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FOR/Maine

**Global Market Analysis and Benchmarking Study
Phase 2: Regional Descriptive Report**

Final Report

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1. INTRODUCTION

This report compiles country-specific information and provides a comparison between the countries. The detailed information by country are provided in an annexed report.

All currencies are converted into US dollars in this summary.

The information from this report feeds into the accompanied product ranking and SWOT analysis report.



2. RAW MATERIAL AVAILABILITY

Europe

Finland has potential to increase the annual harvest by 9 million m³, which equals 11% additional harvest potential from the total annual allowable cut (AAC) (Figure 2.1). The relatively low share of additional harvest potential indicates that the forest resources are already effectively utilized in Finland. Consequently, regional differences in harvesting pressure and distance to any additional volumes increase rapidly thus limiting the affordable volume available. Finland has steadily increased its harvests during the last five years closing in on the AAC. In Finland, the raw material availability is a significant limiting factor and will continue to be so with the emergence of new investments to large-scale biorefineries.

Theoretically, **Germany** has potential to increase annual harvests by some 7 million m³. There is uncertainty with regards to the harvest potential as Germany does not record energy wood consumption. A mean estimate of 23.5 million m³ was used in estimating the theoretical additional harvest potential. Germany's harvest levels have kept steady throughout last ten years. Public opinion is against increasing harvests, and Germany has made efforts to promote non-timber uses of forests. In the longer term, Germany's forest management policy aims to reduce monoculture spruce forests and replace them with more resilient mixed-specie forests. This might decrease the availability of conifer assortments.

At the moment, approximately just 42% of the AAC is utilized in the North-West of **Russia**. Thus, there is potential to increase annual harvests by some 70 million m³. However, most of these forest resources are far from processing facilities and inaccessible due to lack of road infrastructure. The harvests have increased moderately during the previous years.

Canada

Ontario has potential to increase the annual harvest by 16 million m³, which equals over 50% of the total AAC. The AAC level was decreased in Ontario during the last decade, but the consumption of roundwood has declined even faster with the shrinking forest industry and consequently the wood availability is relatively high.

United States

Georgia is currently a net importer of roundwood and the opportunities to expand roundwood production appear to be quite limited. More investments establishing greenfield timberland would be required to increase the potential. The relative share of potential to increase harvests is only 18%. The harvest level decreased during the financial crisis in 2008, but it has slowly recovered since. Georgia still has not reached the harvesting level it had in 2007.

The additional harvest potential in **Maine** is 9.5 million m³, of which 5.0 million m³ is pulpwood, and sawlogs 3.5 million m³ and rest is energy wood. The absolute additional harvest potential is about the same as in Finland, however relatively the forest resource is significantly more underutilized with the potential to increase harvests by 46%. The vast majority of wood in the state is mixed dense hardwood and spruce-fir, with hardwoods accounting for nearly half of all volume. Reported harvest levels of cedar, white and red pine, spruce-fir and other softwoods have all experienced a decline in recent years. Harvest levels have declined mostly due to the downsizing of the pulp and paper industry, which has led to the availability of softwood pulpwood to become strong. Potential for harvesting spruce will also increase in the near future as growth is expected to increase. This is due to a bulge in the age distribution at 21-40 years, which has been caused by large natural losses occurring in the 1970s and 1980s.

Harvest levels have decreased in **Minnesota** since 2005 due to downsizing in pulp and paper sector. There is biological potential to increase current harvesting levels by 6 million m³ or relatively by 48% compared to net growth. The majority of the increased potential is in private forests. However, the biological potential is limited by technical and economic restrictions. For example, protection areas, willingness to sell, forest accessibility, distance to mill and stand



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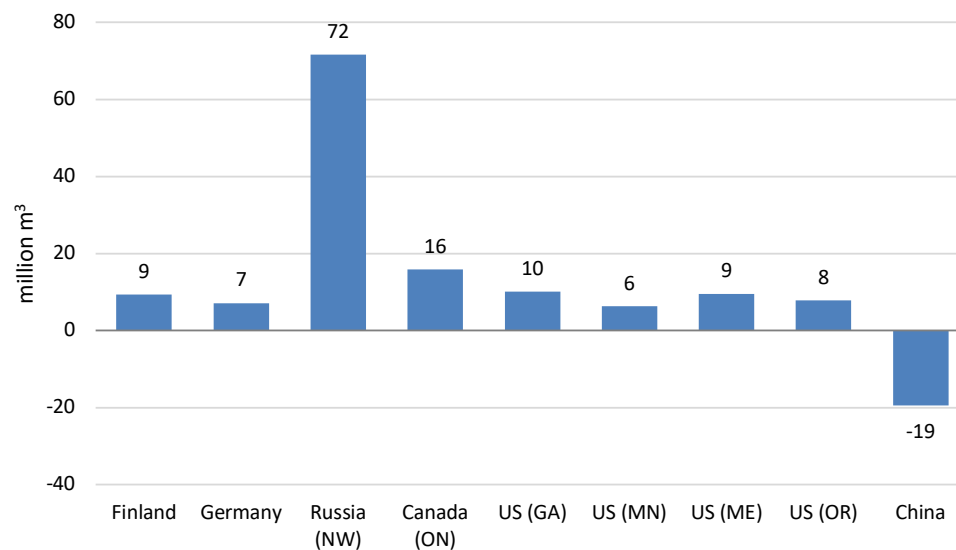
species composition can limit harvest levels. A realistic harvest level increase in short-term could be 2-3.5 million m³. Collection of wood residues could be increased significantly.

Log supply situation in **Oregon** is competitive, partly because of log exports to China. Harvest levels are already in high level in private forests, but in federal forests the harvest levels are low. In federal forests, the environmental goals have the most weight in forest management, which makes overall increase of harvests unlikely. The low harvest levels increased since the financial crisis in 2008 and have steadied during the last five years.

China

China has large differences in harvest potential between regions. In regions where the forest industry is concentrated there is a chronic shortage of roundwood and China is relying increasingly on imports of roundwood. Based on the estimated AAC from planted forests, which are the main source of wood for the Chinese forest industry, the additional harvest potential is negative.

Figure 2.1 Theoretical potential to increase harvests

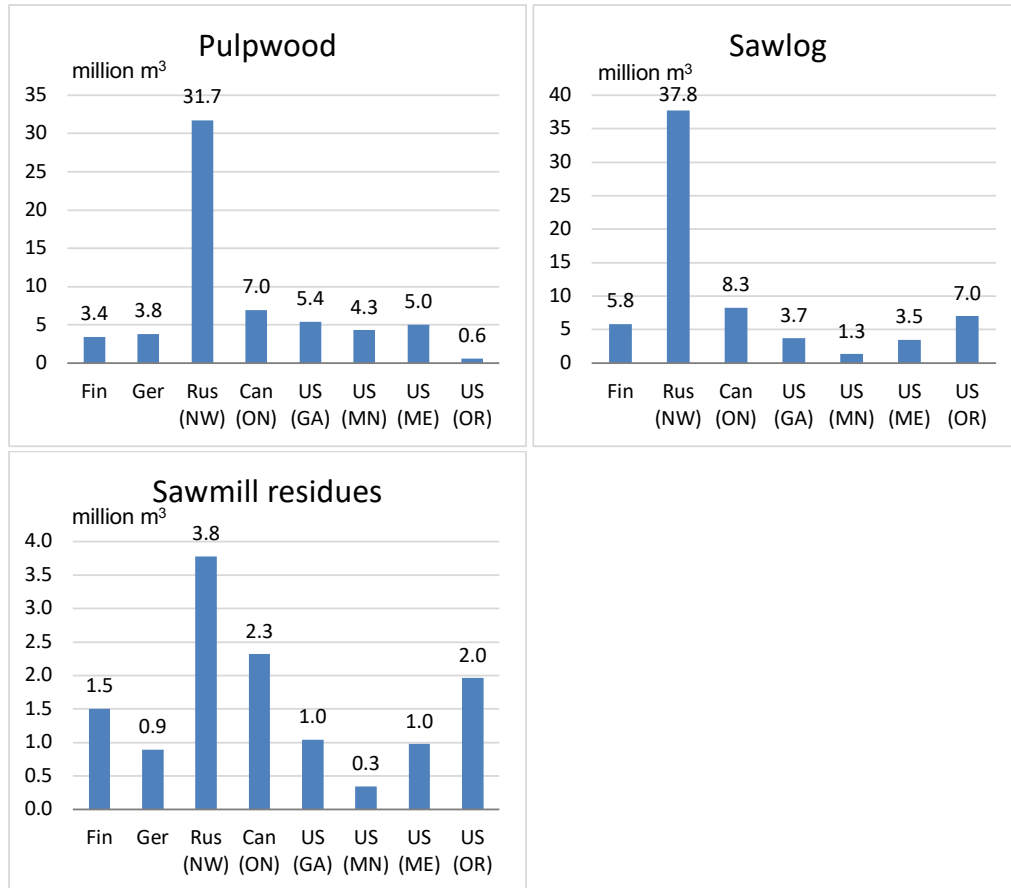


Note: volumes are solid under bark (sub).



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Figure 2.2 Wood availability by product, underbark



Note: sawmill residues consist of wood chips from sawmilling.



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2.1 Forest ownership

Europe

The forest ownership is fragmented with small private forest owners in **Finland**, which restricts industrial scale wood sourcing. Over 50% of the forests are owned by individuals and their forests are specifically those located in the southern parts of Finland (Figure 2.3). Over one third of the forests are owned by the government with large portions of the forests located in the northern parts of Finland.

Half of the **German** forests are privately-owned, and half of the private forests are part of small, 0-20 hectares properties. Fragmentation of these forests and the rising share of forest owners who do not manage their forests are challenges for the wood procurement. However, potential to increase harvests in small private forest properties exists, if the forest owners become willing to sell the wood.

In **Russia**, forests are state property, but legal bodies and citizens can be granted a right to lease forest plots or in some exceptional cases use them free of charge. Forest lease for timber harvesting, hunting, or agriculture is granted through auctions and requires a forest lease agreement.

Canada

In **Ontario Canada** clear majority of the forests are owned by the Crown, i.e. publicly-owned. The public forest management units identify the wood supply opportunities for industry and market the available wood supplies. Wood supplies are subject to approved forest management plans and are adjusted according to the wood supply contracts with mills.

United States

Georgia has the most commercial, privately owned timberland of all the US states. The forests are under private family ownership. The rapidly ageing population of private landowners will likely see a transfer of ownership in the next 10 to 15 years.

Approximately 49% of timberlands in **Minnesota** are privately owned – the majority by private individuals. 51% are public, the state being the largest public owner followed county and federal ownership. The state is an important wood seller, selling stable timber permits from year to year based on the forest authority's long-term forest management goals, while majority of the individual owners are smallholders that own less than 9 acres (3.6 hectares) of timberland.

The majority of **Maine** forests are owned by corporations, with private family ownership accounting for just under a third. Corporate and large private owners contribute to harvests more than smaller owners, compared to the size of their holdings. Corporate owners have a smaller standing timber volume in proportion to acreage than other private owners and public lands.

Private forests (34% of forestland) are the most important source of timber in **Oregon** and the timber production capacity is quite fully utilized. Large proportion of federal ownership can be seen as a hindering factor for harvest increases, since timber production is not an important goal for the federal forest management in Oregon.

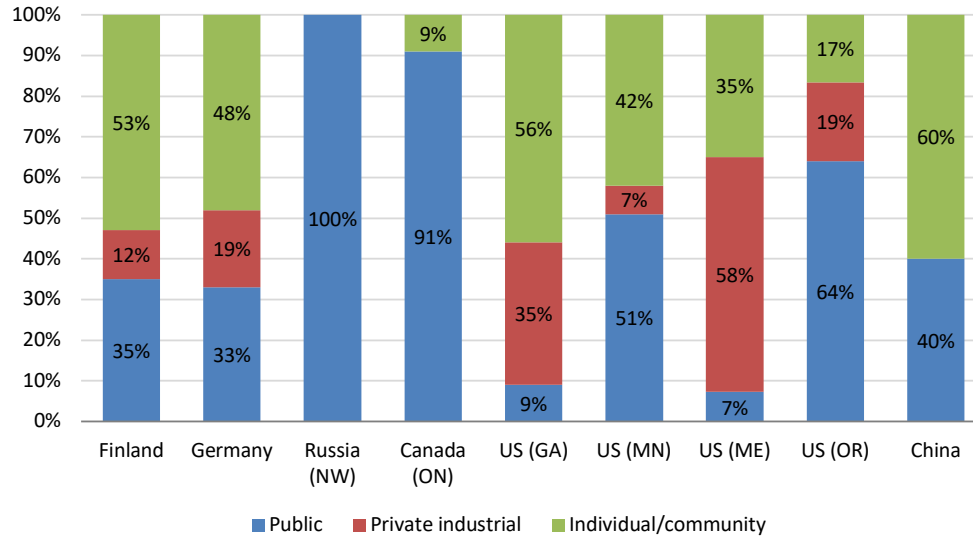
China

In **China** the forest ownership is divided between public and collectively-owned forestland, respectively 40% and 60%. Land tenure rights of collectively-owned forests can be also allocated to individual farmers. Often large companies or government run forestry programmes lease the forestland from farmers and collectives for nominal prices in exchange for their labor.



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Figure 2.3 Forest ownership





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3. RAW MATERIAL COST

The roundwood costs typically correlate with the harvest levels. Some exceptions are evident, for example Finland has increased its harvests near to the AAC without apparent increase in wood prices. However, this has caused price shocks as is currently evident in the early 2018 prices. Prices have decreased in both Maine and Ontario simultaneously with the downsizing of production capacity.

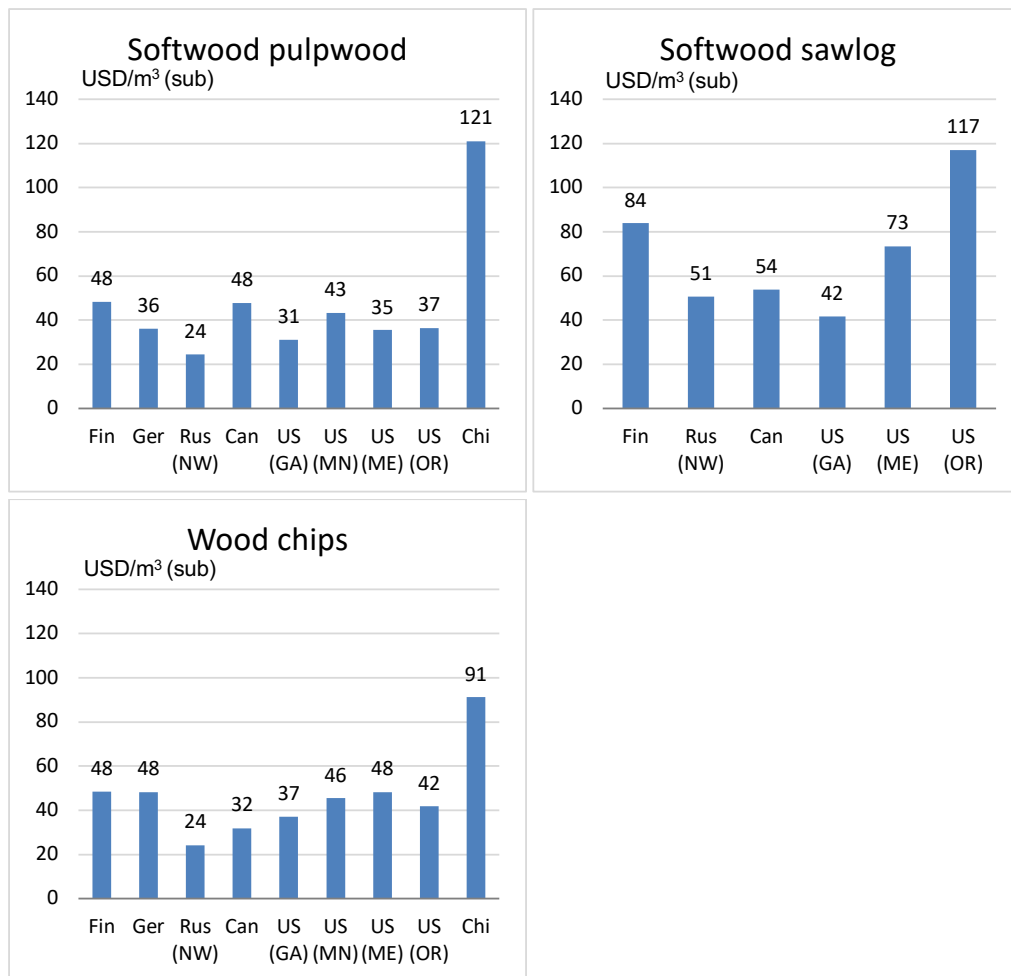
Coniferous pulpwood costs are higher in the selected North American countries than in the selected European countries. The delivered European pulpwood prices are typically below 40 USD/m³, and in Russia even below 30 USD/m³. The North American pulpwood prices range from 35 to 48 USD/m³, where the highest prices are in the Eastern Canada and the lowest price in US Maine. The Eastern Canada price consist of wood prices in Ontario and Quebec. For Chinese pulpwood, eucalyptus roundwood prices were used in the comparison, because it is the dominant species for pulp production in China. The eucalyptus price is a clear outlier among the pulpwood prices and exhibits the severe shortage of wood raw material in the Chinese market.

Regarding the coniferous sawlogs, the lowest delivered prices are in Russia and Canada on a level around 50 USD/m³. Oregon, Finland and Maine have the highest delivered sawlog prices, 117, 84 and 73 USD/m³, respectively. However, in United States the sawlog reference price is for more valuable coniferous species, i.e. Douglas fir in Oregon and spruce and fir in Maine.

The compared wood chip prices are for good quality wood chips suitable for pulping processes. The delivered wood chip prices range from 24 to 48 USD/m³ (Figure 3.1), with the exception of China with a remarkably high price of 91 USD/m³. However, the Chinese price is import price. The lowest wood chip prices are in Russia and Canada at 24 and 32 USD/m³, respectively. Apart from China, the highest wood chip prices are in Germany, Finland and Maine at 48 USD/m³.



Figure 3.1 Delivered pulpwood, sawlog and wood chip prices by countries, 2017



Note: wood chips include the price of wood chips suitable for pulping processes, such as those by-produced in sawmilling

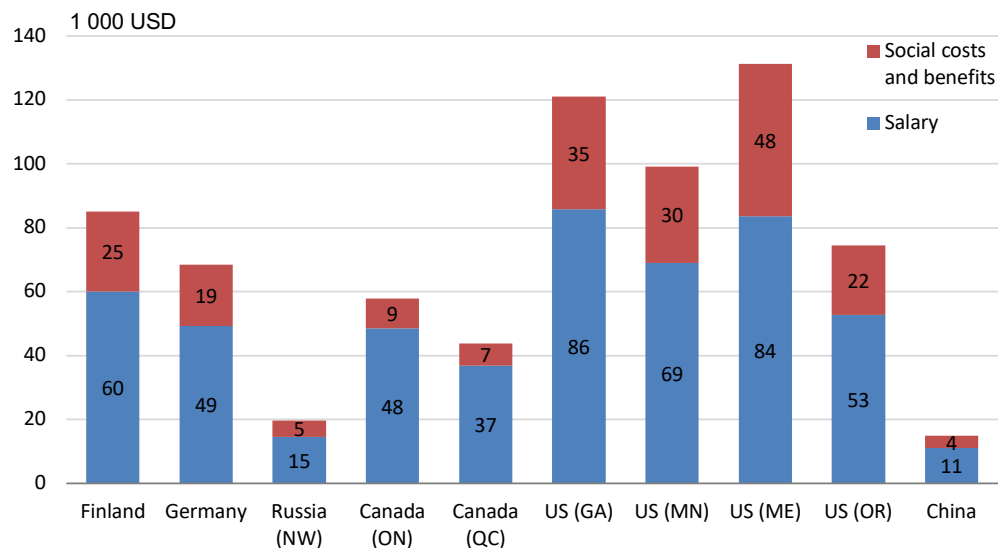


4. LABOR COST

The pulp and paper industry labor costs are the highest in Maine in comparison to the other regions and countries (Figure 4.1). Ontario in Canada has lower labor costs than in North America and Western Europe. Some of Canada's lower labor cost can be attributed to the currently weak Canadian dollar. China and Russia have the lowest labor costs. The total labor cost in China is one-tenth of the cost in Maine. However, the salaries in China have increased rapidly during the last decade and are expected to continue increasing.

Maine has also significant social costs in the employee costs, nearly 37% of the total cost. The lowest social costs are in Canada, with only 16% of the labor cost. Most other regions have social costs ranging from 25 to 30%.

Figure 4.1 Pulp and paper manufacturing industry annual labor cost

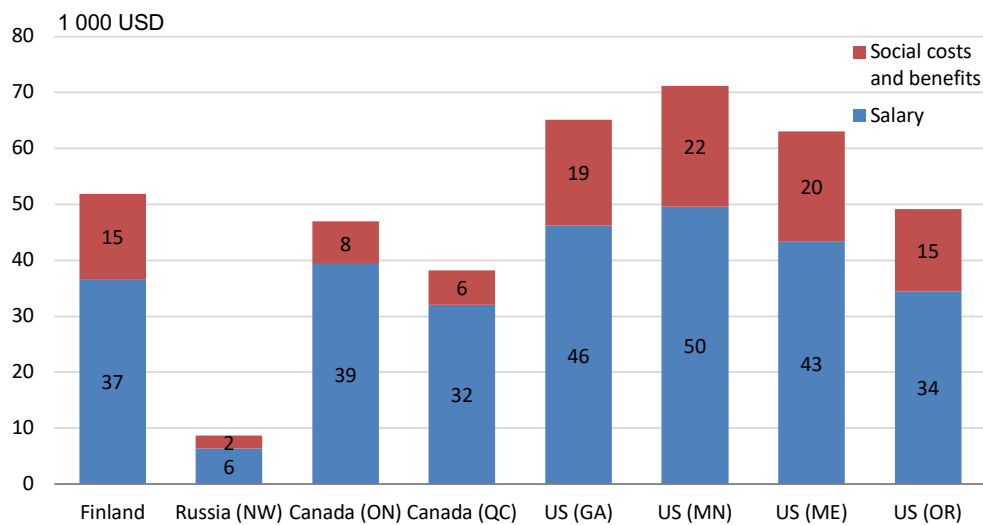


Minnesota has the highest labor cost in the wood working industry paying over 70 000 USD/employee annually (Figure 4.2). Only Russia has lower labor cost than in Ontario Canada. Maine has the second highest labor cost with 60 000 USD/employee annually.



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Figure 4.2 Wood working industry total salary



Note: wood working industries includes sawmills and wood preservation, veneer, plywood and engineered wood product manufacturing, other wood product manufacturing (e.g. fiberboards and particleboards).

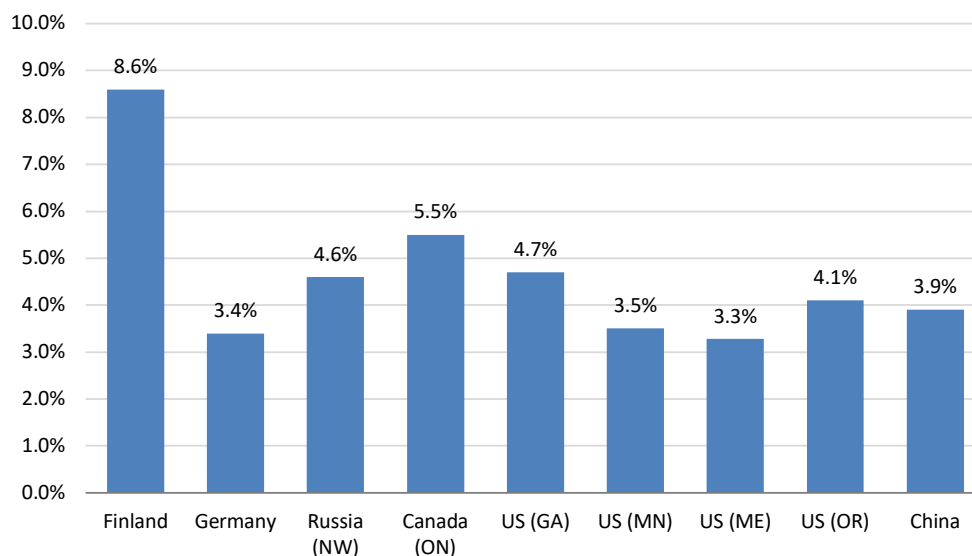


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5. LABOR AVAILABILITY AND SKILLS

Finland has the highest unemployment rate (8.6%) while Maine has the lowest (3.3%) (Figure 5.1). Ontario Canada has the second highest unemployment rate of 5.5%. The unemployment peaked in Ontario during 2004 to 2006 amidst the downfall of the pulp and paper industry. Since then the unemployment rate has decreased steadily as new job opportunities have been developed. In Maine the unemployment rate is higher in the Northern parts than in the Southern parts, respectively 4.2% and 3.0%. Northern Maine is considered to include the counties of Aroostook, Piscataquis, Somerset, Penobscot and Washington.

Figure 5.1 Unemployment rate



Historically, education level has not been a significant limiting factor in the forest industry. However, the skill sets required in the industry are increasing with increased level of technology and automation. Particularly the new biorefinery mills which can produce biochemicals, bio-composites, and biofuels require wider range of higher level expertise.

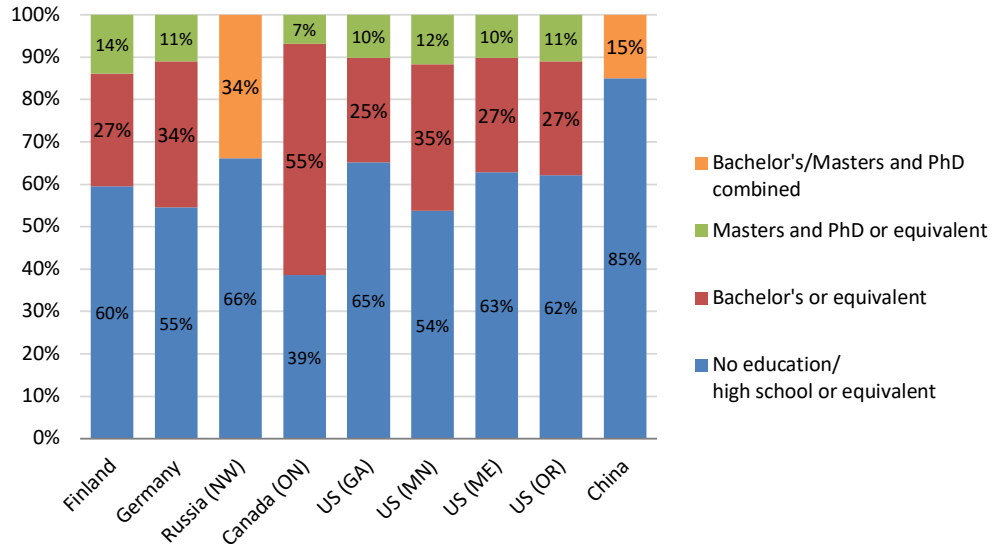
Nearly all selected North American and European regions or countries have about one-third of the population with University degree, with the exception of Finland where the share is only 14% (Figure 5.2). In Germany, the education level is more focused on secondary level education, i.e. University of Applied Sciences which can be loosely defined as similar to college. Germany has only 14% of people over the age 25 with no or low education.

The education levels are not fully comparable between the countries and regions and should be considered with caution.



