal Brazil. *Soc Responsib J* 7: 42–60. <https://doi.org/10.1108/174711111111114530>
- Nelson GC, Bennett E, Berhe AA, Cassman K, DeFries R, Dietz T, Dobermann A, Dobson A, Janetos A, Levy M, Marco D, Nakićenovic N, O'Neill B, Norgaard R, Petschel-Held G, Ojima D, Pingali P, Watson R, Zurek M (2006) Anthropogenic Drivers of Ecosystem Change: an Overview. *Ecol* 11: 29. <https://doi.org/10.5751/ES-01826-110229>
- Näyhä A (2020) Finnish forest-based companies in transition to the circular bioeconomy - drivers, organizational resources and innovations. *For Policy Econ* 110: 101936. <https://doi.org/10.1016/j.forpol.2019.05.022>
- Oksanen J, Rilla N, Pesonen P, Ahola E (2010) Löystymätön ruuvi: merkittäviä kotimaisia metsä- ja metalliteollisuuden innovaatioita 60 vuoden ajalta [Loose-free screw: Significant domestic forest and metal industry innovations dating back 60 years]. TEKES, Helsinki
- Pesonen P (2006) Innovaatiojohtaminen ja sen vaikutuksia metsäteollisuudessa [Innovation management and its effect in forest industry]. VTT Publications 622, VTT, Espoo
- Prime Minister's Office (2008) Working group on the improvement of operating conditions of Finnish forest industries and the forest sector. Prime Minister's Office Publications 21/2008, Helsinki.
- Rametsteiner E, Weiss G (2006) Innovation and innovation policy in forestry: Linking innovation process with systems models. *For Policy Econ* 8: 691–703. <https://doi.org/10.1016/j.forpol.2005.06.009>
- Ranacher L, Wallin I, Valsta L, Kleinschmit D (2020) Social dimensions of a forest-based bioeconomy: A summary and synthesis. *Ambio* 49: 1851–1859. <https://doi.org/10.1007/s13280-020-01401-0>
- Rusko R (2011) Exploring the concept of co-competition: A typology for the strategic moves of the Finnish forest industry. *Ind Mark Manag* 40: 311–320. <https://doi.org/10.1016/j.indmarman.2010.10.002>

- Secco L, Pisani E, Masiero M, Pettenella D (2019) Social and technological innovations in forestry. In: Farcy C, Martinez de Arano I, Rojas-Briales E, Adam L (eds) *Forestry in the midst of global changes*. CRC Press, Taylor & Francis Group, Boca Raton, pp 317–345
- Stora (1994) *Stora Annual report 1993*
- Stora Enso (2016) *Stora Enso Sustainability Report 2015*
- Stora Enso (2022) *Stora Enso Annual Report 2021*
- Temmes A, Peck P (2020) Do forest biorefineries fit with working principles of a circular bioeconomy? A case of Finnish and Swedish initiatives. *For Policy Econ* 110: 101896.
<https://doi.org/10.1016/j.forpol.2019.03.013>
- The Finnish Forest Industries Federation (2020) *Vastuullisia valintoja kohti 2025 – Metsäteollisuuden vastuullisuussitoumusten väliraportti [Responsible Choices towards 2025 – Interim report on sustainability commitments in the forest industry]*. The Finnish Forest Industries Federation.