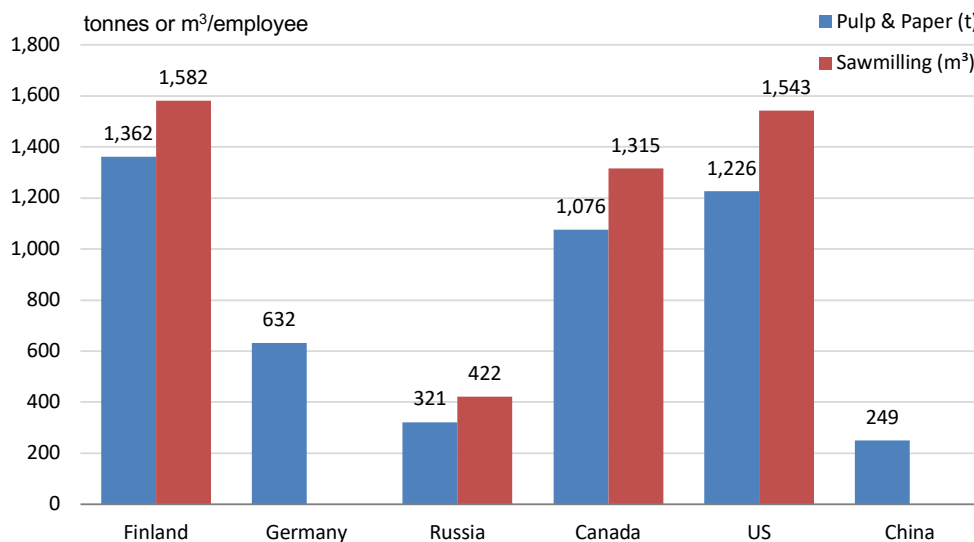
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Figure 5.2 Education level



On country level the pulp and paper production per employee is highest in the United States, Finland and Canada (Figure 5.3). Same applies to the productivity in the sawmilling industry. As previously discussed, the labor costs are higher in United States and Finland, but the higher productivity in these countries compensate the labor cost difference to some extent. Both China and Russia have low productivity as the pulp and paper industry still include old pulp and paper mills with low efficiencies and because of the cheap labor costs the mills keep large pools of employees.

Figure 5.3 Production per employee



Note: sawmilling productivity not reported for Germany and China because LVL production not in the scope of the work for those countries.



6. LOGISTICS COST

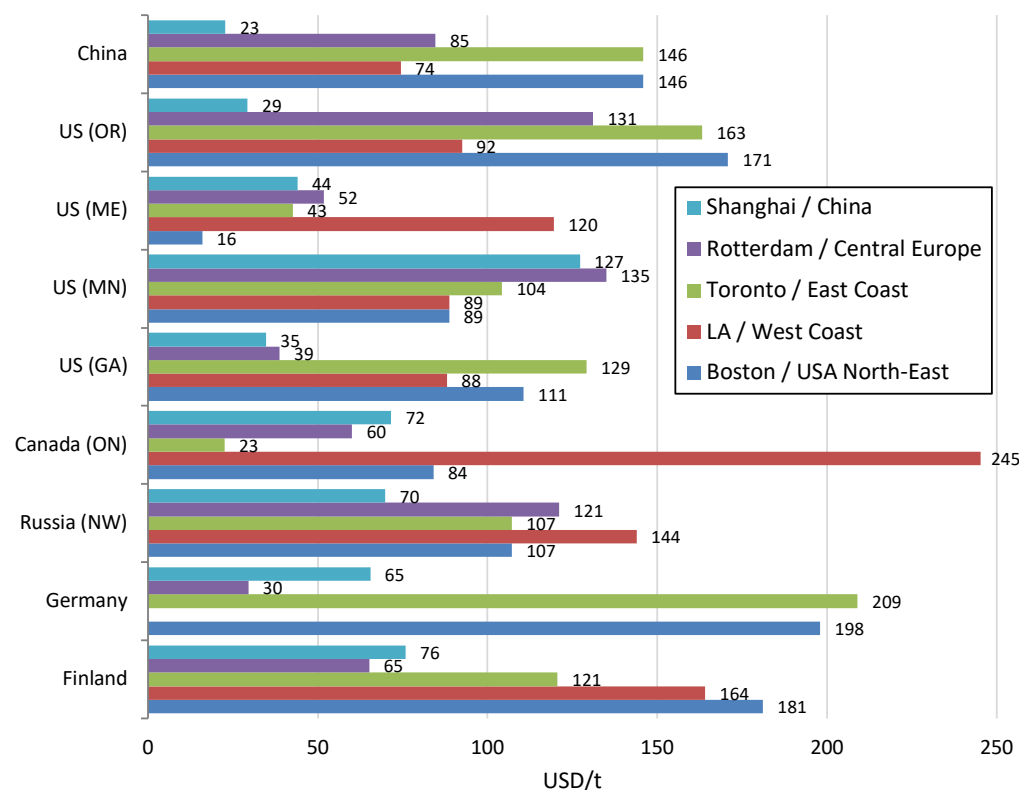
Inland truck transportation costs were estimated from selected forest industry concentrations in the studied regions to a relevant terminal point. In case end-market was located near, truck transportation was considered all the way. The sea freight transportation costs were determined based on the parcel size of the selected products and consequent container types. Three container types were considered relevant, i.e. 20GP, 40GP and 20TT containers. Rail freight was assumed to be used within North America, assuming a boxcar with a maximum weight capacity of 70 tonnes. The rail freight rates were derived from multiple carriers such as BNSF, LAJ, UP, CSXT, ST.

European countries have high costs in shipping goods to North America. Finland and Germany do have quite high transportation costs to China. In 2017 Finland started to export pulp products via a railway connection to China, which is a faster connection than via sea. China pays also significant subsidies to these transports, making it more attractive to export from Finland to China. Germany is well-positioned to deliver in central Europe and relies on the European market.

Nearly all countries and regions, except Russia and Minnesota, have at least one of the selected target markets in proximity with a competitive transportation cost. Minnesota is landlocked and has fairly high transportation costs to the selected target markets across the board. Also Oregon has high transportation costs except to China, benefitting from low cost sea freight.

China has medium to high transportation costs to all selected target markets except to the domestic market. Considering that its domestic market is significant for wood products, China does not suffer from the high transportation costs.

Figure 6.1 Transportation costs to selected sales markets

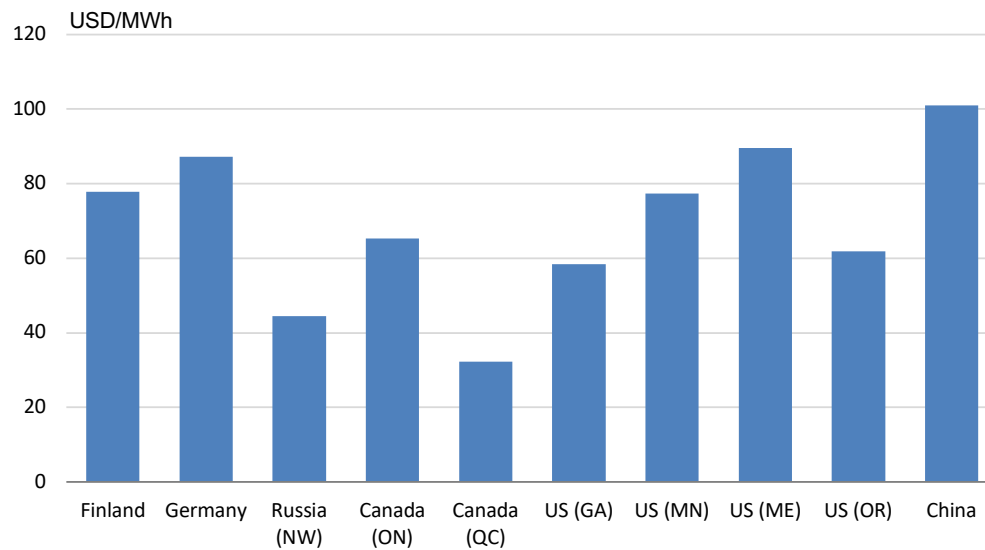




7. OTHER COSTS

China has the highest industrial electricity price among the compared countries and regions (Figure 7.1). Russia has the lowest price of power which is largely due to the extensive amount of hydropower generation. The industrial electricity prices have recently decreased in Canada making the manufacturing industry more competitive. Maine and Germany have relatively high electricity price levels around 90 USD/MWh.

Figure 7.1 Price of power in industrial manufacturing, 2017

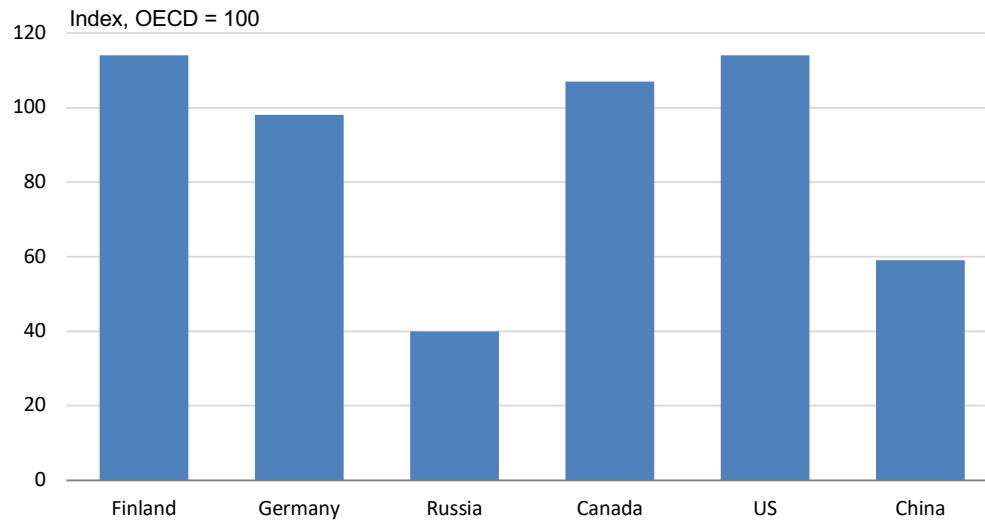


Note: total delivered cost of power including distribution and transmission costs.



For other costs, general price level indexes were compiled to provide a rough indication (Figure 7.2). China and Russia have significantly lower general price levels, respectively 40% and 60% less than the OECD average. Germany has slightly lower price level than OECD average. Finland and United States have a similar 14% higher price level than OECD average.

Figure 7.2 General price levels, 2016



Source: OECD



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8. REGULATORY CLIMATE

A summary of the regulatory climate is presented in Table 8.1. The regulatory climate analysis and its results relate primarily to regulation on harvesting, industrial emissions and environment.

Europe

EU directives affect **Finnish** legislation and regulatory climate. Legislation on forest management is well-developed and enforced, and many forest owners and wood buyers take additional voluntary measures to enhance the sustainability of forest management. The EU Renewable Energy Directive is currently under revision to include solid biomass fuels, which would have a strong impact on Finnish forest-based biomass production. Fire regulation limits the size of wooden buildings to maximum 8-stories tall for living and work buildings or maximum 4-stories tall for public buildings. Emission rights and sulphur directive regulate emissions from production and transport. Overall the regulatory climate is neutral for forest industry in Finland. Environmental and building regulations are similar in many European competitor countries but can be a disadvantage compared to more distant competitors.

In **Germany** the regulatory climate has an emphasis on a variety of goals for forest management and timber production is only one of them. Forest management has to maintain continuous forest cover and maintain the recreational value of forest. Clearcutting large areas is forbidden, which makes a significant difference in comparison to the other selected countries and regions where large industrial clearcutting is typical.

Forest and environmental legislation in **Russia** (and in the North-West) is well-developed, though there are issues with its enforcement. All in all, the regulatory climate for the forest industry in the North-West of the country can be categorised as neutral with some hindering elements especially caused by recently amended requirements for the environmental impact of industrial companies.

Canada

There are a number of federal level regulations that influence forestry and forest industry in **Ontario, Canada**. However, the regulations are perceived as normal for forestry sector. There are Acts that support the bioeconomy development in Ontario. The regulatory climate is considered as *neutral* in Ontario.

United States

Minnesota upholds federal regulation on environmental regulation and market access. Forest management is regulated at the state level and guided by the Minnesota Forest Resources Council. Significant portions of Minnesota's forests are certified. As a conclusion, Minnesota's regulatory climate is neutral, with forest management driven by more than just commercial harvesting concerns, and water and air quality regulations meeting federal standards.

Oregon's regulatory climate is considered neutral with forest management regulations emphasizing commercial priorities for sustainable harvesting and a mix of very stringent to less stringent water and air quality standards.

Maine's regulatory climate is considered neutral. Forest management is less restrictive than European jurisdictions. For example, Maine limits the size of a clear cut to a maximum of 250 acres and two clear cuts cannot be located closer than 250 feet to one another. Regeneration must, however, also be ensured within five years of a clear cut. Environmental regulations enforce the Clean Air Act and Clean Water Act. In terms of market access restrictions, Maine law bans the use of formaldehydes in children's products.

There are relatively few regulations on timber harvesting in **Georgia**. Most notably, the state Best Management Practices (BMP) manual provides guidance to reduce the impact from harvesting activities on water quality and other issues such as erosion. Relevant to the production of LVL and MDF, the Georgia General Assembly passed House Bill 255 in 2015,



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which changed the standards regarding publicly funded buildings. The new law allows for the use of wood products from all forest certification programs and not just FSC, which are required by LEED green building standards.

China

In **China** the government has taken severe measures to combat pollution and has forced several small forest industry companies to shut down their operations. The regulations can be considered part of a process of bringing the Chinese manufacturing operations to standards that are similar to those in North American and European industries. However, the implementation of such regulations is considered unpredictable and often harsh in execution. Consequently, the regulatory climate in China is considered *hindering*.

Table 8.1 Regulatory climate summary

Country	Regulatory climate
Finland	Neutral
Germany	Hindering
Russia, Northwest	Neutral
Canada, Ontario	Neutral
US, Minnesota	Neutral
US, Oregon	Neutral
US, Maine	Neutral
US, Georgia	Enabling
China	Hindering



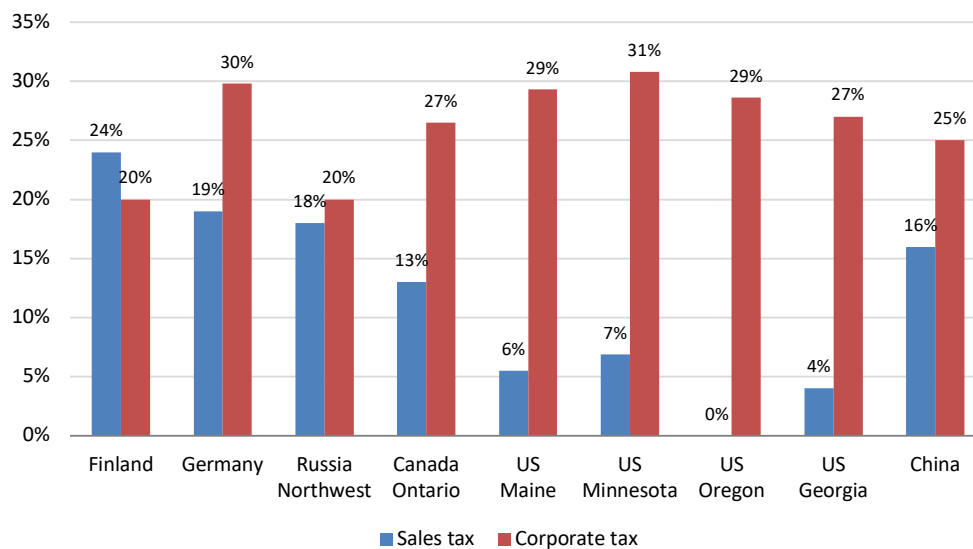
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9. TAXATION

Corporate tax rates are highest in North America and Germany ranging from 27% to 31% (Figure 9.1). Whereas the lowest corporate tax rates are in Finland (20%), Russia (20%), and China (25%). Maine has the third highest corporate tax rate among the countries and regions compared. The US federal corporate tax rate was decreased to 21% and came into effect in January 2018.

Sales tax, known as value added tax (VAT) outside of North America, is significantly lower in the United States ranging from 0% in Oregon to 7% in Minnesota in comparison to other countries. Finland has the highest sales tax with a rate of 24%.

Figure 9.1 Tax rates by country



Note: Federal tax is included in the North American corporate tax rates. Value added tax (VAT) is equivalent to sales tax outside of North America.



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10. POLICIES AND ENABLING ENVIRONMENT

The summary of enabling environment in the studied countries/regions is presented in Table 10.1.

Europe

In **Finland**, the forest industry receives direct subsidies, loans and guarantees. In 2016, the subsidies totalled USD 82 million. Production of renewable energy is subsidized with feed-in tariffs. Wood chips, biogas, and fuelwood use for energy production benefit from the tariffs. The feed-in tariff is paid according to the difference between the desired price and the market price of electricity. The National GHG Emissions strategy that follows objectives and actions agreed in EU, aims to increase the share of renewable energy sources to over 50% of the total energy consumption in 2020's. The strategy includes actions and objectives to increase the use of wood fuels, especially by-products and to refine value-added fuels from them. The National Energy and Climate Strategy for 2030 aims to increase the share of biofuels in road traffic to 30% by the year 2030. The policies will impact forest industry and will likely call forth new subsidies. The Finnish banking sector is stable and large forest industry companies have not had difficulties in getting loans to large investments. There are less private equity investors in Finland than in other European regions however. Large Nordic banks, e.g. Nordea and OP, finance private sawmills. New financiers are arriving from China. The state may provide loan guarantees to investments. Finnvera, which is the state owned official Export Credit Agency can provide loans to investments in special circumstances, but it mainly provides export credit guarantees. Business Finland finances innovation, pilot projects and R&D. Access to financing does not limit forest industry development in Finland, but it neither provides definitive advantage compared to competitors.

Germany has established many policies to boost renewable energy production. One third of all harvested timber is used for energy production. There are also subsidy systems that compensate income losses originating from abstaining from harvests in favour of recreational use of forests. In private forests these subsidies are small, but in state-owned forests more important. Overall, the German policies favour other uses of forest than timber production for raw material. Relative to many other forest industry countries, the overall access to capital is good and the cost of capital is moderate. Infrastructure in Germany in general is well maintained and as a densely populated country it has comprehensive forest road network. Logistic infrastructure in Germany is not an obstacle for growth of production. Germany has invested intensively to R&D of bio-based energy and products and is also active in facilitating cooperation between business and science worlds. German paper and wood product industry's R&D spending has increased 19% from 2007 to 2015.

In the **North-West of Russia**, there are certain governmental incentives aimed at developing the value-adding forest industry, one of the most important being a status of a priority investment project in exploitation of forest resources. Such status guarantees forest lease without auctions, and a 50% discount on lease payments during the payback time of the project. In addition, there are several subsidy programs: subsidies for forming inter-seasonal stock of raw materials, materials and fuel; subsidies for implementing new multi-purpose investment projects on focus areas of the civil industry; subsidies for compensating part of transportation costs, subsidies for compensating part of R&D costs etc. On the other hand, development of the forest industry is hindered by low level of logistic infrastructure, lack of SME access to financing and very limited R&D spending.

Canada

In **Ontario, Canada**, the forest industry benefits directly from programs, such as the Ontario's Forestry Growth Fund, the Mass Timber Program, and reductions in electricity rates. Although these programs are relative in size, Ontario offers many additional indirect advantages, such as "green bonds", low interest-rate loans, and seed capital to support a low carbon economy. Therefore, in relation to incentives the enabling environment is considered high. Ontario has



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some R&D support through programs and funds, but the government R&D expenditure allocation to Ontario's forest sector has declined throughout last decade and is considered medium. According to an independent study on Ontario's logistics, one-third of the roads and bridges were found as in poor or very poor condition. As a result, logistics infrastructure is rated low. Given that Canada's banking climate is stable, large loan guarantees are available for forest sector, private equity market is well-functioning and incentives are available specifically for innovative technologies the access to financing is considered favorable in Ontario.

United States

Maine offers incentive programs with cost-sharing assistance for forest management planning. Other favorable conditions include the presence of research institutions focused on studying manufacturing and engineering of composites and structures, some of which offer early stage capital and commercialization assistance. Given that some of the latter are funded by the federal government, and that Maine's cost-sharing assistance is similar to other state policies on sustainable forest management and conservation, the policy environment is therefore considered medium in its enabling capacity. Based on a survey conducted in 2017, 80% of respondents agreed that there are problems in the forest trucking industry and 30% agreed that there are problems with road conditions. Transit via railway suffers from low levels of investment in the rail networks, a lack of capacity to handle emerging interline standard rail cars (286 000 lb), and no direct connection to the continental US for double stack capable railways. Internationally costs are driven up by its positive net export ratio, leaving 'deadhead' return miles that increase transit costs, and large delays at border crossings. Maine's Atlantic coastline provides access to further national and international business opportunities, with three cargo ports (Portland, Searsport, Eastport). Currently these ports require dredging slated for 2019 or early 2020 to end the reliance on tides for large ships that often cause major delays. Financially and from the view of businesses, Maine is weaker than other states and has historically rated in the bottom quartile for ease of doing business in the United States. Capital flows in the United States across state borders, which positions Maine equally to Georgia, Minnesota and Oregon, but Maine ranks lowest of the four states in terms of Foreign Direct Investment (FDI) and venture capital investment according the PwC. The state's fiscal solvency is slightly below the national average, ranked thirty-fifth by the Mercatus Center. Maine has an opportunity to be a leader in Nanomaterial production and development, as the University of Maine's Process Development Center (PDC) launched the Nanomaterial Pilot Plant already in 2012. It focuses on bio-based nanomaterial R&D and the PDC targets its services strongly to the forest products industry already. With federal IRS based R&D tax incentives already in place, Maine has the potential to attract more corporate R&D activity, especially in the field of nanomaterials.

Georgia's incentives include guaranteed loans, helping companies "consider" (re)locating to Georgia, and providing businesses with assistance programs. However, as none of these policies are focused on the forestry sector, and current forest policies do not go above and beyond federal policies or similar state policies on sustainable forest management, the policy environment in relation to incentives, is therefore rated *medium*. Georgia has comparable road and forest road network to Maine. However, the well-developed rail and marine transit infrastructure and subsequent cost benefits give Georgia a comparative advantage ranking its logistics infrastructure as high. The state of Georgia's fiscal solvency is above average. Given Georgia's numerous incentives, stable state economy, and high level of venture/traditional capital investments, the environment can be considered favorable to the forestry sector. Georgia had the second-highest share of industry-funded university research in 2016, meaning that the state already attracts companies and their R&D functions. The state also offers a R&D tax Credit system to attract companies to invest in R&D spending and Georgia-Pacific has its Innovation Institute located in Georgia currently.

In **Minnesota** the forest industry may benefit from the presence of the forest products management development institute. Current forest policies do not go above and beyond federal policies or similar state policies on sustainable forest management. Minnesota's policy environment is enabling for the development of (clean) technology-driven economy by offering



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grants, loans, and other incentives, with a focus on biofuels (produced from cellulosic biomass), the policy environment with regards to incentives can be ranked high. Minnesota has some loan programs available targeted for bioeconomy development, such as The Community Energy Efficiency & Renewable Energy Loan Program, Green Business Loan Program, Small Business Environmental Assistance Program as well as Renewable Development Fund under the Conservation Improvement Program (CIP). Although Minnesota enjoys a stable banking environment and access to Government backed finance is aimed at small businesses (of which some may be manufacturers)—the state lacks forest-based financial incentives. Additionally, there is a major shortage in early financial backers or strong venture capital interest. Overall, access to finance can be defined as medium in relation to forest industry investments. The forest road network maintenance is costly due to the harsh winter climate. Public roads in Minnesota are ranked twenty-fifth in overall quality and ROPAs poor condition are ranked thirtieth. Overall road infrastructure in Minnesota is slightly worse than the national average—although urban interstates and congestion impacts are significantly worse than national levels. The maximum total gross weight (97,000 lb) for Minnesota is relatively lower than the average allotted weight for forest trucking, driving up transport costs. There is minimal short line rail connection between forests and manufacturing plants in the Northeast, leaving the majority of forestry transit to short- and long-haul trucking. As a result, Minnesota's logistics infrastructure is considered *low*.

Although, the forest industry in **Oregon** may benefit from some financial incentive programs and the presence of research institutions that study advanced wood products and offer seed capital, the present policy environment with regards to incentives can be rated medium. Similar to other states, the bulk of the programs is aimed to increase environmental value of land for (smaller) landowners, and most of the research is financed by the federal government. Oregon's forest and other road network is on par with Maine. Oregon's private forests have extensive road network, but it often needs maintaining before accessing with heavy trucks. Mountainous roads are built especially for well-turning timber trucks, which makes them sometimes unpassable for chip trucks. Oregon does have a railway access to markets, but the rail freight costs were identified high. Consequently, logistics infrastructure is ranked medium. Although Oregon enjoys a stable banking environment and has access to various financial mechanisms, none are directly aimed at the forestry sector. Access to finance is therefore defined as medium (neutral) factor in relation to forest industry investments.

China

China has made significant efforts in modernizing its manufacturing production capacities through subsidies, which usually take the form of free or low-cost loans. The massive subsidies provided for paper industry have helped China to become the world's largest paper producer. Therefore, China is rated high with regards to incentives. China is still undergoing major development in its logistics infrastructure especially in the rural regions. Its current forest road network is still under developed in many rural regions, but significant funds are allocated to improve the infrastructure. Also in the forested regions, the climate is favorable to establish long-lasting forest road networks. As a result logistics infrastructure is rated medium. Multiple development finance institutions are operating in China and provide substantial loans in co-operation with Chinese government bodies to manufacturing industry. As a result access to financing is rated high. R&D spending, which has a focus on pulp and paper industry modernization, is high and China is spending resources to acquire the already available know-how and technologies from mature industries in Europe and North America.



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Table 10.1 Enabling environment

Country	Incentives	Logistics infrastructure	Access to financing	R&D
Finland	Medium	High	Medium	High
Germany	Medium	High	High	High
Russia, Northwest	Medium	Low	Low	Low
Canada, Ontario	High	Low	High	Medium
US, Maine	Medium	Medium	Low	High
US, Minnesota	High	Low	Medium	Medium
US, Oregon	Medium	Medium	Medium	Medium
US, Georgia	Medium	High	High	High
China	High	Medium	High	High

Annex 1

Finland



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FOR/Maine

Global Market Analysis and Benchmarking Study – Finland

Final Report

Helsinki, Finland
June 29, 2018

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ID 122618



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1. TIER 1 – DETAILED ANALYSIS

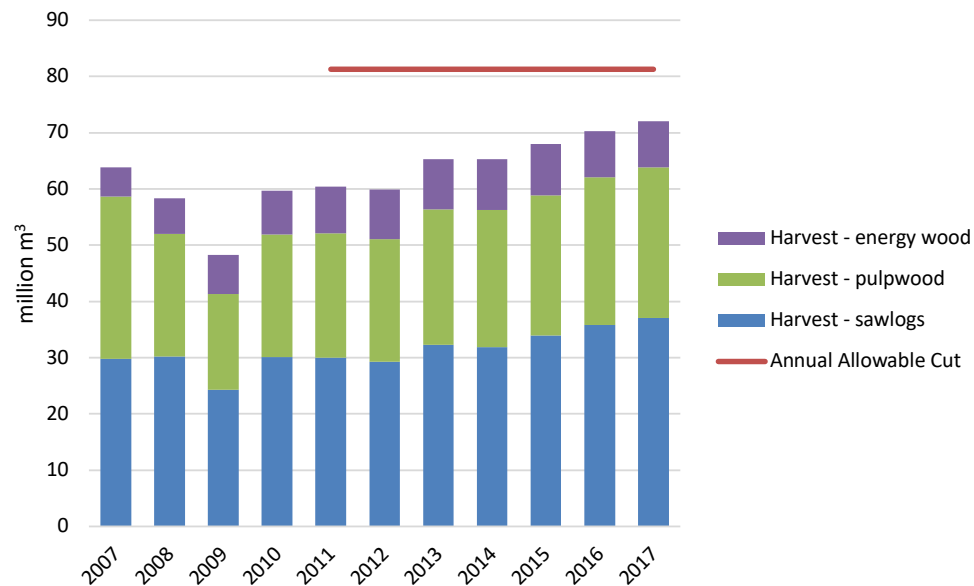
1.1 Raw material

1.1.1 Harvest levels

Forest growth has increased dramatically since the late 1970's in Finland. In 2017, the growth was estimated at over 110 million m³, while the total drain (harvesting + natural mortality) was less than 90 million m³ over bark. Currently, there is potential to increase harvest by 14 million m³ over bark to reach the maximum sustainable yield (MSY), which is a synonym in Finland for the annual allowable cut (AAC) (Figure 1.1). MSY is expected to increase from the current level in 2020's due to unused harvest potential. The potential is 17% of the MSY. However, wood availability differs regionally and is affected by the wood paying capability. Furthermore, harvest levels are not restricted by sustainable yield, but by willingness to sell wood, as majority of the forest is owned by private people in Finland. Forest is inherited within the family, which has resulted to increased forest ownership of urban people, who can be passive in forest management and selling wood to the market. Winters are getting milder due to climate change, reducing the length of the prime harvesting season when the ground is frozen. This can decrease wood availability in the long-term in case investment to road network and machinery does not increase.

Demand of wood in Finland is complemented by roundwood imports. The majority of the imported roundwood is pulpwood. In 2017, total raw wood imports were 7 million m³, of which half was pulpwood and 2.5 million m³ wood chips (Figure 1.2).

Figure 1.1 Harvest levels and annual allowable cut (AAC) 2007-2017 (over bark)

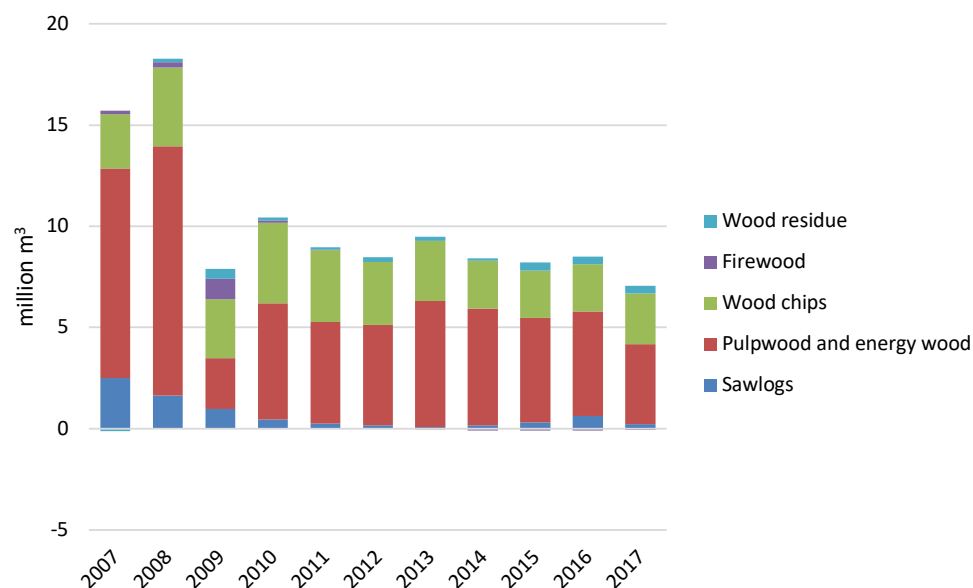


Source: Natural Resources Institute of Finland and Indufor analysis.



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Figure 1.2 Net imports of different wood assortments in Finland 2007-2017 (over bark)



Source: Natural Resources Institute of Finland

Large investments to pulp and paper industry are expected in Finland, driven by the global market price of pulp (Table 1.1). Some sawlogs are already used by pulp and paper plants locally, but future wood demand by the sector may result into more sawlogs being directed to pulp production. Coniferous species, pine and spruce, dominate Finnish forests. Therefore, wood demand exceeds wood supply for certain wood assortments, especially veneer log sized birch.

Announced future investments would consume all available wood in terms of sustainable yield. Metsä Group's Äänekoski pulp and bioproduct started its operation in the latter half of 2017 and will consume in total over 6 million m³. Announced investment for 2018–2020 would increase pulpwood demand by 11 million m³ over bark, so it is unlikely that all of them will realize, as it would create uncertainty of wood availability and increase sawlog use in pulp and paper sector causing the wood prices to increase to unsustainable levels. Additional plans have been announced for pulp and paper mills after 2020, partly with Chinese financing. Many of these new investments would be so called biorefineries, producing both pulp and other wood based chemicals and/or fuels.

Table 1.1 Announced/recent large-scale forestry sector investments

Company	Location / product	Investment, EUR million	Increase in wood use	Timing
2017				
Metsä Group	Äänekoski 1 300 000 t/a pulp and other bioproducts	1 200	4 000 000 m ³ /a coniferous pulpwood. Current use 2 300 000 m ³ /a birch and coniferous pulpwood.	2017
UPM	Kymi 170 000 t/a pulp increase	98	600 000 m ³ /a coniferous and birch pulpwood.	2017
2018-2020				



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Company	Location / product	Investment, EUR million	Increase in wood use	Timing
Boreal Bioref	Kemijärvi 400 000 t/a pulp and other bioproducts	750	ca. 2 200 000 m ³ /a coniferous pulpwood and chips	2019-2020
Kaidi	Kemi biofuel refinery 200 000 t/a biofuels	900	2 800 000 m ³ /a pulpwood, energy wood, wood residues	2019
Finnpulp	Kuopio 1 100 000 t/a pulp and other bioproducts	1 400	ca. 6 000 000 m ³ /a coniferous pulpwood.	2019
Other announced investment plans				
Savonlinna biorefinery project	Savonlinna 50 million liters of liquid biofuels	n.a.	n.a.	Announced 2016
Kaicell Fibres	Kajaani or Paltamo 400 000-460 000 t/a pulp	n.a.	ca. 2 500 000 m ³ /a pulpwood.	Announced 2015
Haapajärvi biorefinery	Haapajärvi, softwood kraft pulp, 400 000 t/a	500	ca. 2 million m ³ /a coniferous pulpwood	Announced 2016
St1 Cellunolix®	Pietarsaari	n.a.	n.a.	Announced 2016

Together, all realized investments in 2017 and all the proposed ones from 2018 to circa 2022 would increase wood consumption by more than 20 million m³ (Figure 1.3). These would exceed the maximum sustainable harvest level, unless wood imports increase, or some downsizing takes place in the existing capacity. However, MSY is expected to increase in the future due to current unused potential, creating new opportunities in the long-run.

Figure 1.3 Potential increase in harvest levels by 2030 (over bark)

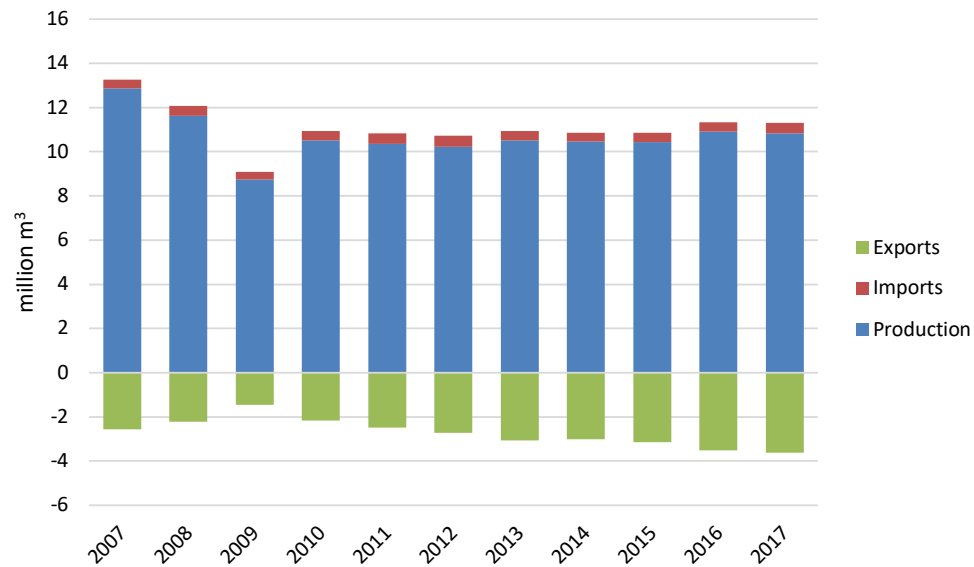
Source: Indufor estimate.



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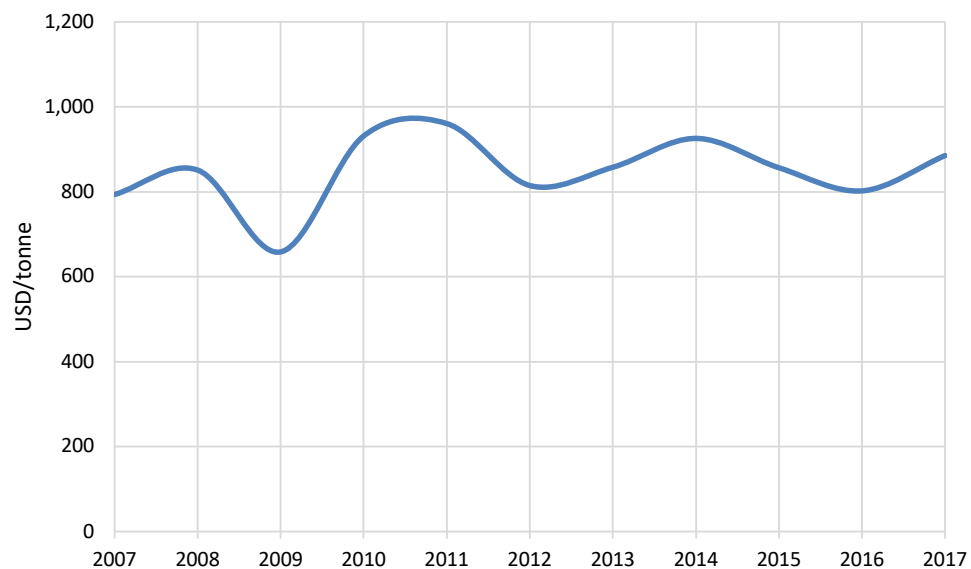
Pulp production has increased modestly during the last years, but has not yet reached the peak levels of before the economic recession of 2009 (Figure 1.4). Pulp production is expected to increase in near future as demonstrated by the realized and announced investments. Pulp price has remained high and is driving the investments (Figure 1.5).

Figure 1.4 Pulp production, import and export (over bark)



Source: Natural Resources Institute of Finland

Figure 1.5 PIX index of NBSK (Northern bleached softwood kraft)



Source: FOEX

Delivery point = North Sea port

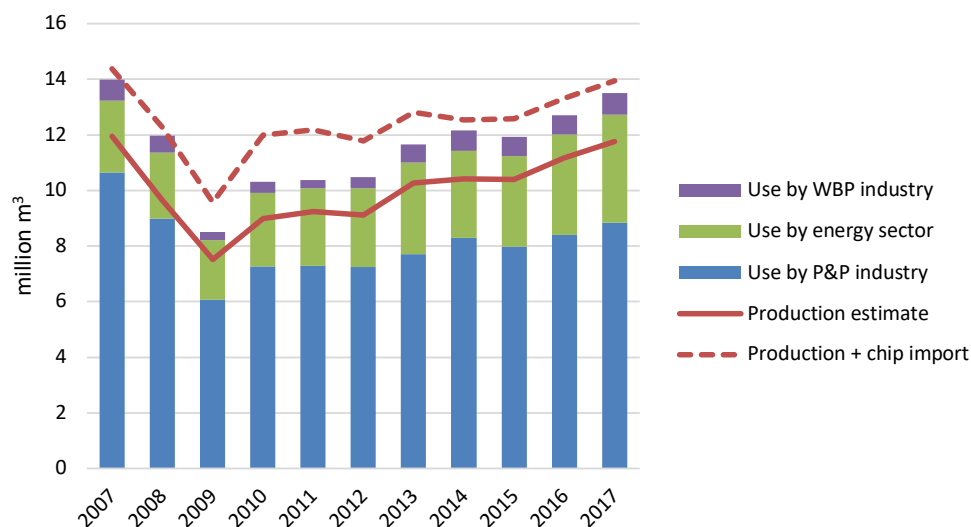


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1.1.2 By-products

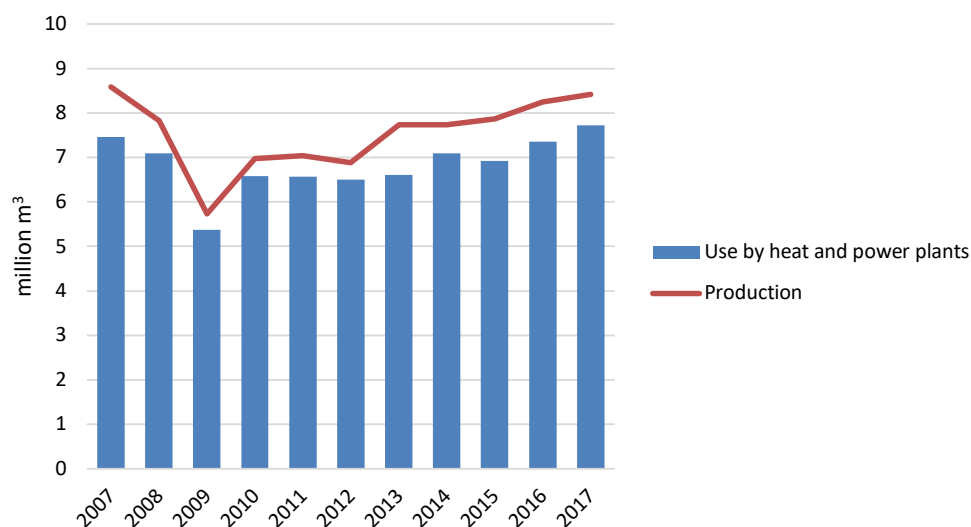
Side-streams of by-products are well utilized in Finland. Little potential remains to increase their consumption. P&P sector is the largest user of by-products, mainly due to consumption of wood chips to chemical pulp production (Figure 1.6). Heat and power plants consume large amounts of wood by-products, e.g. chips and sawdust. They are the main consumer of bark (Figure 1.7). Heat plants are often integrated to sawmills to directly utilize by-products (bark and sawdust).

Figure 1.6 Consumption and production of by-products (chips and sawdust), excluding bark 2007-2017



Source: Natural Resources Institute of Finland, Indufor estimate.

Figure 1.7 Domestic production and consumption of bark by heat and power plants



Source: Natural Resources Institute of Finland, Indufor estimate



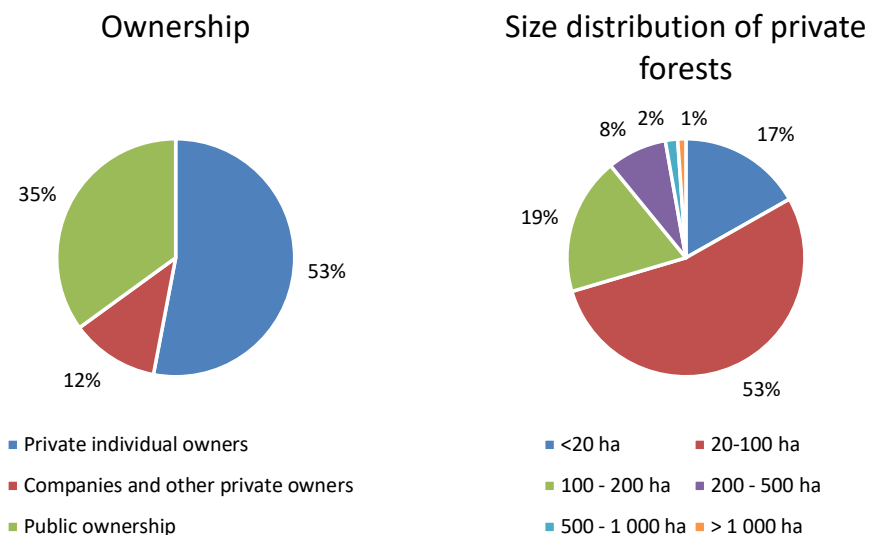
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1.1.3 Forest ownership

Private individuals own majority of the forest in Finland: 13.9 million hectares of the total forest area of 26 million hectares (Figure 1.8). 65% of the forest area in Finland is privately owned, including forest owned by private individuals and companies. 35% of the forest is publicly owned, either by the State Forest Enterprise (Metsähallitus), municipalities, or parishes. State forests are concentrated in the Northern and Eastern Finland and include national park and conservation areas. The State Forest Enterprise is the largest individual forest owner, and an important client for the wood processing industry. However, a clear majority of the wood volume is harvested from private forests, partly due to many State Forest Enterprise's forest in Northern Finland, where the forest growth is slower than in the South.

Forest holdings owned by private individuals are small, on average only 30 hectares. Forest land is bought and sold in the market, but majority of the forest is passed on within a family as inheritance. Due to the inheritance law, the average size of a forest holding continues to decrease, as forest area is distributed between siblings. It can pose threats to forest harvesting, as a larger share of forest owners live in cities and may be passive in wood markets. Consolidated ownership, in which several people, e.g. within a family, combine their forest ownership under a single entity, has an increasing trend.

Figure 1.8 Forest ownership structure



Source: Natural Resources Institute of Finland

Note: total area 26 million ha of which 13.9 million ha are privately owned.



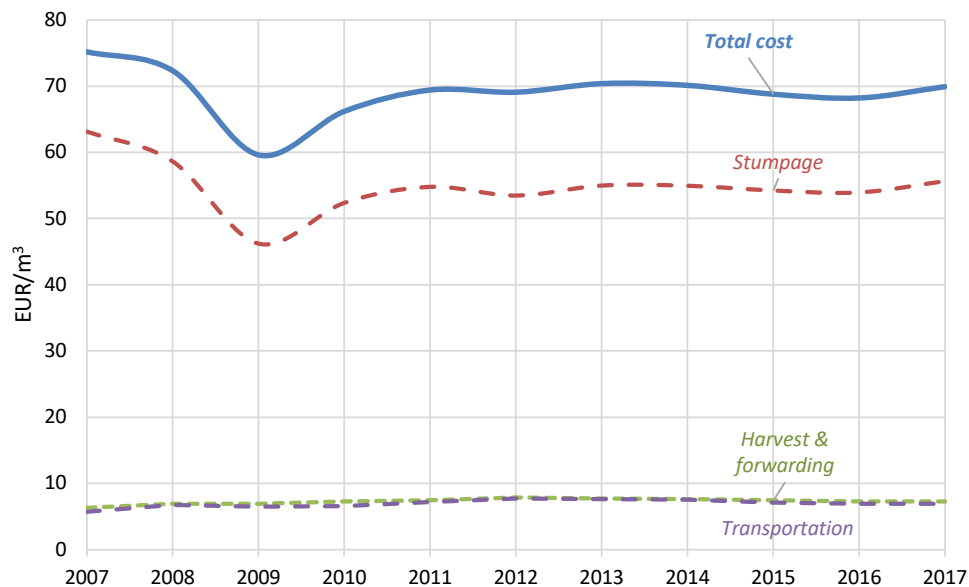
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1.1.4 Delivered wood cost

The delivered wood cost has remained relatively steady during the past ten years (Figure 1.9). The average delivered cost of sawlogs has remained close to 70 EUR/m³ (78 USD/m³), while the delivered cost of pulpwood has been around 40 EUR/m³ (44 USD/m³) over bark. The main determinant in sawlog price is the stumpage price paid for the forest owner, which has been on average 50 to 60 EUR/m³, during the past years. However, the stumpage price depends on the forest age. Stumpage price of sawlogs in the final felling is currently above 63 EUR/m³, while it drops to 40 – 55 EUR/m³ over bark in thinnings. Furthermore, the price depends on the species, as the price of softwoods exceed the price of hardwoods, and on season. Harvest can be easily done in the winter when the ground is frozen and can support heavy machinery. Harvesting can be done only in easily available locations during the spring and the winter due to wet ground. Therefore, better price may be paid for stands that can be harvested during the difficult seasons. Wood is mainly sold as standing sale over bark, in which the wood buyer takes care of the harvest, forwarding and transportation.

Pulpwood has smaller diameter than sawlogs and therefore has a lower stumpage price. The stumpage price of pulpwood has been approximately 17 USD/m³ during the past years. Unlike the sawlogs, the transportation cost is a big determinant of the delivered price. Thus, pulpwood has to be transported shorter distances than sawlogs.

Figure 1.9 Delivered wood costs of sawlogs (over bark), 2007-2017

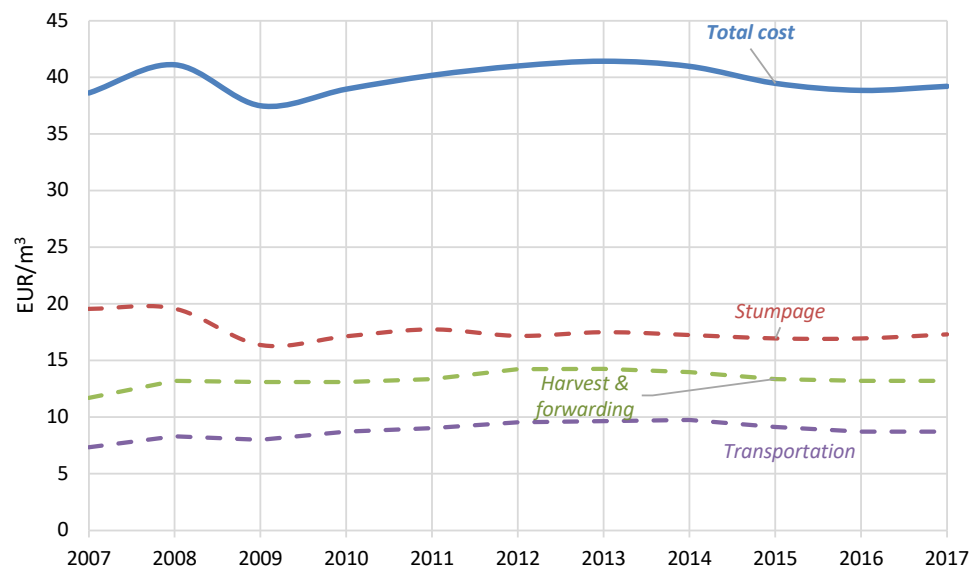


Source: Metsäteho and Natural Resources Institute of Finland



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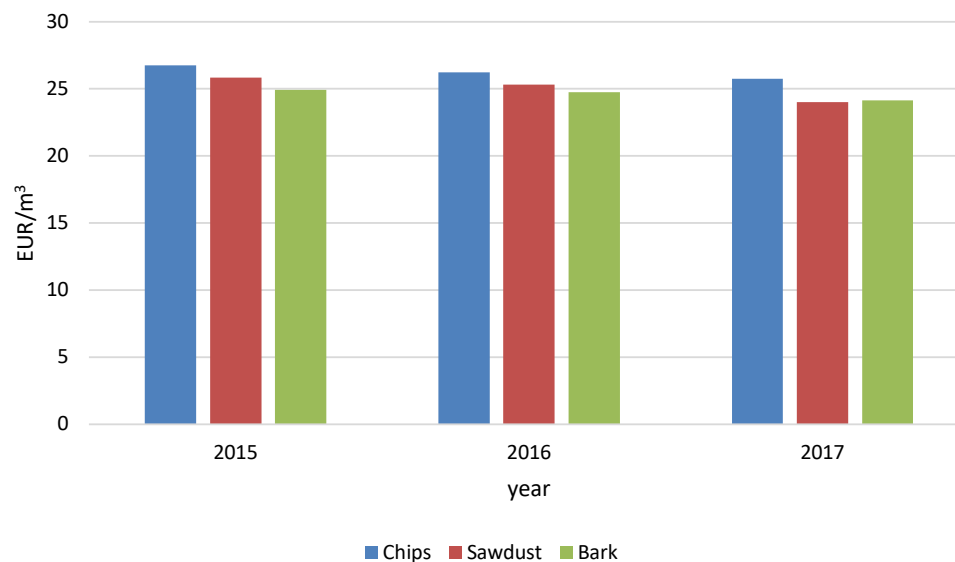
Figure 1.10 Delivered wood costs of pulpwood (over bark) 2007-2017



Source: Metsäteho and Natural Resources Institute of Finland

Prices of wood chips, sawdust and bark have remained rather constant during the last three years, remaining close to 25 EUR/m³ (i.e. 28 USD/m³) (Figure 1.11). The markets for sawdust and bark are less developed than markets for wood chips. Chips have higher demand than sawdust and bark, because they can be used as raw material for chemical pulp in addition to feedstock for energy production.

Figure 1.11 Delivered (at use destination) cost of by-products, 2015-2017



Source: Metsälehti and FOEX



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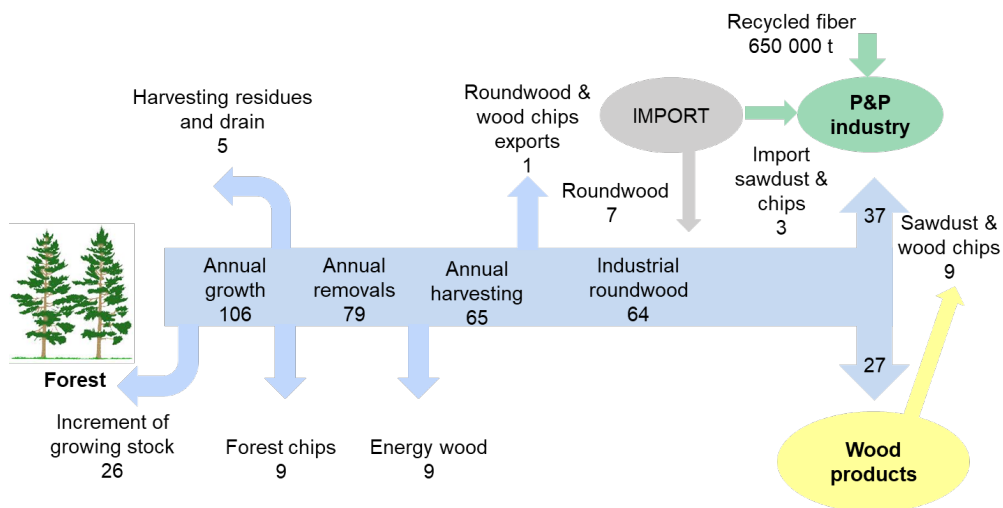
1.1.5 Wood procurement practice

Wood sourcing is highly integrated in Finland (Figure 1.12). Log trading is common even between competitors to cut down transportation costs. Most of the wood is sold on stumpage basis (i.e. as standing timber). Therefore, the buyer will acquire all assortments of wood and will then trade the unwanted assortments further to other companies. Since there is a large number of independent sawmill companies in the country, but only a few large pulp and paper companies, the pulp and paper companies have a lot of market power on both pulpwood and sawlogs. For them, acquiring adequate volumes of pulpwood is critical. Therefore, these companies may overpay for sawlogs in some cases to ensure that they can keep pulpwood costs down and still get the timber.

Typically, a rotation includes two to four harvests, excluding tending of seedling stands. Tending of a young forest may be done before the first commercial thinning. Energywood may be collected from the tending of a young forest, whereas the first thinning is done at forests where the trees have already achieved pulpwood sizes. The relative share of pulpwood decreases while the share of sawlogs increases in the subsequent harvests. The final harvest is usually a clear-cut, but continuous-cover silviculture is slowly gaining foothold in Finnish forestry. Continuous-cover silviculture increases the yields of sawlogs but decreases pulpwood yield.

Often, aim of the forest owners is to grow good quality sawlogs due to their high market price compared to pulpwood. Production of sawlogs also results in pulpwood and energy wood yield, due to diameter requirements.

Figure 1.12 Interdependence of wood supply



Source: Natural Resources Institute of Finland

As stated, different wood assortments have different market prices for stumpage, which have remained constant during the past years. Harvest residues – small diameter trees, branches, tree tops – may be collected later when they have shed needles, or they are left to the site as natural fertilizer. Stumps are seldomly collected.

Sawmilling industry is the main source of wood residues, mainly bark, sawdust and wood chips. Chips can be utilized at pulp mills as raw material, but bark and sawdust are principally used for energy production at integrated power and heat plants. In some cases, the wood residues may be transported short distances (often less than 50 kilometres).



1.2 Workforce

1.2.1 Demographic comparisons

Total population of Finland is 5.5 million and majority of the people live nowadays in cities (Table 1.2). Movement from countryside to cities is continuing at decreasing speed, but especially the younger age classes move to cities to study higher degrees. Population growth is slow, only 0.3% in 2017. Unemployment rate is high, over 8.5% of the labour force. In general, Finnish people are well educated. The primary and secondary education are internationally recognized. Over 30% of the population above the age of 15 has a degree from higher education (university or equivalent) and 14% of the labour force has a master's degree or higher. The share is an underestimation for the active labour force, because the education statistics include young people, who are still studying, and old people, who studied when the education system was different in Finland.