https://global-uploads.webflow.com/5f44f62ce4d302179b465b3a/5fce1d1a39327f2786663602_MT-esite_Vastuullisuussitoumus_2020_final.pdf. Accessed 11 January 2022
- The Finnish Forest Industries Federation (2020) *Vihreä ja vireä talous - metsäteollisuuden ilmastotiekartta 2035 [Green and active economy - climate road map of forestry industry 2035]*. The Finnish Forest Industries Federation. https://global-uploads.webflow.com/5f44f62ce4d302179b465b3a/5fae9c3de86a240e06b76565_Metsa_Esite_Email.pdf. Accessed 13 January 2022
- The Finnish Forest Industries Federation (2021) *About us*. <https://www.metsateollisuus.fi/en/about-us>
Accessed 16 December 2021
- The Finnish Forest Industries Federation (2022) *Menestystarinoita metsästä - innovaatioita kestävämpään tulevaisuuteen [Success stories from the forest - innovations for a more sustainable future]*. The Finnish Forest Industries Federation. https://global-uploads.webflow.com/5f44f62ce4d302179b465b3a/61dd91ec6d60d21818c5e994_Metry_TKI-esite_2021_low.pdf. Accessed 13 January 2022
- Toivanen T (2021) A Player Bigger Than Its Size: Finnish Bioeconomy and Forest Policy in the Era of Global Climate Politics. In: Backhouse M, Lehmann R, Lorenzen K, Lühmann M, Puder J, Rodríguez F, Tittor A (eds) *Bioeconomy and Global Inequalities: Socio-Ecological Perspectives on Biomass Sourcing and Production*. Springer International Publishing, Cham, pp 131–149
- TreeToTextile (2021) *TreeToTextile*. <https://treetotextile.com/>. Accessed 9 May 2022
- United Nations (2015) *Transforming our World: The 2030 Agenda for Sustainable Development*. United Nations Department of Economic and Social Affairs
- University of Helsinki (2021) *The University of Helsinki and Metsä Group join in a partnership to create solutions for the sustainable utilisation of renewable natural resources*.
<https://www.helsinki.fi/en/news/climate-change-and-biodiversity/university-helsinki-and-metsa-group-join-partnership-create-solutions-sustainable-utilisation-renewable-natural-resources>. Accessed 3 February 2022

- UPM Biochemicals (2021) Biorefinery.
https://www.upmbiochemicals.com/biorefinery/?_gl=1*lle4k7*_ga*MTI3MjA5OTc0LjE2MjAwNDQ5Njg.*_ga_HKS85BN03K*MTYyNTczNTA0OS4xMi4xLjE2MjU3MzUyNDUuMA.. Accessed 8 July 2021
- UPM (2010) UPM Annual Report 2009
- UPM (2015) UPM Year of progress Annual Report 2014
- UPM (2019) Press release: UPM is building a new ecosystem for wood-based biomedical solutions together with partners. <https://www.upm.com/about-us/for-media/releases/2019/02/upm-is-building-a-new-ecosystem-for-wood-based-biomedical-solutions-together-with-partners/>. Accessed 8 July 2022
- UPM (2022) UPM Annual Report 2021
- Valtioneuvosto (2022) Suomen biotalousstrategia: Kestävästi kohti korkeampaa arvonlisää [The Finnish Bioeconomy Strategy: Sustainably towards higher value added]. Publications of the Finnish Government 2022:3, Finnish Government, Helsinki.
- Viitala E-J, Leppänen J (2014) Yhteismetsien verotusaseman ja sääntelyn kehitys: lainsäädännön muutokset ja niiden ohjausvaikutukset [Development of taxation status and regulation of jointly owned forests: Changes in legislation and their governance effects]. *Metsätieteen aikakauskirja* article id 6651. <https://doi.org/10.14214/ma.6651>
- Watanabe C, Naveed N, Naveed K, Pekka Neittaanmäki (2017) Transformation of the Forest-based Bioeconomy by Embracing Digital Solutions. *J Technol Manag Grow Economies* 8: 191–214. <https://doi.org/10.15415/jtmge.2017.82005>
- Weiss G, Lawrence A, Hujala T, Lidestav G, Nichiforel L, Nybakk E, Quiroga S, Sarvašová Z, Suarez C, Živojinović I (2019) Forest ownership changes in Europe: State of knowledge and conceptual foundations. *For Policy Econ* 99: 9–20. <https://doi.org/10.1016/j.forpol.2018.03.003>
- Weiss G, Ludvig A, Živojinović I (2020) Four decades of innovation research in forestry and the forest-based industries – A systematic literature review. *For Policy Econ* 120: 102288. <https://doi.org/10.1016/j.forpol.2020.102288>
- Weiss G, Hansen E, Ludvig A, Nybakk E, Toppinen A (2021) Innovation governance in the forest sector: Reviewing concepts, trends and gaps. *For Policy Econ* 130: 102506. <https://doi.org/10.1016/j.forpol.2021.102506>
- Winkel G (ed) (2017) *Towards a sustainable European forest-based bioeconomy: assessment and the way forward*. European Forest Institute, Joensuu