Table 1.2 Key demographic indicators

Indicator	Current situation
Total population (Jan. 2018)	5 513 000
Population growth rate (2017)	0.29%
Population urbanization, rural vs urban (Jan 2018)	21% vs 79%
Unemployment rate (2017)	8.6%
Level of education* (2016)	14%

*Ages 25-65, people with master's degree or higher

Finnish society is determined by a large middle-aged and senior age class, which have partly reached retirement age, or will do so within the next ten years. Those age classes are the result of the baby boom after the second world war at the end of the 1940's and in the 1950's. Age classes have been decreasing since, reaching all time low in 2010's (Figure 1.13).

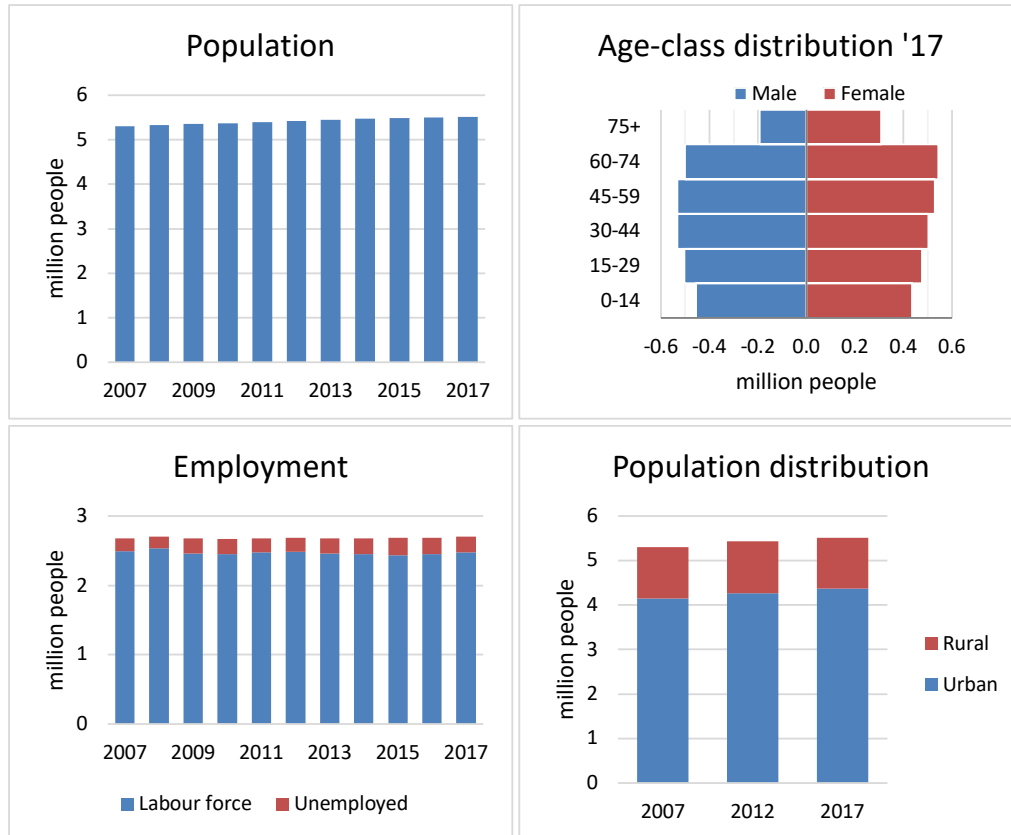
Natural mortality rate exceeds birth rate. However, the population continues to increase due to immigration. The population growth will continue to depend on immigration in the future. The share of old people will increase in the future too, because the average expected lifetime continues to increase. Finland's population is forecast to grow to 5.8 million people by 2030.

Finland is a relatively low density country. The average density per land area, excluding inland water bodies, is 18.1 people per km². Finland was very rural still in the 1960's, but a large-scale movement from the countryside to cities started in the 1970's and the population is nowadays urban. Every 5th person lives in the capital city area, which consists of three merged cities of Helsinki (the capital), Espoo and Vantaa. Almost half of the population lives in the top 10 largest cities. Overall, 4/5ths of the population lives in municipalities that are defined as cities. Average population density in cities is 147.6 people per km², compared to the population density of 14.9 in rural areas, excluding inland water area.

Urbanization continues, and the population increases most rapidly in the capital city area. Meanwhile, the population decreases in the remote countryside, especially as the young people move to cities to study and work. Workforce availability may become a limiting factor in the countryside in the long-run.



Figure 1.13 Historical demographic development

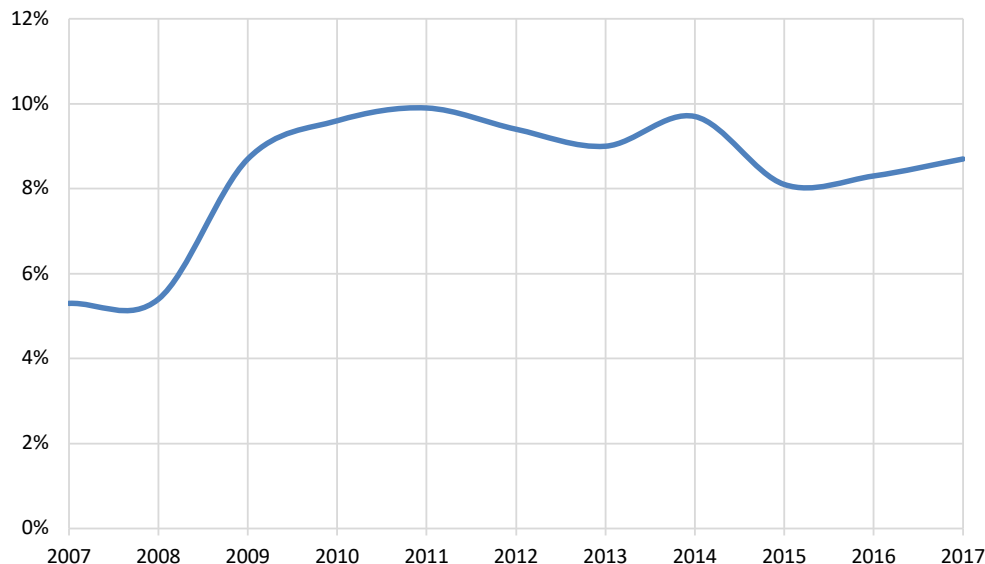


The unemployment rate in Finnish forest industry increased radically after the recession in 2008. The unemployment was close to 5% before 2009 and almost reached 10% in 2011. In 2017 the unemployment rate in forest industry was close to general unemployment level, 8.7%, so there is plenty of educated workforce available (Figure 1.14).



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Figure 1.14 Unemployment rate in the forest industry in Finland, 2007-2017



Source: Natural Resources Institute of Finland

1.2.2 Level of education and the skill levels required

General education level is high in Finland as the public educational system is good. Schools from the start of the pre-school until the end of the university are free. After the secondary school, students can continue either to upper-secondary school, which prepares students for higher education, ending in matriculation examination, or to vocational school. Both upper secondary school and the vocational school take approximately 2 and a half years.

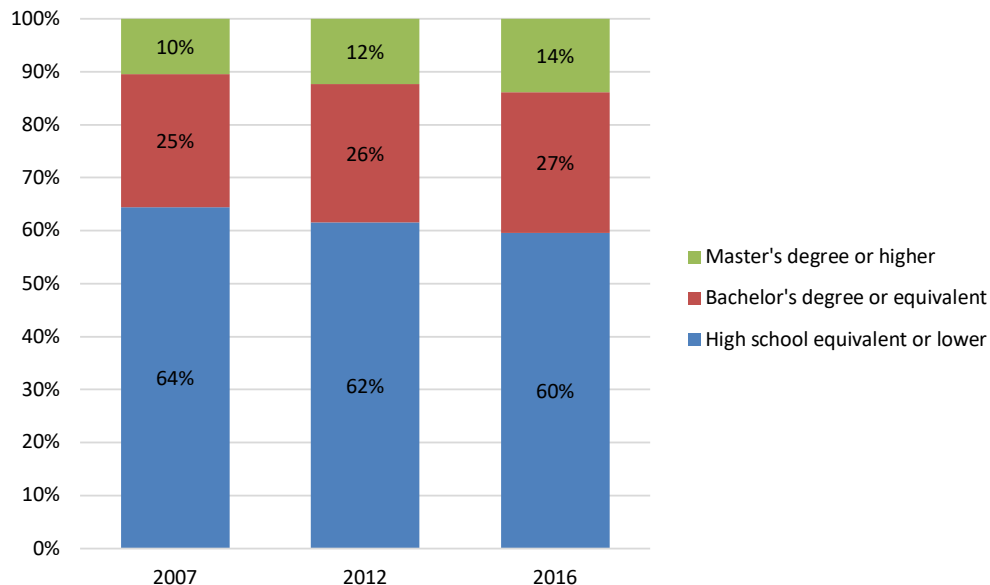
After the secondary stage, people have the opportunity to apply to higher education, either to higher vocational school that is defined still as secondary education, applied university or university. The applied university is approximately 2.5 years, while the university is by assumption 5 years, divided to 3 years of bachelor studies and 2 years of master's studies ending in a master's thesis. University students often study both the bachelor's and the master's degree together.

Educational level is reported for all the people between 25-65, which means that many young people are still studying the higher university degree (Figure 1.15). Furthermore, senior people born before the 1960's distort the statistics, as the share of university degrees in their age classes is much lower than in the younger classes.



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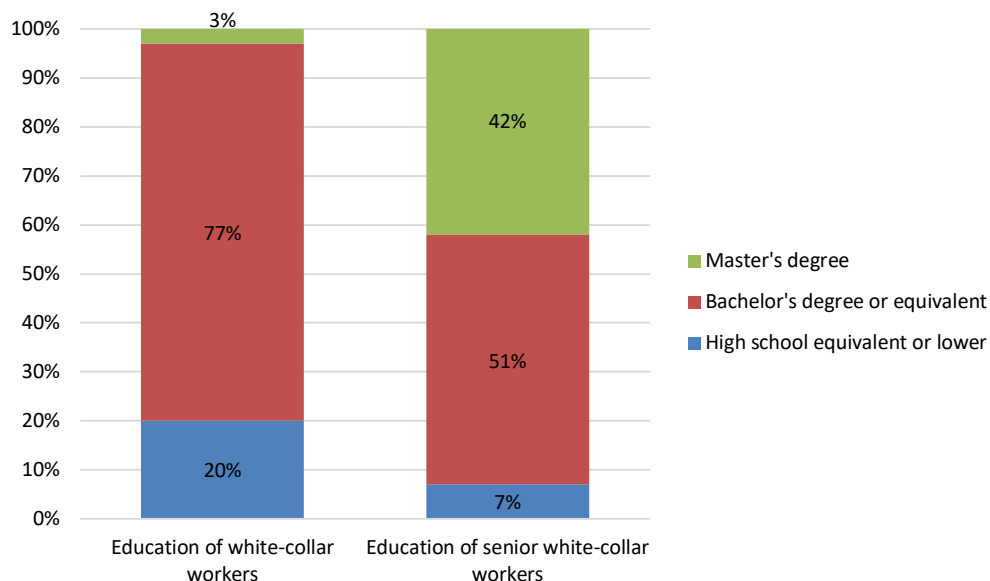
Figure 1.15 Education level of all people above the age of 25



Source: Tilastokeskus (Statistics Finland)

The majority of white-collar workers in forest industry have a tertiary level education, i.e. applied university degree or higher (college or higher) (Figure 1.16). Over 40% of the senior white-collar workers have a master's degree, while the number is less than 5% for the white-collar workers.

Figure 1.16 Educational level of the (lower) white-collar workers and senior white-collar workers in the forestry sector 2017



Source: Finnish Forest Industries



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1.2.3 Typical labor costs

Finland is a social democracy, where the state takes responsibility for funding and organizing public healthcare, education, pension system and social security. Social security costs are therefore high and paid partly by the employer. On average, the social security cost is 30% cost addition to the direct earnings from the employer perspective. Workers pay progressive tax from their salary, which is approximately 30% for average salary.

Blue-collar workers in pulp and paper industry earn more than their counterparts in some other sectors. The process workers work in three shifts, gaining extras from the night and weekend shifts. Labor costs of the white-collar workers can vary a lot depending on their education and work position, but is high on average, as in export industry generally.

Table 1.3 Structure of labour costs in industry and construction sector in 2012

Cost item	%
Direct earnings	59.44%
One-off pay components	7.70%
Contributions to personnel funds	0.05%
Remuneration for days off	10.18%
Cost of fringe benefits	1.12%
Social security costs	20.20%
In-service training costs	0.49%
Other labour costs	0.82%
Labour costs before employer subsidies	100%
Employer's subsidies	-0.04%

Source: Tilastokeskus (Statistics Finland)

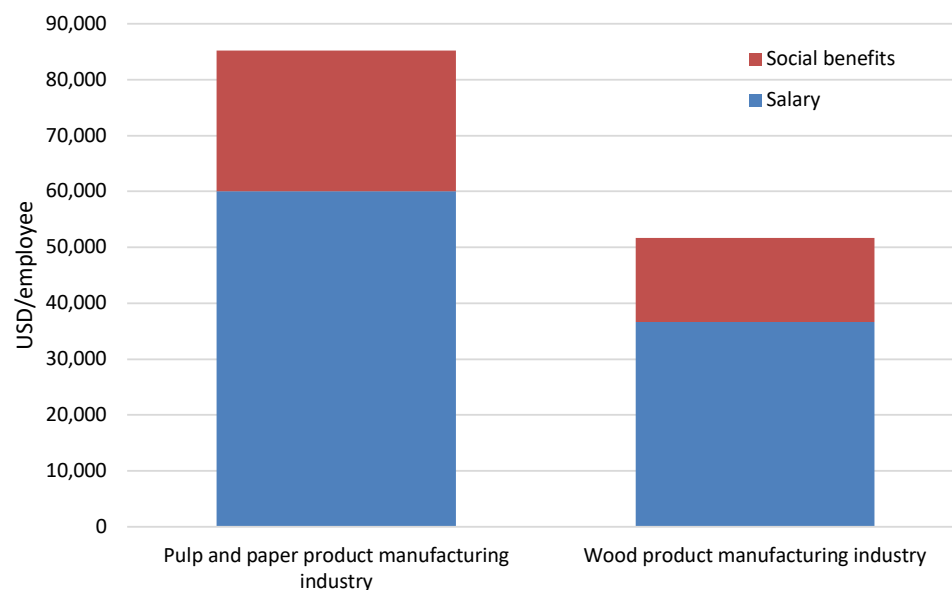
Total salary costs are higher in pulp and paper industry than in sawn industry. The total salary costs per employee in P&P sector were approximately 85 000 USD/worker and the sector employs 20 000 people in Finland (Figure 1.17). Simultaneously, the total salary costs per employee in sawn industry were on average 52 000 USD/worker and the industry employs 21 000 people in Finland.

Production per employee in P&P sector in 2017 was 1 057 tonnes, as the total P&P production was 21.14 million tonnes and total count of workers was 20 000 people. In the solid wood industry, the production per employee was 623 m³ per employee, because the total production of sawn wood and veneer was 13 million m³ and the sector employed 21 000 people.



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Figure 1.17 Average annual labour costs of workers in sawn industry and P&P industry (2016)



Source: Finnish Forest Industries and Indufor database

1.3 Regulatory climate

Principles of Sustainable Forest Management

Finland is committed to implement international conventions and European Union directives and regulations in the management of forest resources. The main international agreements Finland is part of include Convention on the Conservation of European Wildlife and Natural Habitats (Bern convention 1979), the United Nations Convention on Biological Diversity (CBD 1992), the Pan-European Biological and Landscape Diversity Strategy of the co-operation process between European environmental ministries (PEBLDS 1995), and the resolutions of the Ministerial Conferences on the Protection of Forests in Europe from 1993 to 2011 (FOREST EUROPE)

In practise the most significant EU directives having an impact on forest management through national legislation are EU Habitat (92/43/EEC) and Bird (2009/147/EC) directives and Natura 2000 Programme. The directives are implemented through national legislation on nature conservation and forest management. They define the main restrictions on forest use at the landscape level.

In addition, Finland has actively developed and implemented the inter-governmental Pan-European criteria and indicators (C&I) for sustainable management of forests first adopted in Lisbon in 1998 and updated in Madrid 2015 (Box 1). Finland has not yet updated its national C&Is to comply with the revised Pan-European criteria

The reporting to the criteria give an overall picture of the level of sustainable forest management of the country and highlights trends as well as strengths and areas for improvement. National evaluation has been carried out five times and the last update was done in 2012. The results are published in the *State of Finland's forests* reports.



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Box 1: Finland's Criteria for Sustainable Forest Management

Description of forest policy and measures to promote and control forest management

Criterion 1 Forest resources

B1 Preservation and increase of forest land

B2 Maintenance of carbon balance in forests

Criterion 2 Health and vitality

B3 Maintenance of health and vitality of forests

Criterion 3 Productive functions

B4 Safeguarding wood production

B5 Safeguarding and increasing services and non-wood products

Criterion 4 Biological diversity

B6 Safeguarding and protecting biodiversity of forests

Criterion 5 Protective forests

B7 Maintenance and increasing of the protective functions of forests

Criterion 6 Socio-economic functions

B8 Maintenance of the economic viability of forestry

B9 Improvement of employment and occupational safety in the forest sector

B10 Safeguarding the opportunities of the public for participation

National Forest Strategy 2025 sets the policy level objectives and measures for competitive forest sector that promotes active forest use in an economically, environmentally and socially diverse and sustainable manner. Regional forest programs specify the targets and measures at a local context.

Biodiversity protection is enhanced through statutory protection areas or areas with restricted use (e.g. Natura 2000 network). In addition, voluntary biodiversity protection is encouraged through a financing program (METSO) that compensates forest owners of biologically valuable areas. The program has been popular, but its efficiency is dependent on the level budgeted funds.

Legislation on Forest Management

Nature conservation legislation, administered under Ministry of Environment, requires protection of the areas that are deemed biologically the most valuable. In principle, no commercial forestry is allowed on these areas. The Forest Act, administered under the Ministry of Agriculture and Forestry, is the law that controls forest management for timber production. It also includes provisions to safeguard valuable small habitats in forests and – along with other laws and acts creates a solid framework for securing sustainability of forest management at the national level. In addition to the Conservation Act, the Forest Damages Prevention Act, Act on Water Resource Management, legislation on landscape and municipal planning and several other laws stipulate on forest harvesting in special areas (Box 2).

The Forest Act was revised in 2014 and the current law allows forest owners to apply a broader scale of management regimes that reflect better their management objectives. The law still prohibits management that destroys the productive capacity of the stand, but it allows un-even aged forest structures and harvesting of younger stands with smaller medium diameters, which may become interesting to produce wood for biomass industry. The revision process was highly debated by stakeholders and NGOs claimed that removal of age/diameter limits will intensify harvesting which will threaten biodiversity in forest ecosystems.



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Box 2 Legislation Regulating Forest Management

Forest Act (1093/1996)
Forest Decree (1200/1996)
The Law on placing timber and timber products on the market (897/2013)
Forest Damages Prevention Act (1087/2013)
Act on Plant Protection Products (1563/2011)
Act on Commerce of Material for Forest Regeneration (242/2002)
Nature Conservation Act (1096/1996)
Water Act (587/2011)
Environmental Protection Act (86/2000)
Outdoor Recreation Act (606/1973)
Act on Metsähallitus (State Forest Service) (1378/2004)
Reindeer Husbandry Act (848/1990)
Act on the Financing of Sustainable Forestry (1094/1996)
Wilderness Act (62/1991)

Legislation on Sustainable Biomass Production

The national Act on biofuels and bioliquids (393/2013) transfers the requirements of the EU Renewable Energy Directive (2009/28/EC) into national legislation.

The Act is based on Articles 17-19 of the Renewable Energy Directive and grants the Finnish Energy Authority the responsibility for overseeing the enforcement of the Act. The Act (Articles 6-10) specifies the criteria for sustainable biomass production for biofuels as follows – biofuels and bioliquids comply with the sustainability criteria once:

- they substitute fossil fuels releasing GHG emissions
- their production does not involve raw material which originates from biologically diverse areas
- their production does not imply land use changes of areas with high carbon content
- raw material procurement does not lead to drying swamps
- agricultural raw material procurement complies with EU policies regarding agriculture and environment.

The Energy Authority approves sustainability systems of companies or individuals involved in production, import or use of biomass for biofuels or bioliquids. The Energy Authority has developed a sustainability criteria guide for operators, where it specifies national applicability of sustainability criteria and provides guidance for filling in applications for approval of sustainability systems.

The Energy Authority also accredits the verifiers that monitor the quality and implementation of sustainability systems adopted by the operators. It also provides the preliminary information on classification of the biomass into waste, leftover, inedible cellulose or lignocellulose.

The future EU decisions on the sustainable solid biomass production will have a strong impact on Finnish forest-based biomass production, especially if the requirements restrict woody biomass harvesting as a side product from ordinary forest management. The EU Renewable Energy Directive is currently under revision to include solid biomass fuels.

Enforcement

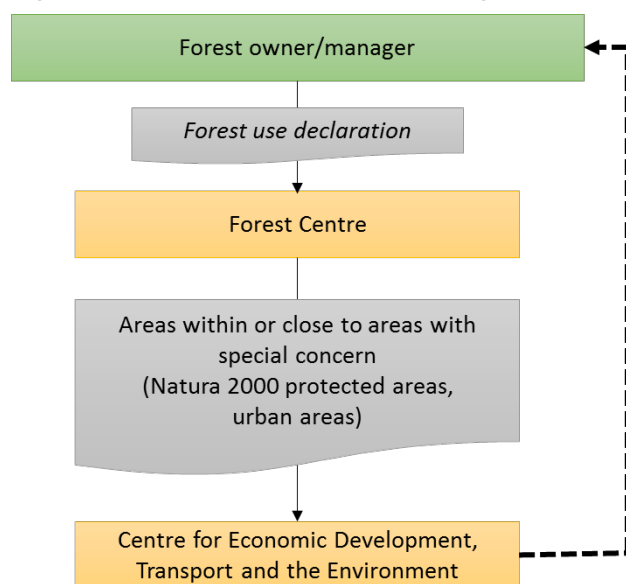


Forest Use Declaration

The control of forest use and timber harvesting is based on statutory notice forest owner/manager shall make on the planned operation. Authority may prohibit the operation or request further information within a given time frame of two weeks. If it does not react within the given time, the operation may proceed. No permit is required.

According to Section 14 of the Forest Act of Finland (1093/1996) forest owners inform the Forest Centre (i.e. authority) on a planned harvest by submitting a Forest Use Declaration 10 days prior to harvesting (but no earlier than 3 years) in a written or electronic form (Figure 1.18). Declaration is valid for 3 years.

Figure 1.18 The Process of Submitting a Forest Use Declaration



Section 9 of the Forest Decree (1200/1996) specifies which type of information shall be included into the declaration – location of the harvesting site, key information on the forest type and stand maturity, purpose and type of planned logging and subsequent regeneration activities (Table 1.4). In addition, forest owners or use rights holders must inform about any ecologically valuable habitats present in the planned harvesting area if they are the habitat types protected by Forest or Nature Conservation Acts. Authorities have site specific information on ecologically valuable habitats and protected areas.

If planned harvest is located on or neighbouring to an area of special concern (e.g. Natura 2000 network, protected areas, municipal planning area), the Forest Centre may notify the Centre for Economic Development, Transport and the Environment (ELY Centres), where also regional authorities on environmental protection operate. ELY Centre verifies compliance of operation with other relevant laws and may add conditions for harvesting.



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Table 1.4 Mandatory Supply Chain Level Information for Harvested Timber in Finland

Site identification	Management	Stand characteristics	Nature values*	Planned activities
↓	↓	↓	↓	↓
Owner and tenure rights holders	Info on voluntary forest management planning	Age, development class or average diameter	Ecologically valuable habitats	Regeneration methods and species
Site location and ID codes	Purpose of planned harvesting	Soil productivity		Soil preparation
Maps		Soil type		Seedling stand management

The forest use declaration is filed to the Forest Centre (authority) and confirmation that the declaration is submitted as appropriate and no further notice is given from the Forest Centre or ELY Centre is an evidence on legal sourcing.

The forest use declaration is not required if there is an intent to harvest wood for household use or within margin zones of powerlines, railways, ditches, roads etc. Neither it is required for harvesting small-sized tree stands. According to the Decree on Sustainable Management and Use of Forests (1234/2010) Average diameter of small-sized tree stands does not exceed 13 cm at the height of 1.3 m.

Voluntary Actions for Sustainable Forest Management

Voluntary Guidelines

The **Best Practice Guidelines for Sustainable Forest Management** are voluntary but establish the basis for sustainable forest management especially in private forests that produce the majority of traded timber. The guidelines give practical interpretation of legal and other up-to-date requirements on sustainable forest management. The guidelines are developed by the expert organisation TAPIO with the support from the Ministry of Agriculture and Forestry. The guidelines are voluntary, nevertheless they are largely applied by forest owners and entrepreneurs.

The main purpose of the guidelines is to help small-sized private forest owners to apply competitive and sustainable management options that are aligned with their objectives and yet comply with legislation. The guidelines are developed in cooperation with relevant stakeholders and they also aim to comply with the requirements of the Finnish PEFC forest certification standard. The guidelines are regularly revised, and the most recent version was published in 2014. In addition to the general forest management guidelines, TAPIO also published guidelines for **Peatland Management, Maintenance of Forest Roads, Profitable Timber Production, Energy Wood Harvesting and Nature Management in Commercial Forests** in 2015-2016.

State forest organisation Metsähallitus applies own guidelines **Environmental Guidelines to Practical Forest Management**. The guidelines take into consideration of the special role of state forests in provision of timber and various types of services to a wide range of citizens. Despite of high social and environmental commitments management of state forests shall be cost efficient and profitable. The guidelines also address production of energy and its environmental and economic feasibility. The **Environmental Guide** outlines the crosscutting principles of protection of biodiversity and ecosystem services in production forests. Metsähallitus engage regional and local stakeholders in drafting of strategic natural resource



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plans. Public is also asked to comment draft versions. Stakeholders have also access to more detailed management and harvesting plans.

Institutional and industrial forest owners usually have own management guidelines that ensure their compliance with laws, and forest certification requirements (either PEFC or FSC).

Forest certification

In Finland about 85% (16.5 million ha) of commercial forest area has a PEFC forest management certificate whereas the share of FSC certified forests is about 8% (1.6 million ha). The figures do not include protected forests.

Forest certification is voluntary and issued certificates provide one evidence on sustainable origin of wood. Both national PEFC and FSC standards, set requirements that go beyond legal requirements. There are differences between the standards but both set management restrictions on biologically valuable habitats and buffer zones. They also require measure to protect forest health but are strict on chemical use. On social sustainability, they are more inclusive when it comes to public participation and consideration of the rights of indigenous people. They also set provisions on training of forest owners and workers, as well as on educating the people on forestry.

Wood building

Fire regulation has been a limiting factor in Finnish wood building, Fire regulation was changed in 1997 to allow wood to be used as hull and front material in houses that are up to 4-stories tall. The regulation was revised in 2011 to allow using wood as main material in living and work buildings that are up to 8-stories tall. Furthermore, the new rules allow building of public buildings, e.g. schools and department stores that are at maximum 4-stories tall. Wood is used to build detached houses, but its use remains small-scale in larger apartment buildings. Concrete building can be more cost-efficient when a building is taller than 2-stories.

Furthermore, wood building is regulated by EN Eurocodes, which determine load-capacities for different building materials. The capacities include different strains such as snow, wind, heat, accidents and lift.

CE marking for construction products came into effect in EU in 2013. The CE markings are harmonized in EU and they are obligatory for products that are listed in the standard and sold within EU. The CE markings are proof that the products fulfil certain criteria. The producer can put a CE tag to a product when it fulfils the criteria related to manufacture, product testing and quality control. The attributes reported in CE marking vary by product and often require a confirmation by a third-party auditor. Wood construction materials that require CE marking include factory made wood fibre products, wood-based panels for use in construction, glued laminated timber and glued solid timber, strength graded structural timber with rectangular cross section, and structural laminated veneer lumber (LVL).

Other regulations that are not directly connected to wood building but building in general generate many requirements to for example emergency exits, accessibility and energy efficiency.

Emission rights

Certain energy intensive industry and all large power plants in EU have to compensate carbon emissions through emission rights. Some forest industry processes are part of the emission rights market. Part of the emission rights are distributed for free, but the rest need to be bought in the carbon market. The emissions rights are admitted by the Energy Authority in Finland. In 2017, the cost of emission rights fluctuated from almost 4 € / tonne to over 8 € / tonne. The cost of emissions rights is expected to increase in the future.

However, compensation benefits are given for certain industries, including forest industry, to cover some of the costs related to emissions rights. The compensation benefit is approximately 40% of the cost of emissions rights.



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Sulphur directive

Sulphur oxide emissions from ships are regulated by EU Directive 2016/802. It establishes limits to the sulphur content of land-based and marine fuels. Marine transport can fulfil the restrictions by using fuels that have low sulphur contents or installing exhaust gas cleaning systems. Low sulphur heavy oils are much more expensive than conventional heavy oils and installing gas exhaust systems increase costs, which transmit to freight costs. It is expected that in the near future the cost of low sulphur heavy fuels settles close to the cost of conventional heavy fuels.

Conclusion

Overall the regulatory climate is neutral for forest industry in Finland. Environmental and building regulations are similar in many European competitor countries, but can be an disadvantage compared to more distant competitors.

1.4 Taxation

The general value added tax in Finland is 24%. The value added tax is 0% for export deliveries. Companies can refund the added value taxes they have paid from products and services from their own VAT.

Capital gains tax influences capital income of shareholders, but more importantly, from forest sector perspective, it affects wood-selling too. Wood selling is treated as capital gain and the seller has to pay capital gain tax from the income. The capital gain tax is 30% up to yearly capital income of 30 000 EUR. The tax increases to 34% for the part that exceeds 30 000 EUR.

Industry pays general property tax for land and buildings they own. Forest land that is used for forestry is exempted from the property tax. The property tax depends on the value of the property and its location (municipality). The property tax is 0.93-2% of the value of the property. According to the tax authority, the average property tax is 1.16% in Finland.

Corporate tax is paid from the earnings before interest and taxes (EBIT). In 2014, the corporate tax was reduced to 20% of the EBIT. The corporate tax is smaller in Finland than in many main competitor countries.

Energy tax is paid for production of liquid fuels, electricity, and other certain fuels. The exact energy taxes are nationally decided in laws 1472/1994 and 1260/1996. However, the minimum level is harmonized in EU based on directives 2003/96/EY and 2009/29/EY. Consumption of liquid fuels and electricity are taxed. Industry pays lower tax rate for electricity (0.703 eurocent/kWh) than households (2.254 eurocent/kWh).

Production taxes exist for all liquid fuels. The taxes are smaller for biofuels than for fossil fuels, because part of the tax is paid according to carbon emissions. Furthermore, use of fossil fuels are taxed heavily, except for diesel, which benefits from tax deductions.

Icebreakers are required in the winter to transport sea cargo. Industry pays fairway tax with which the icebreaking is financed.

As a conclusion, the tax level is high in Finland and impacts negatively on forest industry, especially together with high labour and social costs.



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2. TIER 2 – GENERAL ANALYSIS

2.1 Policies

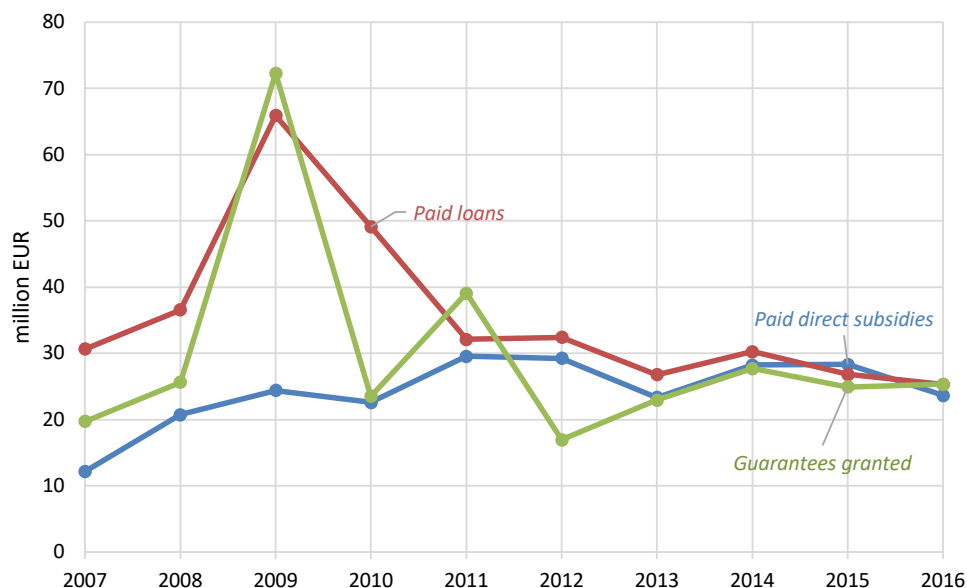
The National GHG Emissions strategy that follows objectives and actions agreed in EU, aims to increase the share of renewable energy sources to over 50% of the total energy consumption in 2020's. The strategy includes actions and objectives to increase the use of wood fuels, especially by-products and to refine value-added fuels from them. The National Energy and Climate Strategy for 2030 aims to increase the share of biofuels in road traffic to 30% by the year 2030. The policies will impact forest industry and will likely call forth new subsidies.

The Act on the Financing of Sustainable Forestry (Kestävän metsätalouden rahoituslaki) aims to guarantee tending of young forests and their growth. In 2015, forest owners gained 1.6 billion euros as revenue from selling wood and spent 223 million euros to silviculture, of which 65 million euros were state subsidies.

Subsidies to sustainable forestry are allocated by Finnish Forest Centres to silvicultural and forest management activities that are poorly profitable. Tasks that can benefit from the subsidy include tending of seedlings and young stands, energy wood collection, maintenance of forest road network, management of peatland forests and fertilization to correct nutritional defects. Only private individuals can benefit from the Act on the Financing of Sustainable Forestry. The funding is limited.

The forest industry receives direct subsidies, loans and guarantees. In 2016, the subsidies totalled 82 million USD (Figure 2.1).

Figure 2.1 Subsidies to forest industry 2007-2016



Source: Tilastokeskus (Statistics Finland)

Production of renewable energy is subsidized with feed-in tariffs. Wood chips, biogas, and fuelwood use for energy production benefit from the tariffs. The feed-in tariff is paid according to the difference between the desired price and the market price of electricity.

Forest industry benefits from several energy subsidies in addition to the emission right compensation. Forest Industry is one of the largest beneficiaries of the emission right



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compensation. Diesel is subsidized against petrol. The energy content tax for diesel has been reduced by 25.95 eurocents per litre. Furthermore, industry pays reduced tax for electricity compared to households and public sector. Electricity tax for them is 2.254 eurocents per kWh, while the industry pays only 0.703 eurocents/kWh. Moreover, the energy intensive industry, including forest industry, can refund some of the energy taxes.

The forest industry benefits from many direct subsidies and tax deductions, which benefit the industry, but constitute a small share of the total industry turnover. Policy can be defined as beneficial for the forest industry.

2.2 Access to financing

Finnish bank sector is stable. Existing big forest industry companies haven't had difficulties in getting loans to large investments. There are less private equity investors in Finland than in other European regions however. Large Nordic banks, e.g. Nordea and OP, finance private sawmills. New financiers are arriving from China.

The state may provide loan guarantees to investments. Finnvera, which is the state owned official Export Credit Agency can provide loans to investments in special circumstances, but it mainly provides export credit guarantees. Business Finland finances innovation, pilot projects and R&D. Long-term credit rating of Finland is AA+/Aa1, which is the second highest rating level, so the interest rates of state loans are moderate.

EU's NER 300 programme is the world's largest funding programme for environmentally safe carbon capture and storage and innovative renewable energy technologies on a commercial scale. This EU finance is supporting existing bioproduct mill investment in Kemi, Finland, and leveraging new private equity.

In terms of financing, Finland benefits from the stability of Euro. Loan interest likely remains low in the future, as the Euribor (Euro Interbank Offered Rate), the daily average reference rate at which Eurozone banks offer to lend funds to other banks in the euro money market, has remained negative during the past two years. The inflation rate in Finland remains lower than the average rate in EU. In 2017, the inflation was 0.7% in Finland, based on consumer price index.

Access to financing does not limit forest industry development in Finland, but it neither provides definitive advantage compared to competitors. Therefore, it can be defined neutral factor in relation to forest industry investments.

2.3 Logistic infrastructure and transportation costs

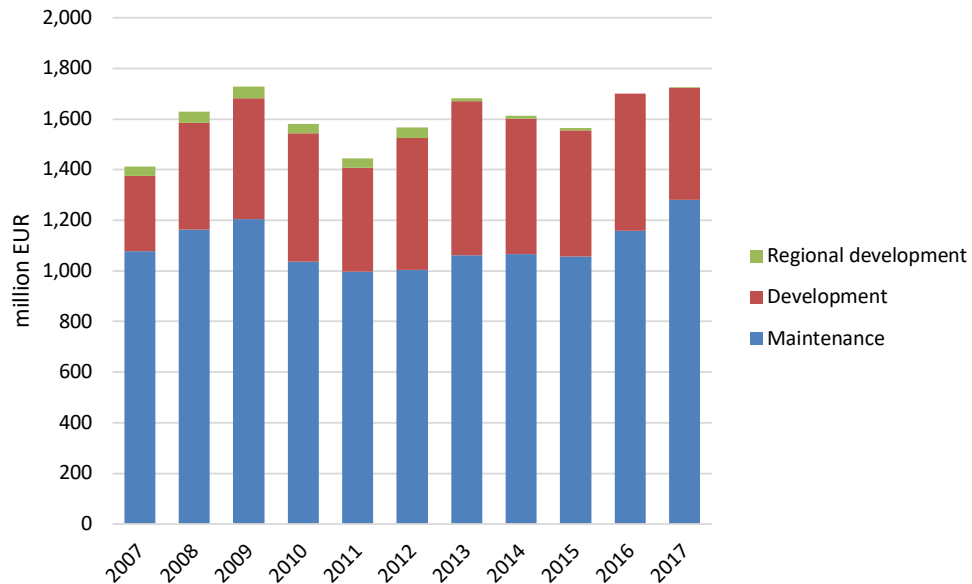
Finland has good logistic infrastructure. Maritime transportation can be used year around at the main harbours at Baltic Sea, due to existing icebreaking fleet, and train network connects Finland to Russia. Forest Industry uses over 15 seaports to export and import. Within Finland, the train network and road network are extensive apart from the northernmost Finland. Trucks, together with their cargo, can weight up to 76 tonnes if they have nine axels. Therefore, trucks that have 8 or 9 axels can carry heavy cargo of more than 40 tonnes, which has decreased unit costs for transportation. However, the bridge restrictions limit transporting the heavy loads across some areas and increase transportation distance due to forced detours.

The state is responsible for maintaining and developing motorways, trunk roads and other primary roads. Moreover, the state maintains and develops all the railways (Figure 2.2).



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Figure 2.2 State finance to road and rail network maintenance and development, 2007-2017



Source: Liikennejärjestelmä.fi

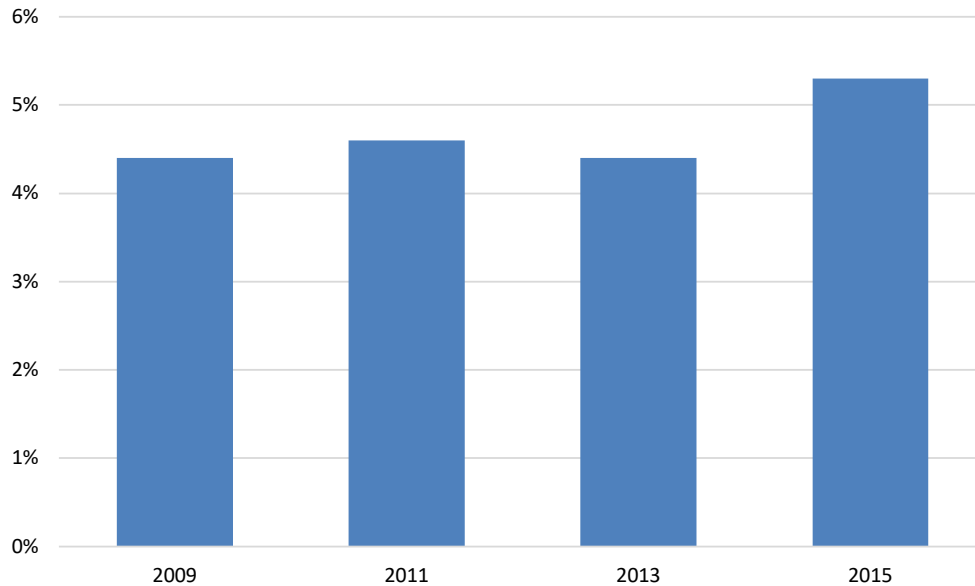
The forest road network is one of the most extensive in the world, providing good access to forests. The forest roads are built by the forest owner, often before the end harvest to facilitate harvesting. The Act on the Financing of Sustainable Forestry provides subsidies to maintenance of forest roads.

Logistic costs are often small compared to other costs, especially labour costs. Inclusion in EU enables free trade between the member countries. The share of transportation costs of the revenue in the forest industry are close to 5%, while the whole logistic costs are approximately 15-20% (Figure 2.3). Even as logistic costs are small compared to many other costs, logistic costs and performance are higher in Finland than in many competitor countries, such as Sweden and Germany. Finland is also located farther away from the global market than its main competitors in terms of transport distance.



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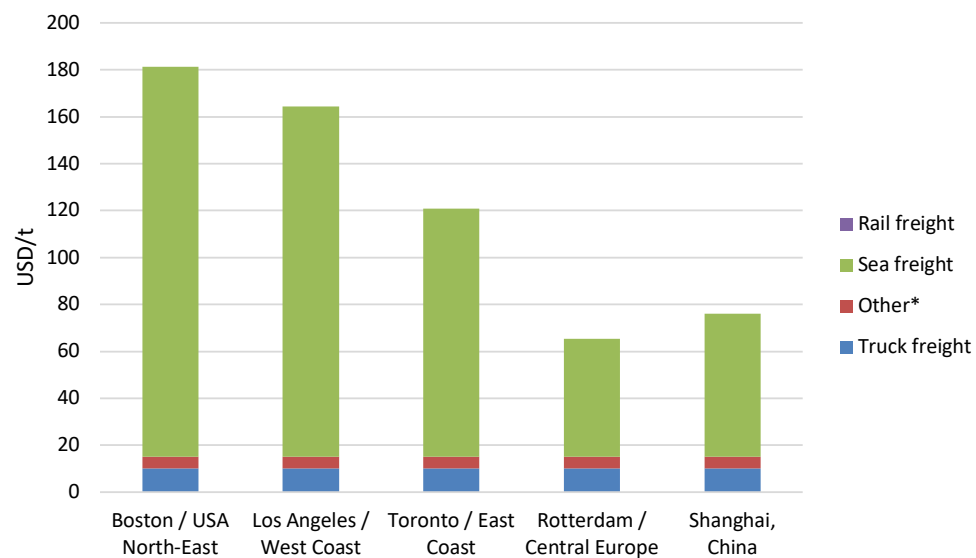
Figure 2.3 Share of transportation costs of the revenues in industry



Source: Finland State of Logistics, 2016

Finland has low inland transportation costs due to relatively short distances from inland to ports as well as good road infrastructure (Figure 2.4). Sea freight costs are high but still relatively competitive to European and Chinese markets. Since 2017, Finland has also used railway connection to export pulp and paper to China. The rail transportation receives export subsidies from a Chinese province.

Figure 2.4 Transportation costs



(*) Port costs, unloading and loading.



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As a conclusion, the logistic infrastructure and costs are not considered limiting factors in Finnish forest industry. Logistic infrastructure, especially the forest road network, and weight regulation, provide advantages against competitors, but the location of Finland increases maritime distances and costs.



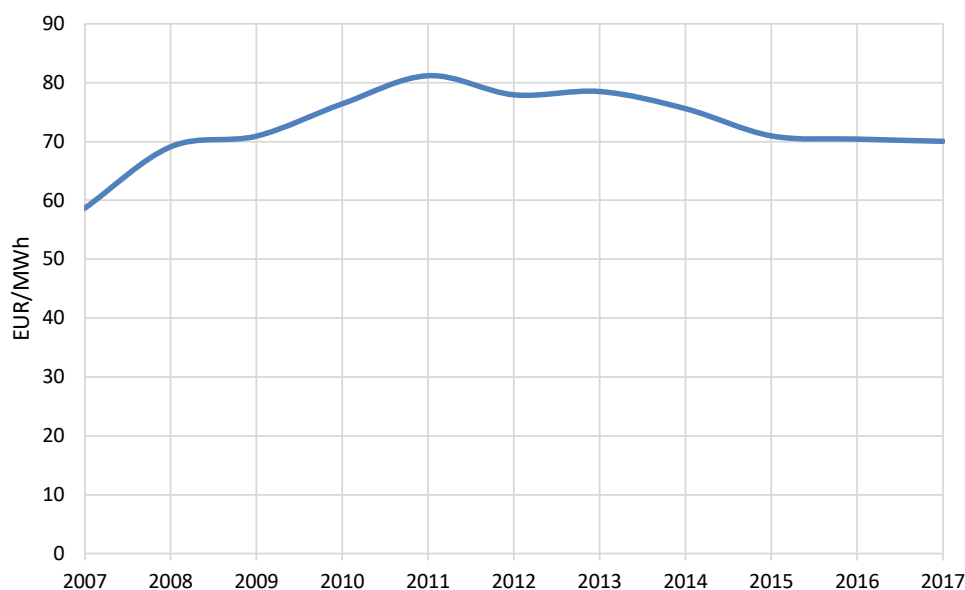
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3. TIER 3 – HIGH LEVEL ANALYSIS

3.1 Energy

Electricity price for companies that use over 2 000 MWh annually is nowadays at 70 EUR/MWh (79 USD/MWh) (Figure 3.1). Forest industry produces approximately half of the electricity they consume. Pulp mills and the new bioproduct mills are self-sufficient in energy and sell excess energy to the network. Often the mills have integrated heat and power plants that use by-products such as bark and black liquor as feedstock. Furthermore, the forest industry has improved its energy efficiency to decrease GHG emissions and cut costs.

Figure 3.1 Electricity price development for companies that use over 2 000 MWh annually, 2007-2017



Source: Tilastokeskus (Statistics Finland)

3.2 Key supplies

Key supplies, such as spare parts, resins and other chemicals are available in Finland thanks to local manufacturers and importers. Finnish suppliers are generally reliable and provide good quality supplies. Most of the supplies are available within EU, which facilitates sourcing, decreases time and increases reliability. Key supplies can be more expensive than in e.g. Central Europe.

Large forest industry suppliers and service providers are present in Finland. For example Valmet, one of the leading service providers for P&P and energy sector in the world, has Finnish origin and is headquartered in Finland. Availability of key supplies has neutral impact on Finnish forest industry.

3.3 R&D

R&D in solid wood industry is small compared to pulp and paper industry. R&D has a decreasing trend in the forestry sector, but it still ranks high in global comparison. The public sector finances universities and research institutions that take part in R&D. Most of the big forest sector companies cooperate with universities in the field. There are three large technical universities

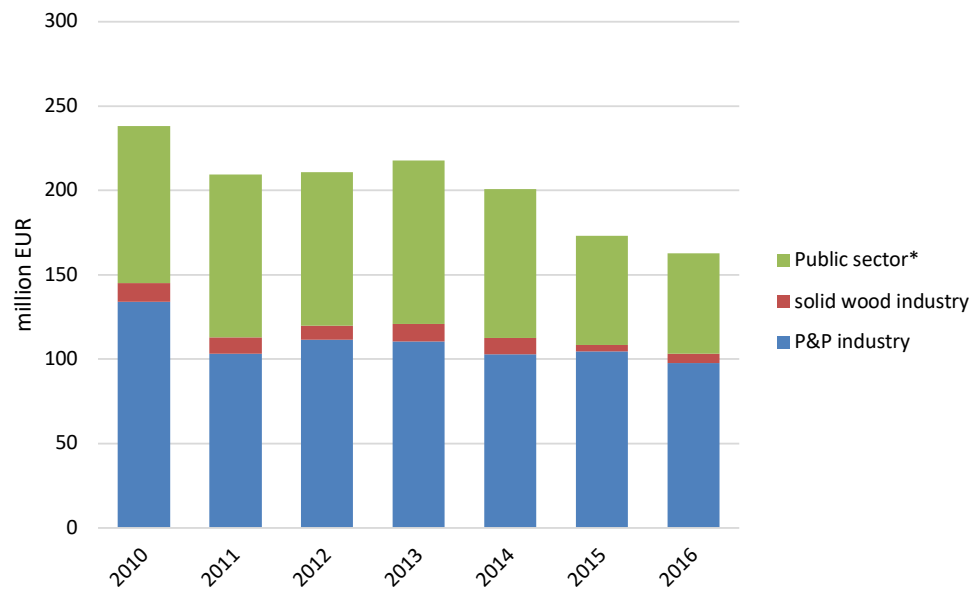


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(institutes of technology) that offer careers related to forest industry. Furthermore, four universities provide careers in technology in smaller extent.

Business Finland provides finance, either as grants or loans, to innovation, piloting and R&D of Finnish companies. The total R&D expenditure in forest industry is EUR 100 million annually, which equals approximately USD 120 million in today's currency (Figure 3.2).

Figure 3.2 R&D expenditure



Source: Tilastokeskus (Statistics Finland)

* expenditure to technical chemistry, material technics, environmental biotechnology and industrial biotechnology.

Annex 2

Germany



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FOR/Maine

Global Market Analysis and Benchmarking Study – Germany

Final Report

Helsinki, Finland
June 29, 2018

8117
ID 122619



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1. TIER 1 – DETAILED ANALYSIS

The products chosen to phase 2 for Germany were MDF, pyrolysis oil and nanocellulose. Phase 1 identified the raw materials for MDF and pyrolysis oil as pulp grade logs and different types of wood processing residues, while forest-based raw materials for nanocellulose are dissolving pulp and bleached or unbleached Kraft pulp. Focus of analyses will be on these raw materials.

1.1 Raw material

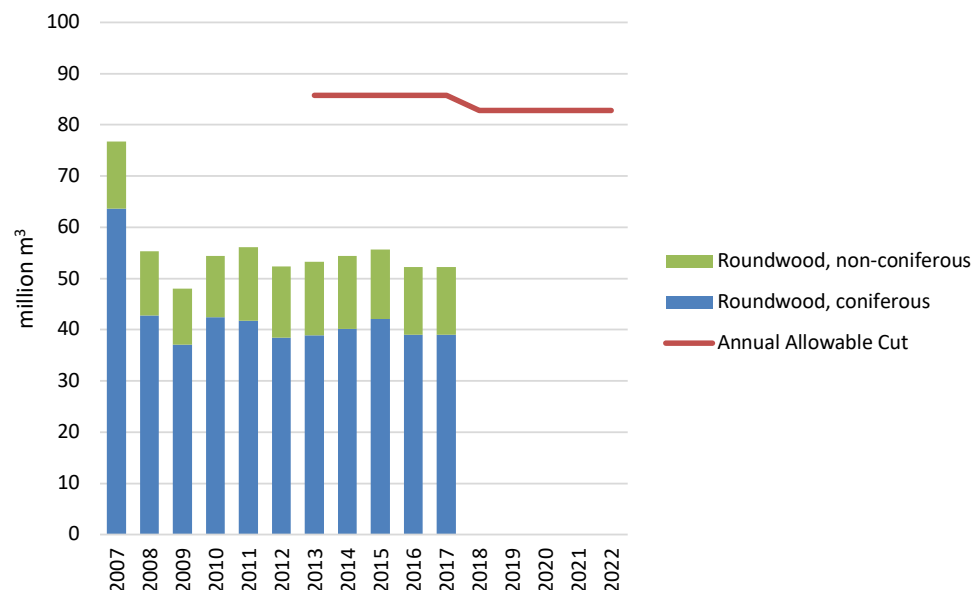
1.1.1 Harvest levels

Two thirds of harvested timber in Germany is used as industrial raw material, while the rest is used for energy production. Approximately 64% of the forest area in Germany is PEFC certified, while 9% is FSC certified.

Harvest levels in Germany have been stable since 2008. Third National Forest Inventory reports that future timber supply of German forests is 20-30 million m³ larger than the current annual harvest volume, which indicates room to increase harvests. Because German forest policy emphasizes non-timber use of forests, major harvest increases are unlikely. Nordic countries and some Eastern European countries are more likely to witness harvesting increases when compared to Germany. Harvesting potential of deciduous trees, beech in particular, will increase in the future, as the proportion of mixed-specie forests will increase.

The amount of firewood harvests is estimated to be 17-30 million m³ annually and a significant share of it occurs for household use in private forests. Household use is not included in the official statistics in Figure 1.1.

Figure 1.1 Harvest volumes and annual allowable cut (AAC) in Germany



Source: FAO stat, Bundeswaldinventur 3. 2017-2022 are predictions based on inventory results.

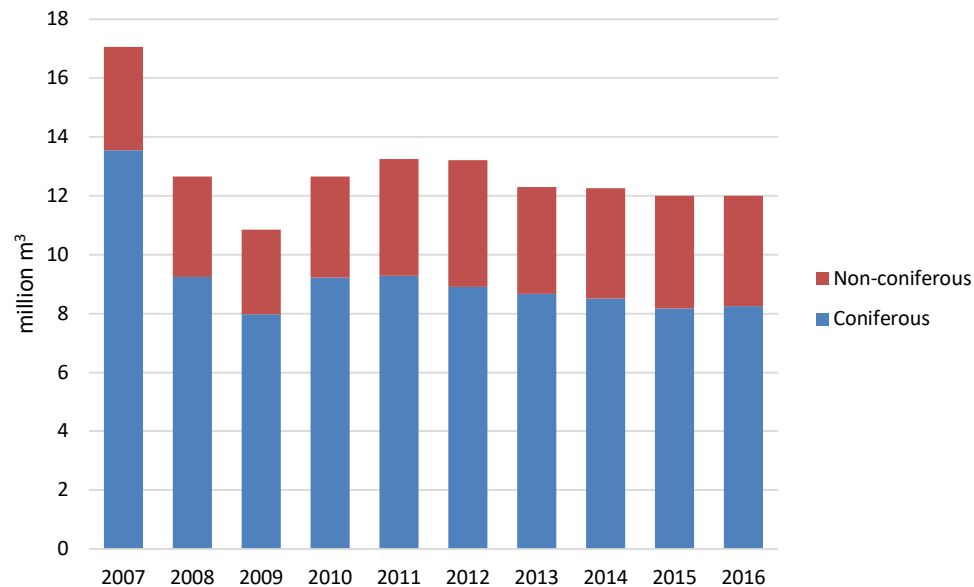
Through the last decade, production of conifer pulpwood has been more than double the production of non-conifer pulpwood. In the future there might be difficulties to meet the demand of conifer pulpwood, as one of the most important principles of German state forest management has been the transition from spruce monocultures to mixed forests.



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Production of pulpwood in Figure 1.2 includes also wood chips that are made directly in the forest (fuel chips for energy).

Figure 1.2 Production of pulpwood and wood chips



Source: FAO stat.

Dissolving pulp and bleached or unbleached chemical sulphate pulp is used as raw material to produce nanocellulose. The most important raw material source for German paper industry is recovered paper with a share of 64.2% (2017) of paper industry raw material consumption. Paper industry's total consumption of chemical pulp was 4.6 million tonnes in 2017, having risen 1 % since 2016. Most of the chemical pulp used by the paper industry is imported to Germany. Potential future investments in nanocellulose would have to compete for the same raw materials with the paper industry. However, production and applications of nanocellulose are in very early phase.

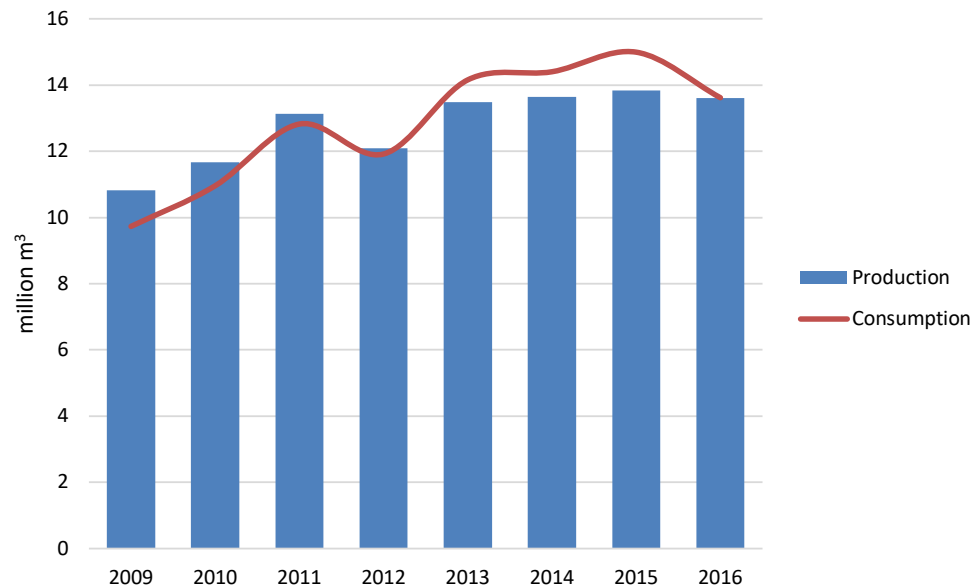
1.1.2 By-products

Figure 1.3 presents production and consumption of wood processing by-products. Chips made directly in forest are excluded from this chart. Wood processing by-products include wood that has been reduced to small pieces (such as chips) and residues from sawmills, veneer, carpentry and joinery production. It also includes the raw material that will be used to pellet production. There is a large particle board and MDF industry in Germany. Those industries, jointly with the pulp and paper industry use almost all the available wood chips, sawdust and planer shavings from the sawmill industry.

Sawmill capacity in Germany is currently not fully utilized. Pressure exists to close down sawmills with weaker competitiveness. Thus, a major increase in availability of sawmill by-products is not likely. Wood based panel capacity in Germany is already operating at high capacity and new major investments are not expected.



Figure 1.3 Production and consumption of wood processing by-products



Source: FAO stat.

1.1.3 Forest ownership

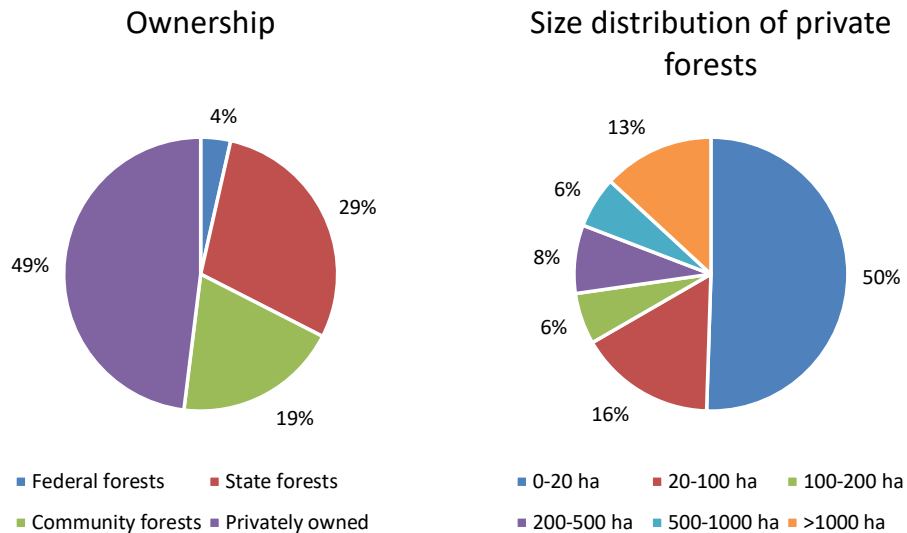
Total forest area of Germany is 11.4 million hectares, with approximately half of the area as privately owned. Federal forests and forests owned by the states comprise approximately a third of the forest area. Key forest management goals of the state forests are to increase the proportion of mixed forests, transfer even-aged forests to multi-storied forest and to maintain variety of forest ecosystem services in addition to timber production. Approximately 91% of all forest area is available for utilization, while 9% is subject to restrictions.

The total number of forest owners in Germany is over two million. Half of the private forests are part of small, 0-20 hectares forest properties and often spread out geographically. The small size of forest properties and the rising share of forest owners who do not manage their forests are challenges which the implementation of Forest Strategy 2020 focuses on. However, potential to increase harvests in small private forest properties exists, if the forest owners become willing to sell the wood.



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Figure 1.4 Forest ownership and size distribution of privately owned forest area



Source: Bundeswaldinventur 3. Note: total forest area 11.4 million hectares.

1.1.4 Delivered wood cost

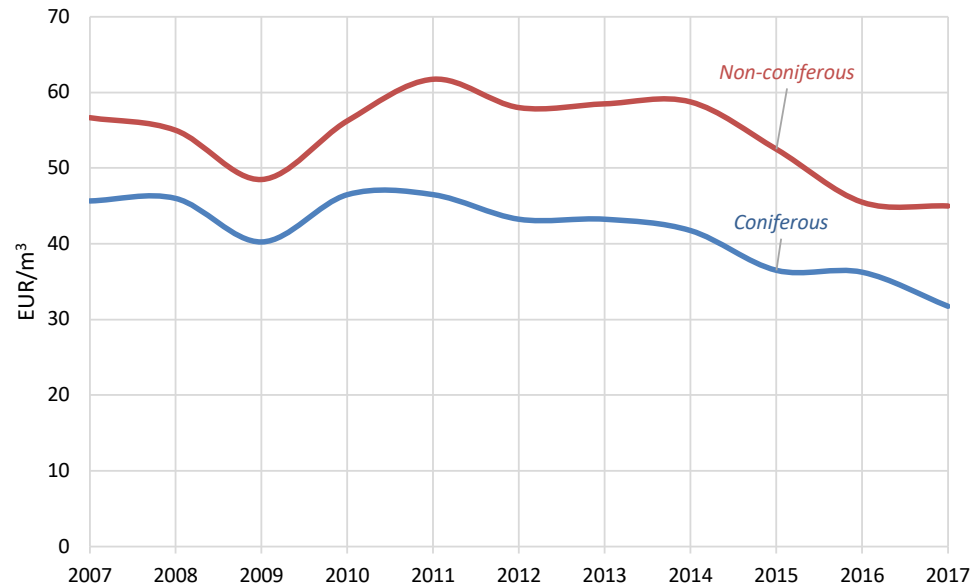
Delivered pulpwood prices declined by 5-15 EUR/m³ between 2010 and 2017 (Figure 1.5). The price of chips in relation to roundwood has increased, which indicates increased demand of chips. Key drivers for chip consumption growth are Germany's investments to renewable energy and heat production. Average cost of harvesting is 14-17 EUR/m³ depending on the tree size. Average cost of forwarding is 6-7 EUR/m³.

In a longer term, the German forest policy aims to convert the monocultural spruce forests to mixed-species forests, which will likely increase the price for spruce assortments.



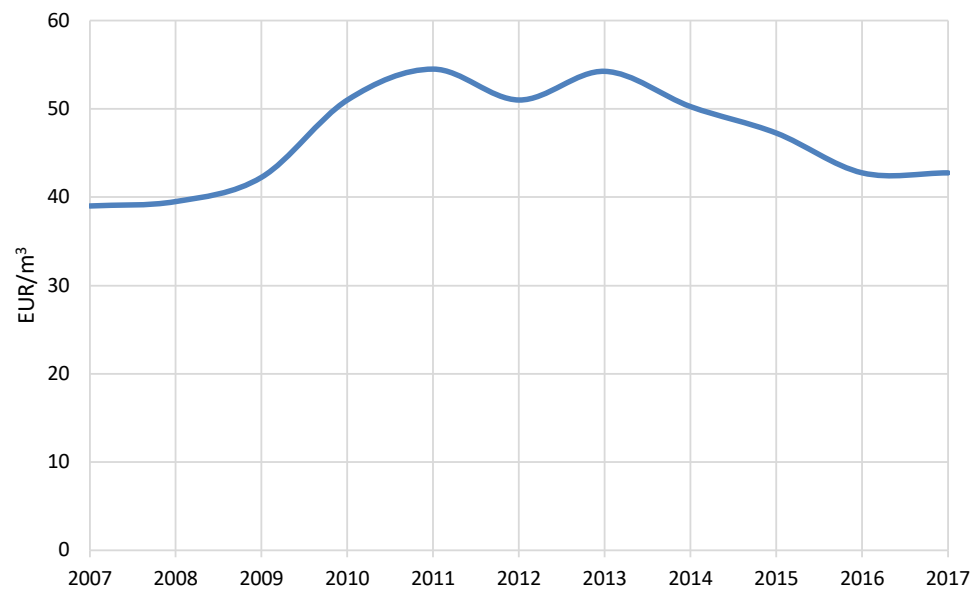
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Figure 1.5 Pulpwood delivered price, 2007-2017



Source: Wood Resource Quarterly

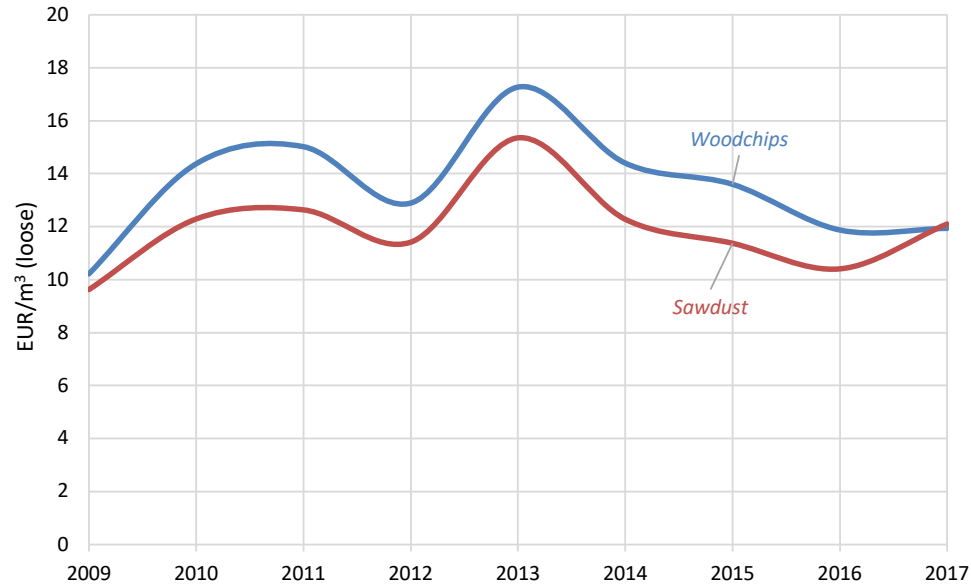
Figure 1.6 Coniferous wood chip delivered price, 2007-2017



Source: Wood Resource Quarterly



Figure 1.7 Price of sawmill residues



Source: EUWID Wood products and panels

1.1.5 Wood procurement practice

The German close-to-nature forest management system is based on selective harvests as clearcutting large areas is forbidden. Instead of the clearcutting system, harvested trees in Germany are selected—giving timber buyers a better overview of the respective assortments. This reduces the interdependence of sawlog and pulpwood supply. Usually harvested timber is sold from roadside, while the most valuable timber assortments are sold via auctions.

1.2 Workforce

1.2.1 Demographic comparisons

The total population of Germany was approximately 82 million people in 2016. Age groups between 45 to 59 years are the largest age groups of the German population. As the retirement age is currently 65 years and 7 months, Germany will undergo an increasing movement out of the labor force in the following decade (Figure 1.8). Urban population accounts for 75.5% of total population, while proportion of rural population is 24.5%. In 2016, the total number of people at ages 15-64 was 54.1 million.

German population was declining during 2004-2011 due to low birth rates, but since 2012 the population has been growing again. The most important reason for the change has been immigration and the higher fertility rate of immigrants. From 2012 to 2016 the birth rate has increased from 8.4 to 9.3 births per 1000 people, reaching highest level in 40 years.

The unemployment rate in Germany is very low and the country has a competitive labor force due to limited pay raises in the 2000's and a highly educated workforce.



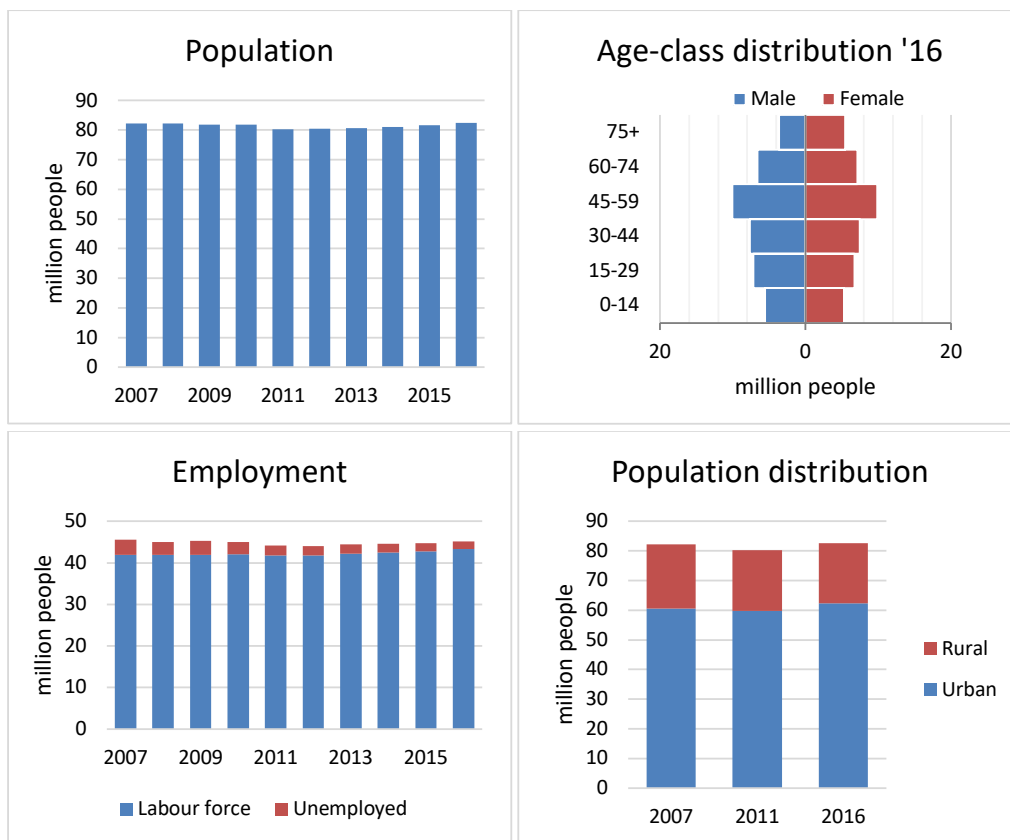
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Table 1.1 Key demographic indicators

Indicator	Current situation
Total population (2016)	82 490 000
Population growth rate (2016)	1.0%
Population urbanization, rural vs urban (2016)	24.5% vs 75.5%
Unemployment rate (2018)	3.4%
Level of education ⁽¹⁾ (2016)	86.5%

⁽¹⁾ Ages 25 to 64, people with higher than secondary school diploma or equivalent.

Figure 1.8 Historical demographic development



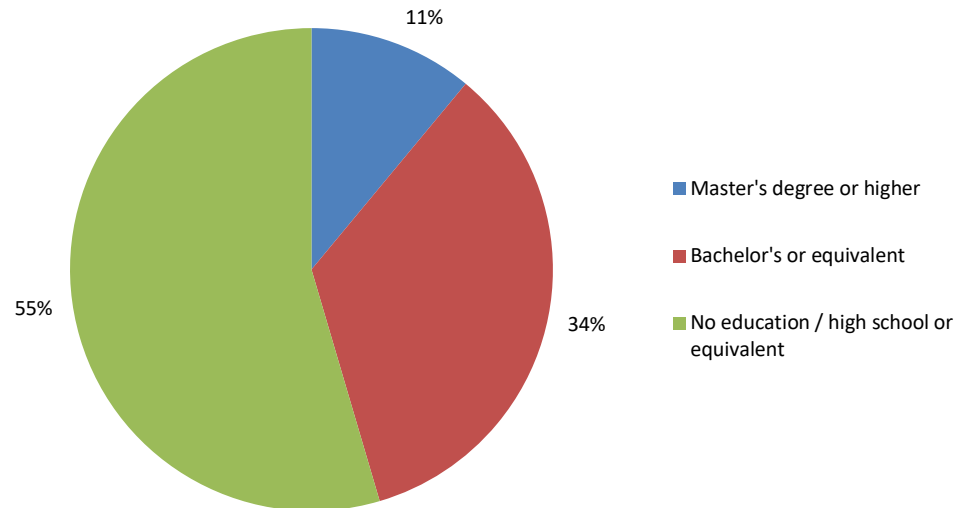
Source: World Bank

1.2.2 Level of education in each competitor country and the skill levels required

The German population is one of the most educated in the world. Currently the employment rate is high. In 2016, 45% of German adults had either Master's or Bachelor's degree education., 55% of adults had completed either primary, lower secondary or upper-secondary education. Upper secondary education means education usually given to people between ages 16-20. Figure 1.10 represents education level of unemployed people. Recruiting skilled labor will become more difficult in the future, since the employment rate is already high.

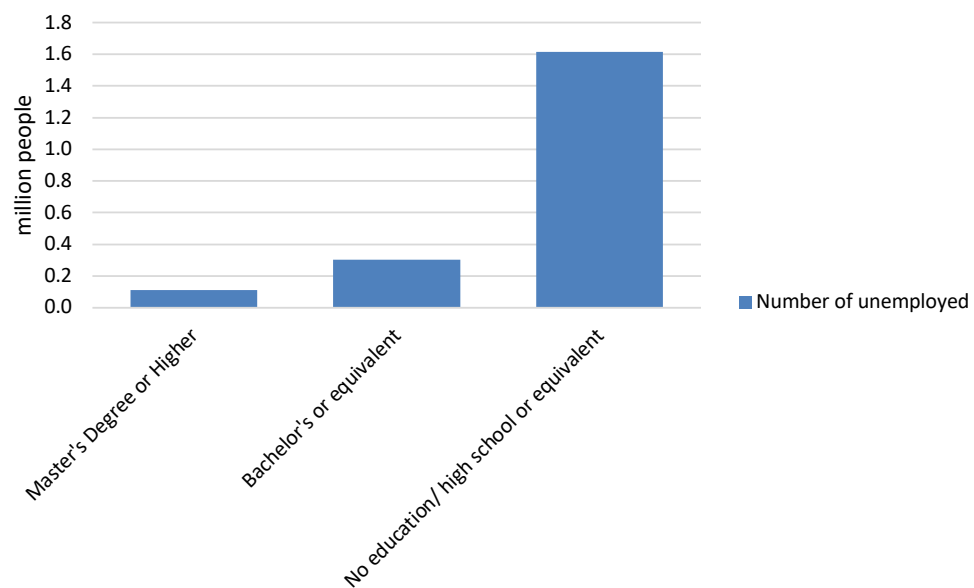


Figure 1.9 **Level of education in Germany**



Source: World Bank

Figure 1.10 **Education level of unemployed workforce**



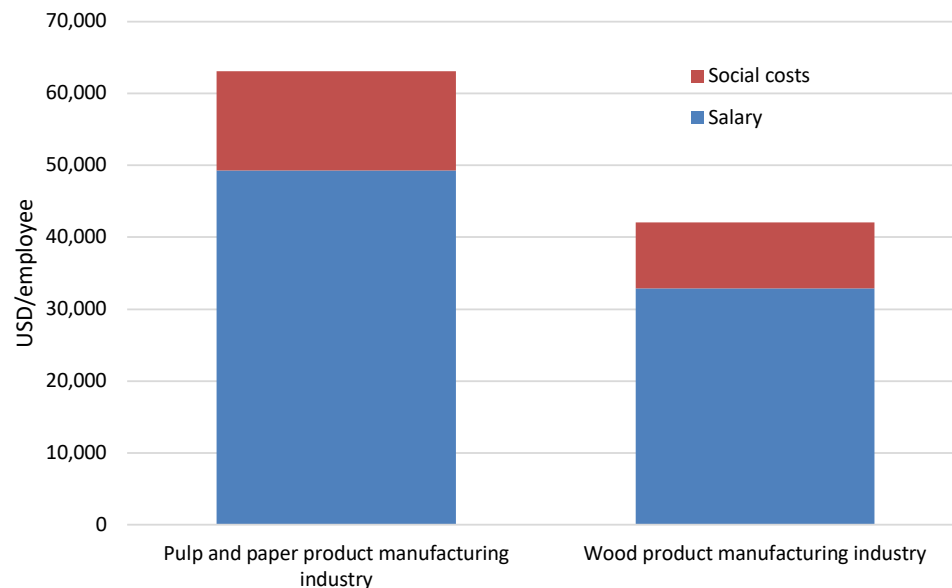
Source: OECD, World Bank



1.2.3 Typical labor costs

Germany's employment is in high level due to economic growth and labor policy reforms made between 2000 and 2010. Because of increased salaries during the present decade, part of the competitive advantage gained through labor policy reforms have been lost. Figure 1.11 presents average annual labor costs of relevant manufacturing sectors. The share of social costs is approximately 22% in both sectors. As the German employment rate is record high and economic growth is strong, there are pressures to increase wages.

Figure 1.11 Labor costs per full-time employee, 2015



Source: Statistisches Bundesamt (Destatis)

1.3 Regulatory climate

Federal Forest Law

Germany has a long tradition in forest management and has very detailed and restrictive forest legislation. There are both federal and state level laws in Germany and the legislation varies considerably by state (Bundesland). Wood production is not in many cases considered to be the main function of the forests, but recreation and other natural values are very important in this densely populated country.

The most important forest act on federal level, the Federal Forest Law from 1975 was renewed in 2010. It contains both framework provisions to be specified by the States, and in the case of concurrent legislation, directly applicable provisions.

The Federal Forest Act, as described in Art. 1 Federal Forest Law, has three main aims:

1. To conserve forests due to their economic benefits (productive function) and their importance for the environment and the recreation of the population (protective and recreational functions), to expand them, wherever possible, and to ensure their sound management on a sustainable basis, whilst promoting the forestry sector and integrating of the public interests and the concerns of forest owners.
2. To promote forestry.



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3. To generate a balance between the interests of the general public and the interests of the forest owners.

Forest Strategy 2020

German forest strategy 2020 lays a foundation for the National Forest Programme (NWP). In cooperation with key stakeholders, the most important forest management goals have been defined along with the means of solving problems between various interest groups. The Forest Strategy 2020 reflects the responsibility of the federal government for forests as a natural and economic resource. The vision of the Forest Strategy 2020 aims to ensure sustainable management preserves and develops site-specific, robust forests with mainly indigenous tree species that are capable in adapting to climate change. The forests offer wide range of raw materials, biodiversity and recreational services. The ecological soundness, stability and diversity of forests in Germany have all notably increased. The goal of the Forest Strategy 2020 is to develop a viable balance, adapted to future requirements, between the growing demands made to forests and their sustainable performance. The basis for the goal is the equal consideration of the three dimensions of sustainability: economic, ecological, and social.

Joint instruction on the procurement of wood products in Germany

On January 2007 the German government (Federal Ministry of Economics and Technology, Federal Ministry of Food, Agriculture and Consumer Protection, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, and the Federal Ministry of Transport, Building and Urban Affairs) issued a joint instruction on the procurement of wood products. The instruction states wood products procured by the federal administration must demonstrably come from legal and sustainable forest management.

European Timber Regulation (EUTR)

Due diligence has to be conducted in order to place timber or timber products into European markets. EUTR covers wide range of timber products, such as paper, pulp or solid wood products. Due diligence requires the operator to have access to information on timber product description, country of harvest, species, quantity, details about the supplier and information on compliance with national legislation. Due diligence also requires active risk management and risk mitigation to prevent access of any illegal timber to European markets. EU member states are responsible for enforcing the regulation, but EU commission has set up "FLEGT" expert group to assist national authorities on the subject of illegal timber trade prevention.

Renewable Energy Heat Act (Erneubare Energien Wärmesetz - EEWärmeG)

Renewable Energy Heat Act obligates the owners of newly constructed buildings to use renewable energy to meet a portion of their heat requirement. Under this act bioenergy can only be used if it is generated by using high technology conversion such as liquid biomass for conversion to fuel and gaseous biomass in co-generation plants. Included in the act, building owners have the option to use CHP and energy saving measures, and to acquire heat from CHP or renewable energy based district heating network.

General targets for Renewable energy

In 2008 the German parliament ratified the new Renewable Energy Sources Act (EEG) and the Renewable Heat Sources Act setting the national targets for renewable energy. Based on this the contribution of renewable sources to the energy supply has to be increased to a minimum



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of 30% and 14% of the electricity and heat supply, respectively. Electricity produced in a renewable manner and heat from biomass, should comprise 8% and 9.7%, respectively.

National Biomass Action Plan

The Biomass Action Plan highlights both the strategies and actions needed to promote more efficient, sustainable bioenergy production. The following issues are of particular importance:

Utilizing the surrounding bioenergy potential, especially the availability of marketable technologies—and building out the infrastructure required to do so. Global issues, such as worldwide potential and the impacts of intensified bioenergy use must be taken into account in current and future bioenergy export states. Available resources must be managed wisely to ensure their long-term availability and to prevent their use conflicting with other policy objectives like environmental protection, nature conservation, and food security.

A broad scope of social needs must to be taken into account. Acceptance of intensified bioenergy use can only be successful by fostering dependent relationships between stakeholders and the public. Extensive biomass use largely depends on prevailing economic conditions such as energy price trends and the markets for food and feed, in addition to technological progression. The German government should create the necessary legal and political foundations to provide incentives for this development.

On-going promotion and subsidisation for biomass use for each of the three sectors – heat, electricity and fuel production. All of these must be adequately considered, while preventing market distortions. The use of biomass must be optimised in regards its GHG emission reduction potential and its energy efficiency.

Intensified bioenergy use must occur under sustainable conditions. There is an urgent need for international standards, and to ensure that bioenergy traded is produced sustainably. The German government supports these issues in its relevant international bodies. The Biomass Action Plan has been integrated into the German Renewable Energy Action Plan to comply with the requirements of the EU Renewable Energy Directive.

1.4 Taxation

Value added tax rate is currently 19%. Corporate tax rate in Germany is currently 29.79%. This includes a general corporation tax of 15%, the solidary surcharge of 0.825% and the trade tax which is on average 14%. The exact level of trade tax depends on the region. The tax base for corporate tax is tied to annual business profits. Due to income correction rules and deductions, the final tax base is usually not equal to annual profit announced in companies' financial statement. If a corporation is managed from Germany, the corporation's domestic and foreign earnings are subject to taxation in Germany. However, corporate companies which do not have executive board in Germany, need to pay taxes only for income generated inside Germany.

Subsidiary companies operating in Germany are liable to 25% withholding tax, when they distribute profits to their foreign parent company. To avoid double taxation, Germany has negotiated Double Taxation Agreements with individual countries.



2. TIER 2 – GENERAL ANALYSIS

2.1 Policies

The baseline for policies concerning bio-based energy and products is summarized in National Policy Strategy on Bioeconomy. The strategy sets priorities and measures to development of bioeconomy. Guiding principles include the highest priority for food security (over industry and energy production), highest value adding products should be given preference, and that bioeconomy needs to satisfy the production requirements, such as protection of the environment and social responsibility. The policy strategy pays attention that wood as a building raw material helps in mitigating climate change. As German population gets older, need for apartment buildings increases. Combining this increase with bioeconomy goals may spark significant growth to wood construction of multi-storey buildings.

The German bioeconomy policy recognizes the importance of funding support to protect the competitiveness of bio-based energy or products. The policy strategy underlines that biofuels would not be viable without public funding support, such as tax incentives. Standards are created to measure impact of policies and to strengthen the use of renewable materials.

The German government has been very active in setting up policies and subsidies to encourage power production from renewable sources. The most important of them are listed below.

Renewable Energy Sources Act (EEG)

The most important legal instrument in Germany to promote electricity production from renewable sources is the Renewable Energy Sources Act (EEG). It provides feed in tariffs for every kWh of renewable electricity supplied to the national grid. The tariff value depends on the source, conversion technology and size of the plant. Additional tariff payments are provided for e.g. using wood for CHP plants.

Market Incentive Programme for Renewable energy (MAP)

In Germany, bioenergy has had challenges in entering markets. Bioenergy systems have a potential to provide long term energy and cost savings, but the short term upfront investment costs can be a disincentive. Bioenergy has had difficulties in asserting itself on the market despite its positive environmental impact. Since 2000 the Federal Government has been supporting the investments of biomass plants through the Market Incentive Programme (Marktanreizprogramm - MAP). Until mid-2006 the programme had subsidized the start of over 70 000 small scale biomass plants with the total cost of 126 million EUR releasing a total investment of 1 billion EUR.

Subsidies from Non-Governmental Organizations

Reconstruction Bank KfW provides low-interest loans for the installation of biomass heating systems with a capacity >100 kWh. Some of the states have their own subsidies for biomass heating systems, in addition to the governmental subsidies.

2.2 Access to financing

Germany has stable banking system, and its importance as the center of financing in the EU is likely to increase with Brexit. Germany has the highest credit ratings from S&P, Moody's and Fitch. Access to bank financing is good and there is a large number of other private equity investors in the country. Thus, relative to many other forest industry countries, the overall access to capital is good and the cost of capital is moderate.

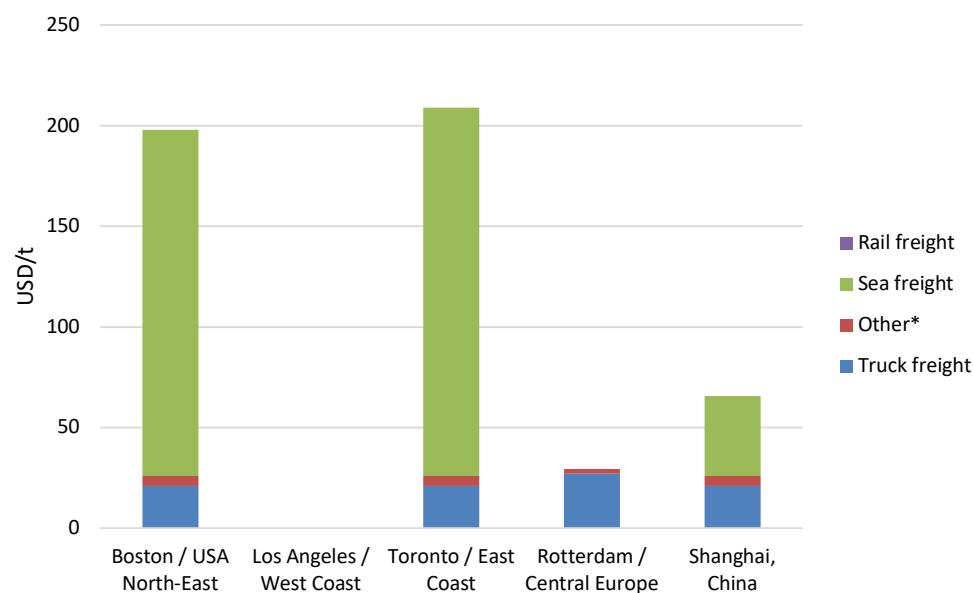


2.3 Logistic infrastructure and transportation costs

Infrastructure in Germany in general is well maintained and as a densely populated country it has comprehensive forest road network. The role of the state forest organization is rather strong in providing maintenance services to private forest owners and to municipalities. Logistic infrastructure in Germany is not an obstacle for growth of production. Maximum weight of truck transport in Germany is 40-44 tonnes, which is significantly lower than for example Finland's maximum of 72 tonnes. Germany's weight limits are in line with EU regulations, while Finland's higher limit is an exemption.

Germany has advantage of being centrally located in Europe with excellent access to multiple end-markets in Europe (Figure 2.1). The sea freight costs are very high from Germany to U.S. whereas the sea freight to China is competitive. The German pulp and paper industry is spread out inland and is focussed primarily on satisfying the large domestic demand. Consequently, high sea freight costs are not a major limiting factor. Los Angeles and West Coast of U.S. is not considered as a realistic market for Germany and is therefore omitted from the analysis.

Figure 2.1 Transportation costs



(*) Port costs, unloading and loading.



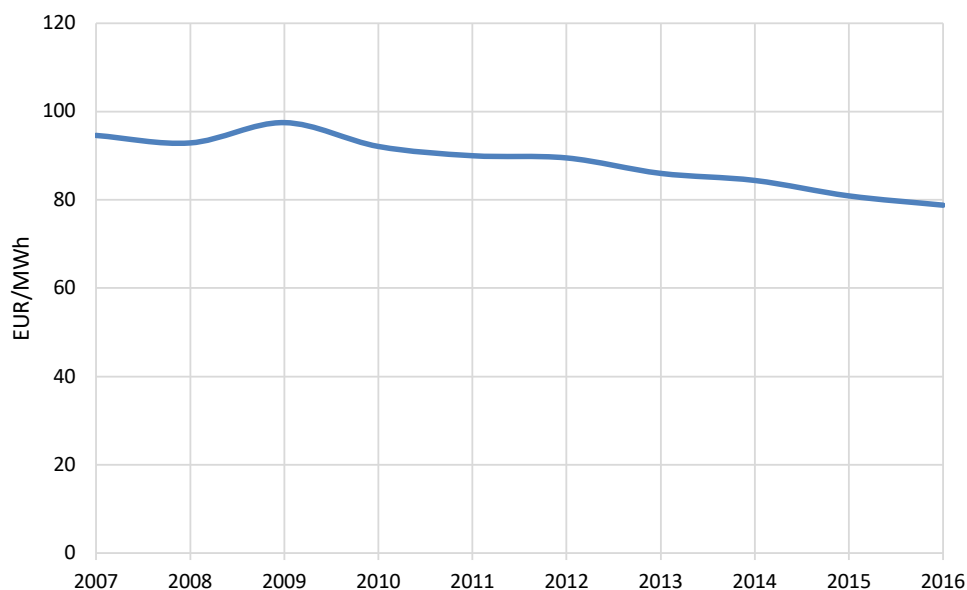
3. TIER 3 – HIGH LEVEL ANALYSIS

3.1 Energy

In the aftermath of Fukushima incident in 2011, Germany decided to reduce nuclear energy production. During this reduction in nuclear energy, the use of coal, and renewable energy sources has increased. Subsidies from the government have significantly boosted installation of new renewable energy production capacity, such as wind and solar power and thus reduced the price of electricity. To secure stable production and price of electricity, Germany adopted new Electricity Market Act framework in 2016. The framework improves information flow of electricity prices, increases energy providers responsibility to deliver sufficient energy to clients and introduces a capacity reserve.

Recent development of energy prices for medium size industries are presented in Figure 3.1. From 2009 to 2016 the prices have been declining.

Figure 3.1 Electricity price for medium size industries



Source: Eurostat

3.2 Key supplies

Germany as the European economic powerhouse has good access to variety of supplies and engineering. Germany is a base of operations for companies, such as Siempelkamp, which provide production lines of wood-based products, as well as the maintenance services. Entire manufacturing chain of plastics is present in Germany, which means the availability of resin producers and plastic converters.

3.3 R&D

German paper and wood product industry's research and development (R&D) spending has increased 19% from 2007 to 2015. In 2015 the total R&D spending of paper and wood product industry was 215 million EUR.

There are a number of public sector institutions that conduct R&D functions in Germany. Johann Heinrich von Thünen Institute conducts research around forests, forestry and timber. Wood and

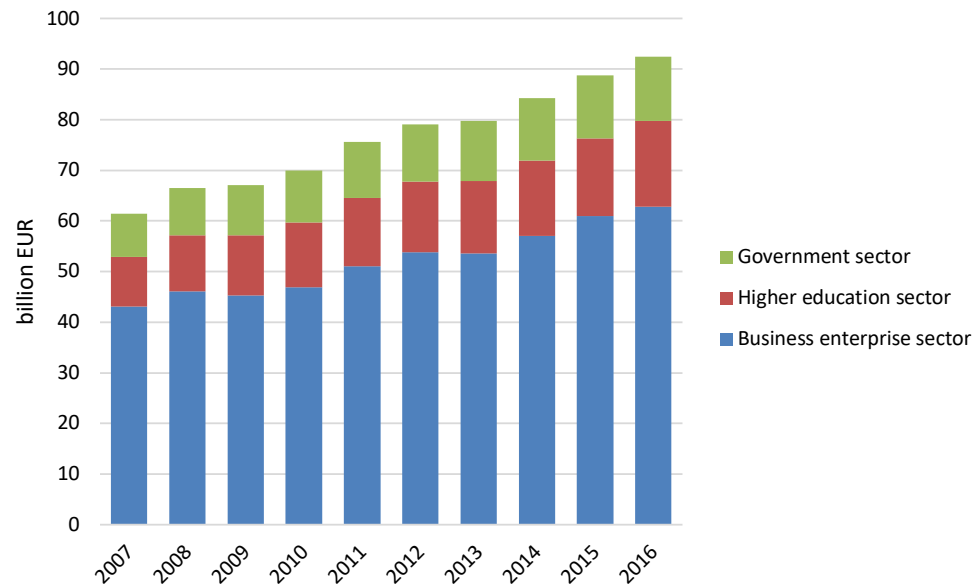


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forests-related science and education is provided by universities of Hamburg, Dresden, Göttingen and Freiburg. Engineer-level education on forestry is provided by universities of applied sciences in Hildesheim/Holzminden, Eberswalde, Weihenstephan (Freising), Rottenburg and Schwarzburg. However, the largest share of the R&D in Germany is done by private enterprises. In the forest industry, R&D has been dominated by the wood products sector over pulp and paper (e.g. with wood construction materials such CLT).

Over 50 different research institutes in Germany focus partially or primarily on bioeconomy-related research. An example of the interdisciplinary research is the Bioeconomy Science Center (BioSC), which currently is comprised of 54 research institutes. National Research Strategy Bioeconomy 2030 was published in 2010. The bioeconomy strategy announced “Using renewable resources for industry” as one of its five key fields of action. In addition to research institutes 60 universities and 37 universities of applied sciences conduct relevant research about the bioeconomy. Germany has invested intensively to R&D of bio-based energy & products and is also active in facilitating cooperation between business and science worlds.

Figure 3.2 Intramural R&D expenditure



Source: Eurostat

Annex 3

Russia, Northwest



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FOR/Maine

Global Market Analysis and Benchmarking Study – Russia

Final Report

Helsinki, Finland
June 29, 2018

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1. TIER 1 – DETAILED ANALYSIS

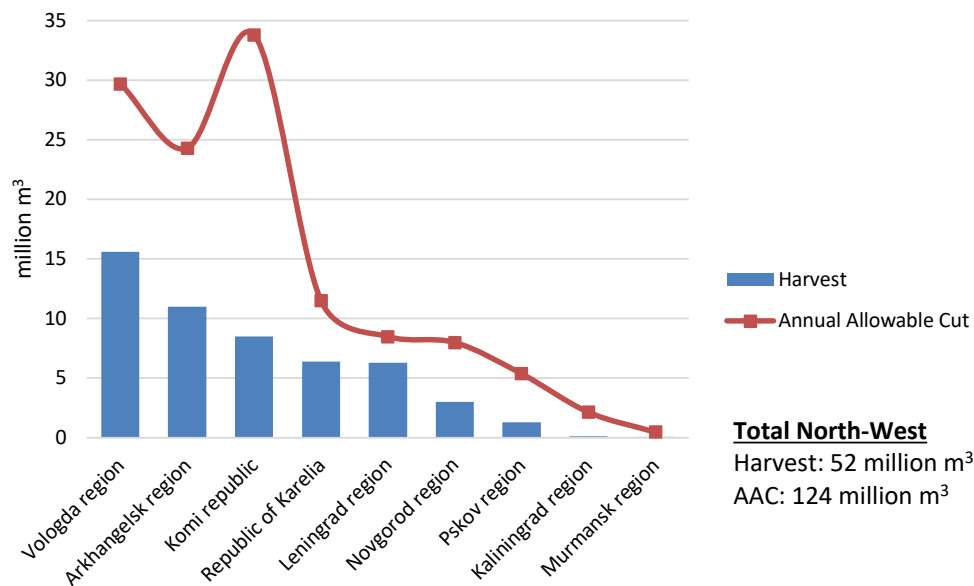
1.1 Raw material

1.1.1 Harvest levels

Estimates place 17% of Russian total annual allowable cut (AAC) as concentrated in the North-Western Federal District (equalling to 124 million m³). At the moment, approximately 42% of the AAC is utilized in the region, which is higher than the national average of 30%. Most of the AAC is concentrated in Vologda and Arkhangelsk oblasts, while the highest forest utilisation rate is observed for Leningrad oblast (Figure 1.1). The low rate for the AAC use in Russia in general and in the North-West is directly attributed to low forest infrastructure and non-accessibility of vast forest resources. Thus, it is more appropriate to discuss the economically feasible AAC, which entails a significantly higher utilisation rate. For example, the economically feasible AAC in the North-Western Federal District is estimated by Greenpeace to be at 75% capacity.

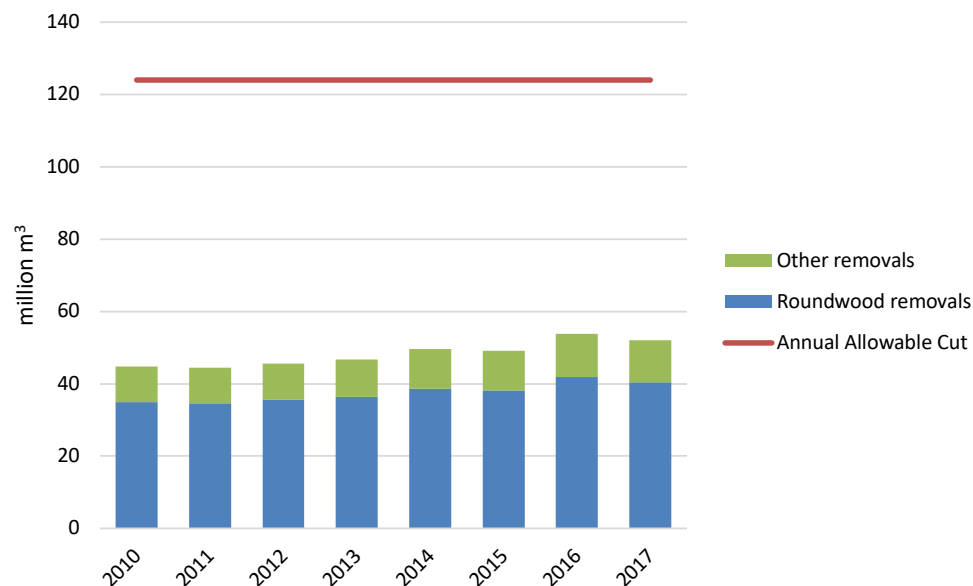
According to the State Program “Development of Russian forestry in 2013-2020”, the AAC use in the North-West should increase over the period of 2012-2030 and reach 50%. The follow-up “Strategy for the Development of the Forest Complex of Russia until 2030” outlines several potential forest sector investment projects in the region—1 and 2-million-ton P&P projects in Vologda and Arkhangelsk oblasts respectively; additional sawmilling, plywood and wood-based panel capacities in Karelia and Arkhangelsk oblasts, as well as new pellet and prefab houses productions in Leningrad oblast.

Figure 1.1 Harvest volumes and AAC in the North-West Russia



Source: EMISS, Rosstat

Figure 1.2 Harvest levels and AAC in North-West Russia, 2010-2017



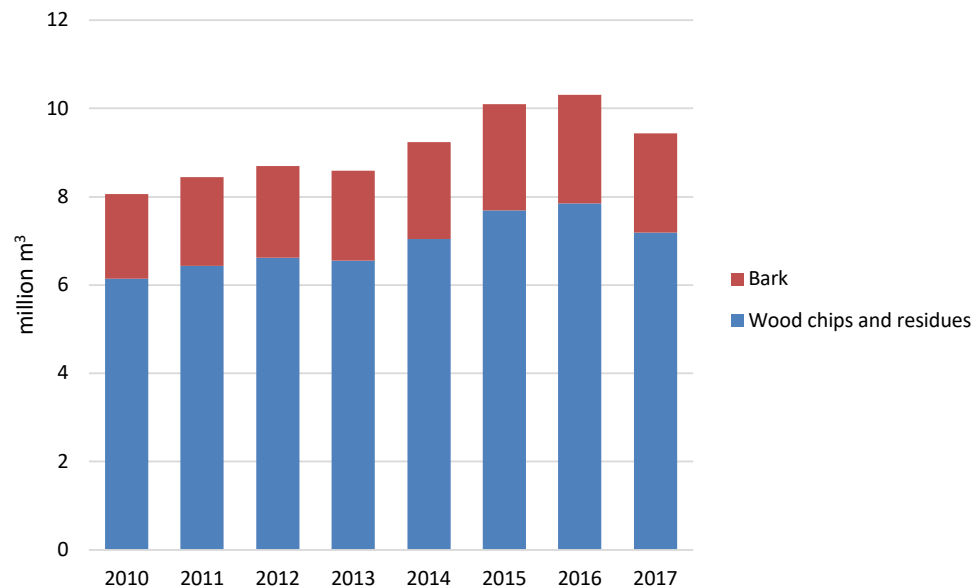
Source: EMISS, Rosstat

1.1.2 By-products

Based on the historical consumption of roundwood assortments by different industries, Indufor estimated by-product production volumes in the North-West of Russia using Indufor's databases on by-product streams from different production operations. In 2017, by-product production was estimated at around 9.4 million m³ (Figure 1.3).

There is one oriented strand board (OSB) plant ("DOK Kalevala" in the Republic of Karelia, annual capacity – 300 000 m³), three medium density fibreboard plant (MDF) plants in Komi Republic, Leningrad and Vologda oblasts ("Lesplitinvest" – 100 000 m³, "Sheksninskyi kombinat" – 60 000 m³, and "Zheshart" – 130 000 m³), and seven larger-sized particle board plants with the annual capacity ranging between 120 000 and 500 000 m³. According to Indufor's estimates, altogether these plants consume around 4.2 million m³ of wood. In addition, there are around 10 pulp and paper mills in the region with the wood consumption ranging from 4.5 million m³ at Ilim Koryazma to smaller scale mills with the consumption not exceeding several hundred thousand. Their total raw material demand is estimated at around 19-20 million m³. Furthermore, in 2017, nearly 700 000 tons of wood pellets were produced in the North-West, indicating that the pellet sector also utilized around one million m³ of wood, mostly in form of sawmilling residues.

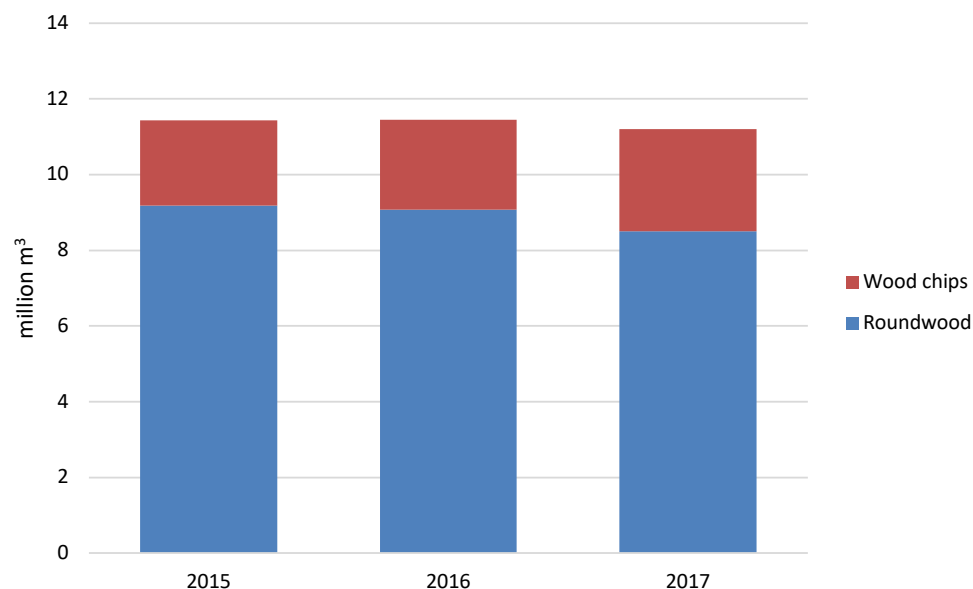
Figure 1.3 Estimated by-product volumes in the North-West of Russia, 2010-2017



Source: EMISS and Indufor analysis.

Significant volumes of roundwood and wood chips are also exported from the North-Western Federal District. According to Indufor estimates, these export volumes have been within the range of 11.2-11.4 million m³ per year, during the past three years (Figure 1.4). 20% of the volume is wood chips (mostly softwood). Finland is Russia's biggest single trade partner with as high as a 94% share in wood chips exports and 82% in roundwood. 2/3 of the exported roundwood volume is birch pulpwood.

Figure 1.4 Wood raw material exports from the North-West Russia, 2015-2017



Source: National Customs Database and Indufor analysis.

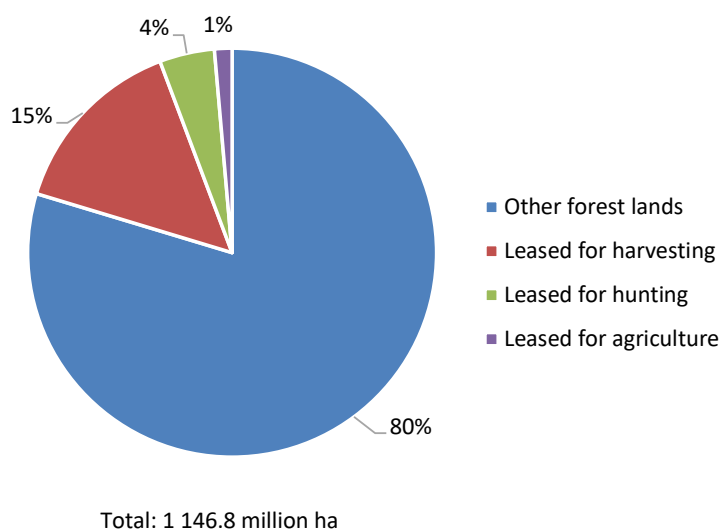
There is also regional trade of roundwood and wood chips with other federal districts, making objective, detailed estimations of available wood raw material in the North-West of Russia complex.

Examination of the demand and supply (AAC vs. harvesting) balance leads to a conclusion that easily procured cubic meters of wood are already harvested and utilized in the region. Remaining volumes are hard to extract or are harvested wood of low quality, so-called “technological raw material” feedstock. High logistic costs and low infrastructure developments currently makes transportation of the latter often not financially feasible. Thus, any investment into industrial processing of wood in the region will be based on careful examination of the most suitable location and investigation of options for integrated production. One scenario to consider could be purchase of wood currently designated for exports.

1.1.3 Forest ownership

According to the Forest Code of 2007, the main legislative document regulating management and use of forests in Russia, forest resources fall under federal ownership, and there are currently no possibilities for the privatization of forests—although this question is frequently raised. Thus, forests are leased on an auction basis for harvesting of wood, agriculture or hunting. As of 2017, the government was leasing 241.2 million ha of forests, equalling 21% of forest lands in the country. The majority of leased forests are rented for wood harvesting. On average, leaseholders harvest around 65% of their AAC. The majority of forests are not leased for any use due to the fact that most of them are located in remote areas with no or low levels of infrastructure and are far from wood processing facilities (Figure 1.5).

Figure 1.5 Forest use in Russia

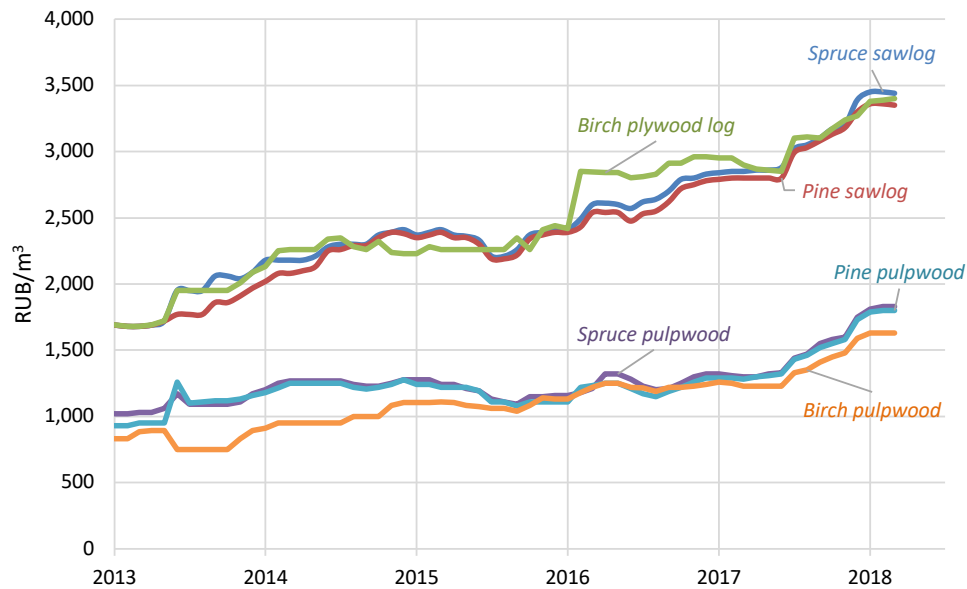


Source: Rosleshoz

1.1.4 Delivered wood cost

During past 5 years, the prices for all type of wood assortments have been increasing in the North-West of Russia within the range of 1.0-1.2% per year. At the moment, spruce saw logs and birch plywood logs demand the highest price, while birch pulpwood demand the lowest (Figure 1.6).

Figure 1.6 Prices of wood assortments in the North-West Russia, 2013-2017



Note. Weighted average prices for round timber excluding VAT, shipped to the wagon at the nearest shipping station (FCA, or delivered by the supplier's motor vehicle to the buyer's warehouse (DDP)

Source: Roslesinforg.

Over the period from 2012 to 2017 the price for technological wood chips in the North-West of Russia has been growing at 0.8% per year and reached the peak of 1 500 RUB/m³ at the end of 2017 (Figure 1.7). Technological chips are used for production of P&P products, wood-based panels, chemical products and energy. Over 60% of technological chips are used in the pulp and paper industry. Transportation costs are the main cost component forming up to 80% the total costs of wood chips in Russia.

Figure 1.7 Prices of wood chips in the North-West Russia, 2012-2017



Source: EMISS.

1.1.5 Wood procurement practice

In the European part of Russia wood is typically sold in assortments. The most demanded assortment types are coniferous logs (especially spruce) for sawnwood production and birch plywood logs for plywood production. Small-diameter wood (i.e. pulpwood, technological wood and firewood) is used for making a variety of end products, such as pulp, paper and reconstituted wood-based panels (MDF, particleboard, fibreboard and OSB). Most Russian processing mills prefer to purchase wood “first hand”—through leaseholders and harvesting companies. In cases when wood is delivered to buyers in trucks, transportation costs are typically covered by the seller. When wood is transported by railways, the most typical selling point is a buyer’s railcar at a dispatch station. The share of wood sold through traders is rather marginal.

1.2 Workforce

1.2.1 Demographics

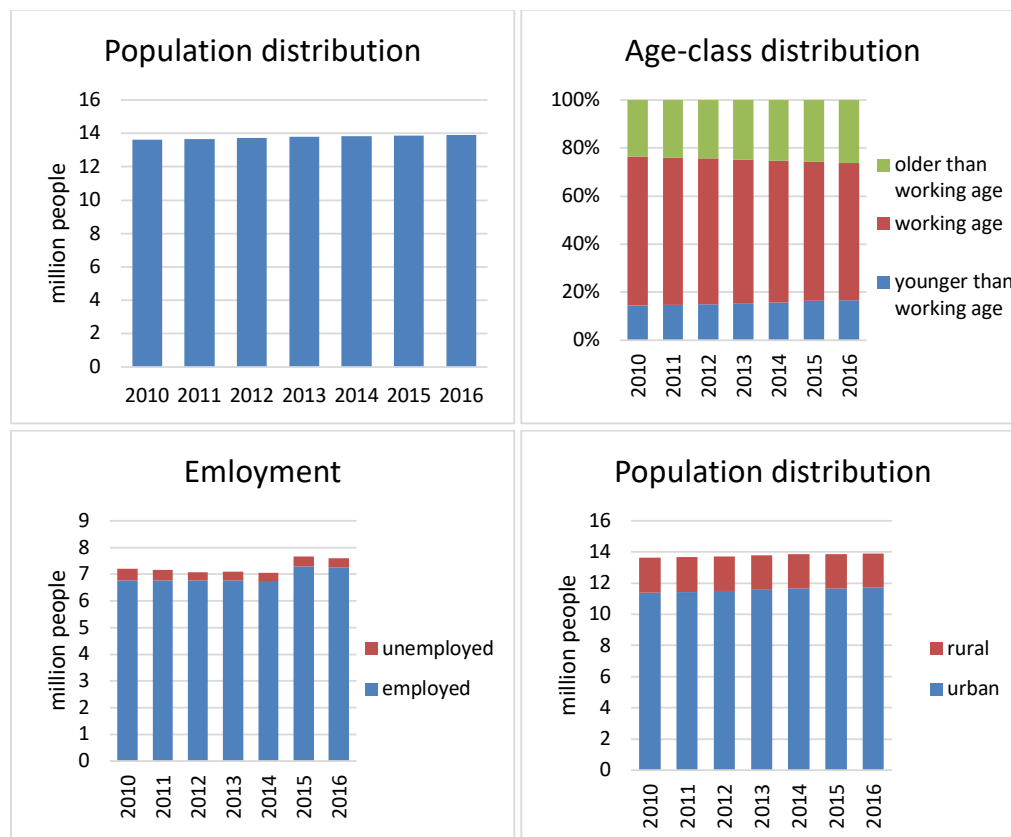
The total population of the North-West of Russia is nearly 14 million people, with half living in Saint-Petersburg or Leningrad region (Table 1.1). The population is heavily urbanized and only 16% live in the rural areas. Female population dominates (117 women to 100 men). The unemployment rate is rather low – 4.6% compared to the Russian average of 5.5% – and 57% of the total population is of the working age.

Table 1.1 Key demographic indicators for the North-West Russia, 2016

Indicator	Current situation
Total population	13 899 000
Population growth rate (2017 vs.2016)	0.03%
Population density, rural vs urban	15.7% vs 84.3%
Unemployment rate	4.6%

Between 2010 and 2016 there has been positive development in population growth, urbanisation and employment. However, the share of population of the working age has been shrinking (Figure 1.8).

Figure 1.8 Historical demographic development

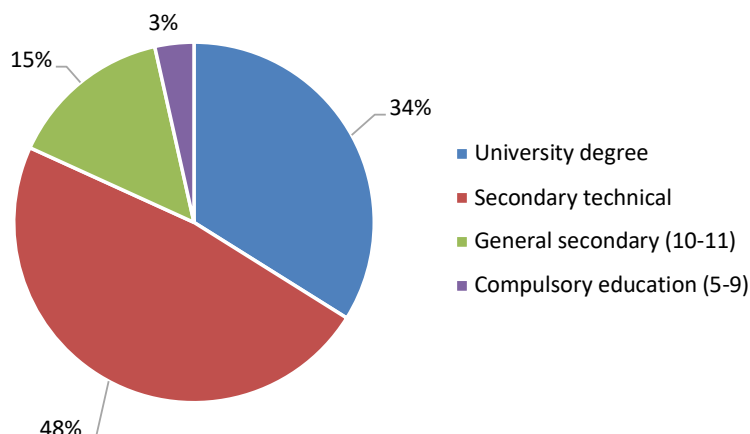


Source: GKS. Note: Working age in Russia is 16-59 for men and 16-54 for women

1.2.2 Level of education in each competitor country and the skill levels required

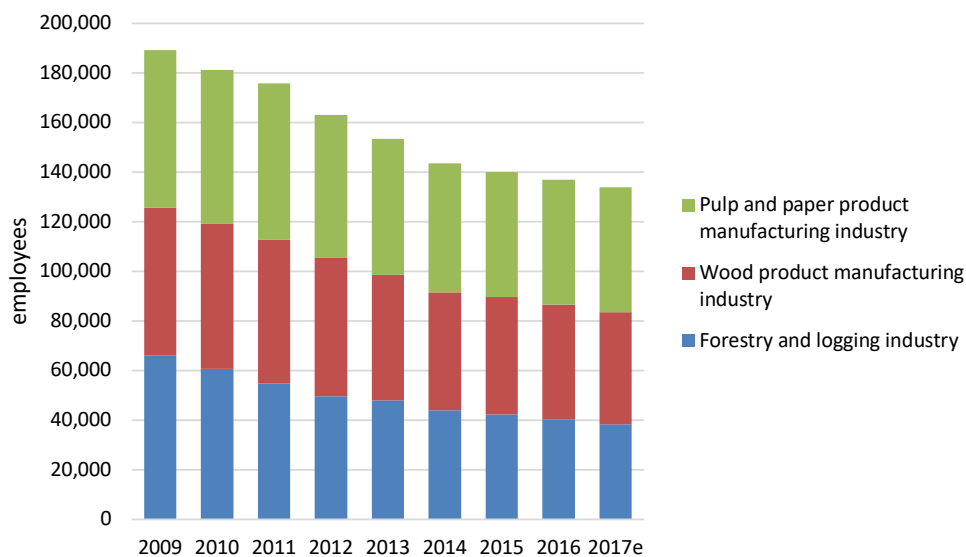
Nearly third of the economically active population in the North-West has a university degree, while almost half – a secondary technical (Figure 1.9). The share of population with a university degree is in line with the Russian average, while for secondary technical education it is slightly higher. The share of people with compulsory or elementary education is marginal both in the North-West and Russia in general. Availability of (skilled) workforce is generally not perceived as a constraint in the North-West of the country when compared to, for example, Siberia or the Far East. However, there are remaining problems associated with sufficient levels of education of the workforce in more remote and rural areas.

Figure 1.9 Level of education in the North-West Russia, 2017



The forest sector labor force in the North-West has been diminishing drastically from nearly 190 000 jobs to 134 000 jobs from 2009 to 2017. The distribution of workforce among forestry/logging works, mechanical wood processing and the P&P production is almost equal with slight predominance of the latter (Figure 1.10).

Figure 1.10 Forest sector direct employment in the North-West Russia, 2009-2017e



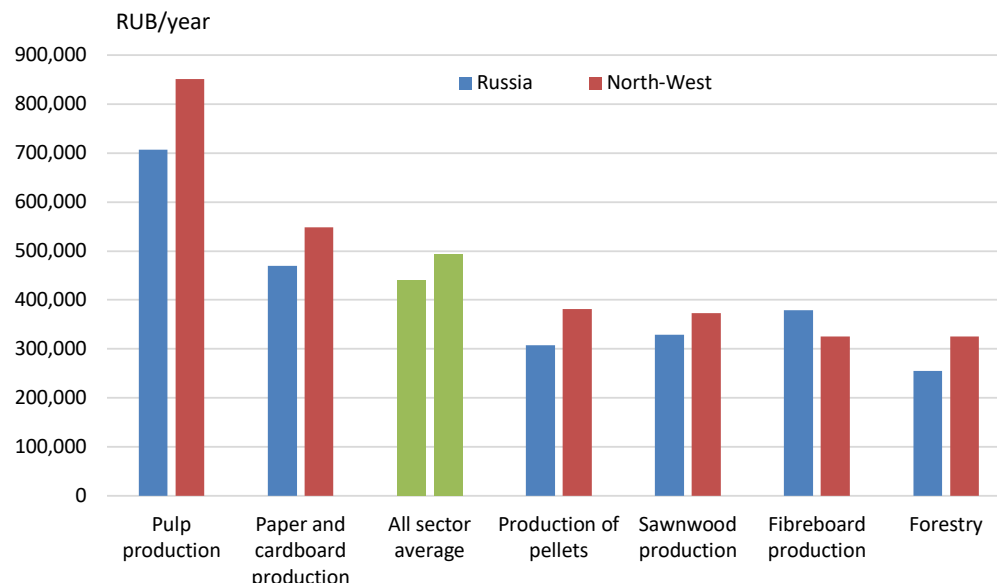
Source: EMISS.

1.2.3 Typical labor costs

Forestry activities, harvesting and wood processing are still quite labour-intensive in Russia, providing substantial opportunities for local people to gain employment from companies in the forest sector. However, the salary level in the forest sector is rather low (Figure 1.11). Aside from the pulp and paper industry, the salary level in the forest sector is lower than the average

salary level of all sectors. In the North-Western region, forest sector salaries are slightly higher when compared to the Russian average.

Figure 1.11 Average salaries in the forest sector in the North-West Russia in 2017



Source: EMISS

1.3 Regulatory climate

The Forest Code is the main piece of the Russian forest legislation defining the principles of sustainable multiple forest use, conservation, regeneration, and stakeholder participation in decision-making. In Russia, forests are state property, but legal bodies can be granted a right to use them in perpetuity, free of charge or they can be leased for a limited period of time. Citizens can be granted a right to lease forests or to use them free of charge. A lease agreement is usually concluded for the period of 10 to 49 years depending on the period of permitted use of forests set in the forest management regulations.

Perpetual use is granted upon a decision of state or regional authorities: free-of-charge use requires an agreement on use without charge, while leasing is based on a forest lease agreement. Forest use rights for timber harvesting, hunting, or agriculture that are based on leasing agreement are issued to the winner of auctions. Forests for priority investment projects can be exceptionally leased out without an auction. The same forest area can have multiple lease agreements for different use rights e.g. for timber harvesting and hunting.

Wood can be harvested in line with any of the different types of agreements:

- forest lease agreement,
- agreement on use of forests without charge,
- agreement of sale and purchase forest stands.

The Forest Code delegates development of *forest plans* and *forest management regulations* to regions. Forest plans set specific aims and objectives of regional forest planning, as well as measures and geographical areas of implementing planned use of forests. *Forest plans* are supplemented with maps of *lesnichestvos* (administrative forest management units) and are developed according to a standard template for all regions. *Forest management regulations* are developed for each *lesnichestvo*, determining the following six items 1) permitted forest use categories; 2) harvesting age; 3) annual allowable cuts; 4) restrictions on forest use; 5) harvesting bans; and 6) requirements for forest protection, conservation and regeneration.

A number of other laws, regulations, and documents determining principles of timber harvesting and trade in Russia are presented in the box below.

Box 1 Legislation regulating timber harvesting and trade in Russia

- Order on Development and Conclusion of a Lease Agreement for a Forest Area in State or Municipal Property and Sample Forms
- Order on Development and Conclusion of an Agreement of Sale and Purchase of a Forest Area in State or Municipal Property and Sample Forms
- Order on Content of the Forest Management Plan and Procedures for its Development
- Order on Procedures of Governmental and Municipal Assessment of a Forest Management Plan
- Order on Approval, Filling in, Submission and Format of Forest Declaration Online
- Order on Rules for Timber Harvesting, Methods and Sequence of Carrying Them out, Sample Form of a Technological Chart, Inspection Report and Rules for Harvested Site Inspection
- Order on Submission of a Report on the Use of Forests, its Form and Format Requirements
- Rules of Sanitary Safety in Forests, Rules of Fire Safety in Forests
- Rules of Forest Management
- Rules of Forest Regeneration
- On amendments to the Forest Code and the Code of Administrative Infractions of the Russian Federation
- Order on Accompanying Document for Timber Transportation
- Order on Adoption of Regulations on Submission of Declarations on Timber Transactions
- Order on Amending the Order № 1047-p of the Government of the Russian Federation from June 13, 2014

The main strategic documents forming a path for future development of the Russian forest sector include the following:

- *Foundations of the State Policy in the Field of Forests Use, Conservation, Protection and Regeneration till 2030*, which states the principles, aims, tasks and mechanisms of the national forest policy
- *Forestry development for 2013-2020*, which describes the position and role of the forest sector in the Russian economy. The strategy includes 1) an analysis of the current state of forests and forest industries and perspectives on domestic and export markets of wood products; 2) an examination of forest use potential; 3) an identification of problems in the forest sector; 4) insights into forest development aims, tasks and main directions; 5) a depiction of various scenarios of forest sector development; and 6) a list of different measures which would serve to assist in the implementation of the current strategy.
- *Strategy for the Development of the Forest Complex of Russia till 2020*, which is a state programme setting aims, purposes and indicators demonstrating whether these have been reached in addition to the main expected results. This state program has several sub-programmes under its umbrella, including forest protection and conservation, securing forest use, forest regeneration, and implementation of the state program *Forestry development for 2013-2020*.

N.B. The subsequent “*Strategy for the Development of the Forest Complex of Russia till 2030*” is also under preparation so that when the 2020-strategy ends, another strategy will immediately follow.

Starting from 2016 the Federal Service for Supervision of Natural Resource Usage together with regional authorities has been keeping a record and dividing industrial companies into 4 categories depending on their environmental impact – from minimal (forth) to significantly negative (first) – as required by the Law N 219-Φ3 on Changes to the Federal Law on Environmental Protection and certain legal acts. The companies belonging to the first category will be required to obtain an ecological permit for waste and emissions and set up emission monitoring systems, while companies from the fourth category are exempt. Many experts consider the Russian environmental legislation too burdening and hard to implement as company reporting nowadays consists of around a hundred documents, and will be even more burdensome with introduction of the new requirements.

The Russian standardisation system consists of State Union standards (GOST) and Codes of Practices (SP). State Union standards (GOST) are used for ensuring control over the quality of

produced goods and services. Construction Standards and Regulations (SNIP)—one thematic section of Codes of Practices (SP)—regulate construction and engineering works. The Urban Development Code is the main law regulating the construction sector in Russia. In addition, there are technical guidelines regulating, for example, overall and fire safety of buildings.

All in all, the regulatory climate in Russia can be categorised as neutral, although in some certain respects (e.g. compliance with the environmental legislation) may hinder business.

1.4 Taxation

According to the *Tax Code of the Russian Federation*, legal entities and private entrepreneurs are required to register with tax authorities. Upon registration a certificate or a notification of the registration is issued with a tax payer ID number. Legal entities and private entrepreneurs are required to pay insurance fees within the framework of work and civil law contracts. Such insurance fees include statutory pension insurance, statutory social insurance (temporary incapacity for work and maternity) and statutory medical insurance and are to be paid to the Federal Tax Service. The Tax Code of the Russian Federation states that domestic sales of goods, e.g. wood, are subject to a value-added tax. The VAT can be also paid on export sales and retroactively claimed afterwards. The Tax Code of the Russian Federation also sets that profits are subject to a profit tax. The value added tax in Russia is 18%, while the profit tax—20% (3% of which is paid to the federal budget and 17% to the regional).

2. TIER 2 – GENERAL ANALYSIS

2.1 Policies

One of the main governmental incentives for developing the forest industry and increasing harvesting levels in Russia are so-called “*priority investment projects in exploitation of forest resources*”. This concept was first introduced into Russian legislation in 2007, and it aimed at stimulating domestic value-adding timber processing with economic incentives. Companies apply to be included into a list of priority projects updated by the Ministry of Industry and Trade. The most significant bonus for such projects is the right to obtain 1) a forest lease without the auction procedure, and 2) a 50% discount on lease payments during the payback time of the project in question. As of March 2018, the status of priority investment projects has been granted to 141 investment projects with the total AAC of 82 million m³.

In 2017, the state support amounting to RUB 5.2 billion was disbursed to the forest sector through various channels:

- Subsidies for forming interseasonal stock of raw materials, materials and fuel (RUB 400 million)
- Subsidies for implementing priority investment projects in exploitation of forest resources in the Far Eastern Federal District (RUB 1.3 billion)
- Subsidies for implementing new multi-purpose investment projects on focus areas of the civil industry (RUB 813 million)
- Subsidies for compensating part of transportation costs (RUB 2.6 billion)
- Subsidies for compensating part of R&D costs (RUB 50 million).

The support in the form of soft loans from the Production Development Fund amounted at RUB 2 237 million in 2017. In addition, certain legislative initiatives were passed during the past year in order to increase competitiveness of the Russian forest sector. For example, a ban on certain types of imported products has been introduced to reduce competition in government tendering. Furthermore, establishment of new wood processing facilities in the Far Eastern Federal District has been supported by introduction of quotas and changing tariffs for export of certain wood materials.

In Russia, there are both state and private industrial parks (75 and 91 respectively as of 2017). State industrial parks are mainly oriented at large corporations, while private – at medium-sized businesses and offer more flexible conditions. The main benefits of industrial parks include their offering of investors plots with preestablished infrastructure, and a lower level of bureaucracy and paperwork. In some cases, industrial parks also offer tax reliefs and other incentives. Similarly, there are also technoparks and technopolis with the main difference from industrial parks being the additional scope on R&D activities.

2.2 Access to financing

Depreciation of rouble in 2014 has affected the forest sector in several ways, also in regard to access of Russian forest companies to financing. The forest sector is becoming more monopolised and the access to financing of small and medium-sized forest companies more limited. This, in its own turn, leads to underfinancing and inability of self-development. The situation is the opposite for large companies and companies belonging to vertically integrated groups. Due to asset collateral, they have access to loans at minimal rates and develop in more favourable conditions when compared to SMEs. Fully or partly foreign-owned forest companies have access to investments through their own channels what also strengthens their market position. The direct influence of EU and US sanctions on the forest sector is minimal. The main factor limiting access to financing is a high interest rate of the Central Bank of Russia, however the negative influence of that is mostly felt by SMEs rather than large or foreign forest industry companies operating in Russia.

2.3 Logistic infrastructure and transportation costs

The North-West Federal District has a good geographical location as it is situated in close proximity to the EU and well connected to the main European ports. It has relatively well-developed transport infrastructure system including railways, motor roads, water and air ways.

Southern parts of the district have the densest transport network which becomes sparser moving North and sub-par in the Northeast and polar regions.

The total length of operating railroads is 12 410 km, including:

- October Railway – 8 285 km;
- Arkhangelsk and Solvychegodsk sections of the Northern Railway – 1 726 km;
- Sosnovogorsk and Vorkuta sections of the Northern Railway – 1 861 km;
- Vologda section of the Northern Railway – 540 km.

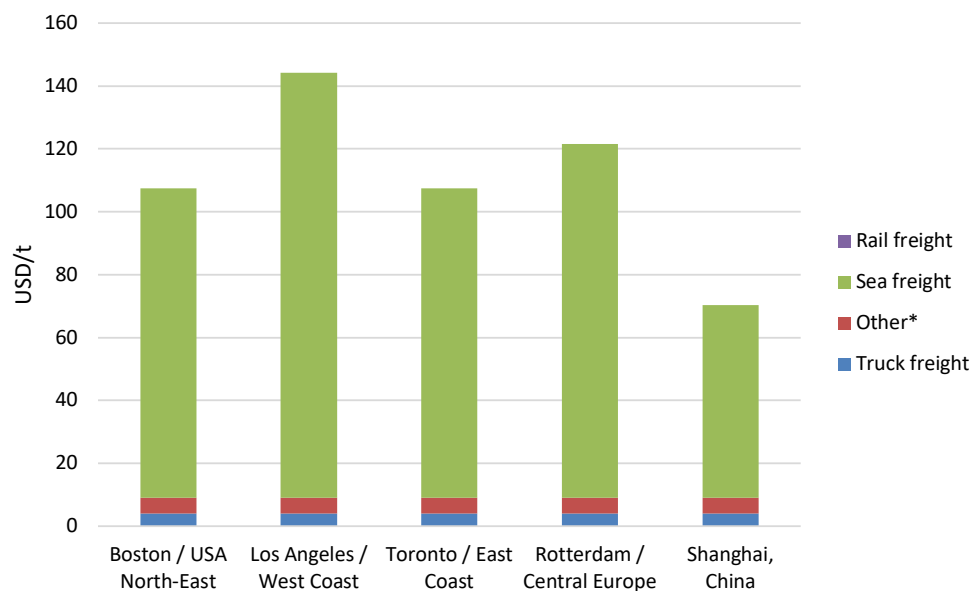
The total length of motor roads is 146 800 km, 65% of which are hard-surfaced. Similar to railways, the motor road network is very sparse in the north-east and polar regions. This mode of transport leads in transported goods and passengers.

There are 8 large sea ports in the North-West Federal District: Saint-Petersburg, Kaliningrad, Murmansk, Arkhangelsk, Vyborg, Vysotsk, Primorsk and Ust-Luga. At the national level over half of sea freight containers are transported through ports of the North-West.

In the North-West the density of forest roads is about 2 m/ha (vs 11 m/ha in neighbouring Finland), while the estimated optimal density for the North-West of Russia would be some 6 m/ha. The cost of road construction is also considerably higher in the North-West of Russia than in Finland – some EUR 30 000 per 1 km vs. EUR 15 000 in Eastern Finland. The cost difference is partially explained by low bearing capacity of soil (clay, clay loam and peat), availability of stone material and ruggedness of the landscape. According to estimates, the share of road construction in wood transportation costs is around 10%.

Generally speaking, transportation infrastructure and the forest road network are considered a limiting factor in relation to forestry and forest industry in Russia.

Figure 2.1 Transportation costs



(*) Port costs, unloading and loading.

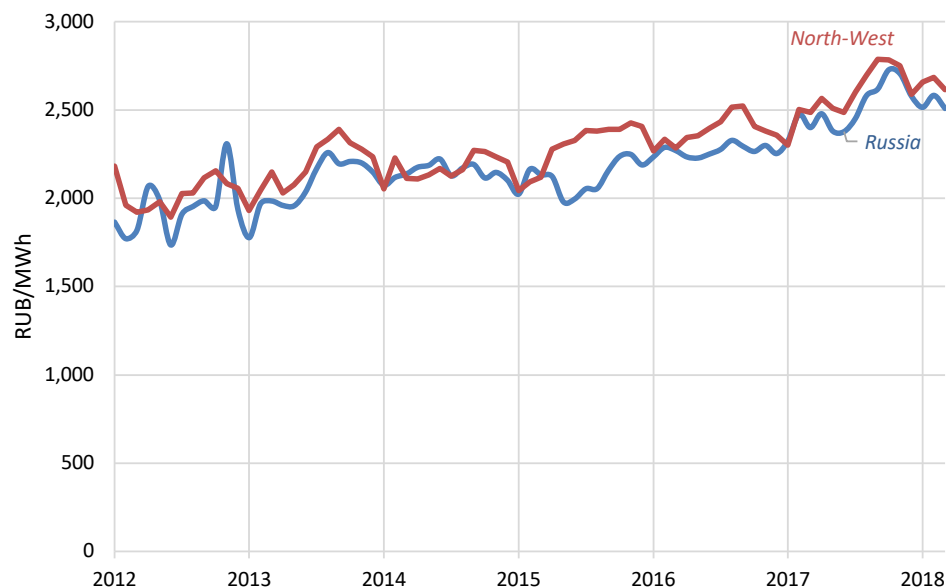
3. TIER 3 – HIGH LEVEL ANALYSIS

3.1 Energy

Currently the average electricity price for industrial operators stands at around 2 600 RUB/MWh in the North-West Russia. During the past 5 years it has been growing at the average rate of 0.3% per year. The electricity prices are currently some 4% higher in the North-West compared to the Russian average.

In Russia, the electricity market consists of two levels—wholesale and retail. On the wholesale market the main actors are power generation companies, operators of export/import of electricity, marketing organizations, electric distribution companies and large consumers, while on the retail market—electricity consumers, utilities organizations, guaranteeing suppliers, independent power supply companies and others. Guaranteeing suppliers¹ are companies which in accordance with the Law on Electric Power 26.03.2003 № 35-ФЗ are obliged to provide electricity to any consumer requesting for it.

Figure 3.1 Delivered industry electricity price, 2012-2017



Source: EMISS.

3.2 Key supplies

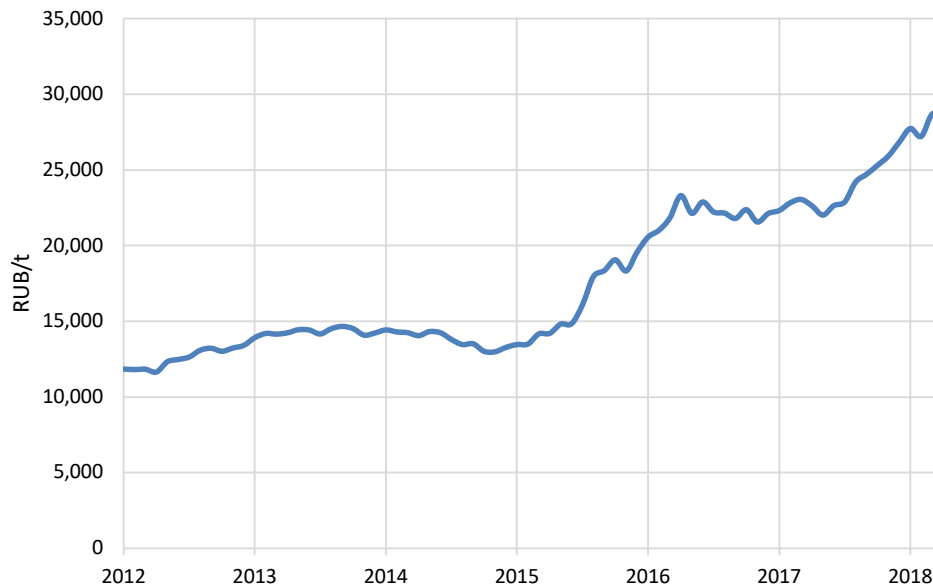
During the past 5 years the average price for sodium hydroxide (caustic soda) has been growing by 1.2% per year and the most rapid growth has been taking place since mid-2015. The average producer's price currently stands at RUB 28 500 (Figure 3.2).

The main producers of sodium hydroxide (caustic soda) in Russia are: AO Kaustik (Volgograd), OOO RusVinil (Kstovo), AO Bashkirskaya Sodovaya Kompaniya (Sterlitamak), AO Sayanskhiplast (Sayansk), OOO Halopolimer (Kirovo-Chepetsk), PAO Himprom (Novocheboksarsk) and others. None of these companies are situated in the North-West of Russia. Nearly half of caustic soda production in Russia is concentrated in Volga Federal

¹ The list of guaranteeing suppliers per federal district is available at https://energybase.ru/generation?CompanySearch%5Bcountry_id%5D=&CompanySearch%5Bdistrict_id%5D=29&CompanySearch%5Bname%5D=&CompanySearch%5Bcity_id%5D=#divider

District. There is a high degree of competition among producers of caustic soda. Most mills are more than 20 years old and integrated into holding companies.

Figure 3.2 Average producer prices for sodium hydroxide (caustic soda), 2012-2018



Source: EMISS.

Compared to sodium hydroxide, the average price for phenol has been more prone to fluctuations during the same reference period (Figure 3.3). The latest available statistics demonstrates that as of April 2018 the average production price for a ton of phenol amounted at RUB 66 250.

Phenol market is dominated by domestic producers and the share of import is less than 3%. Similar to caustic soda, the overall majority of production is concentrated in Volga Federal District.

The biggest producers of PF resins in Russia are OAO Metafraks (Gubakha), OAO Karbolit, OOO Tomskneftekhim (Tomsk), OOO Sibmetakhim (Tomsk), OOO Togliattikauchuk (Tolyatti), OAO Togliattiazot (Tolyatti) and others.

Figure 3.3 Average producer prices for phenol, 2012-2018



Source: EMISS.

3.3 R&D

The main institutions involved in R&D activities relevant for the forest sector are: the Russian Research Institute for Silviculture and Mechanization of Forestry, the State Scientific Centre of Forest Sector, Saint Petersburg State Technological University of Plant Polymers and the All-Russia Institute of Continuous Education in Forestry. Saint Petersburg State Forest Technical University, Moscow State Forest University, and Petrozavodsk State University are among the leading universities in the North-West providing forest-related education.

There are certain technological innovations which are gradually being adopted by forest industry companies in the North-West of Russia—integration of GIS systems in planning of harvesting operations, logistic cost calculations and forest fire monitoring; use of automated systems for monitoring fuel use and spare parts wear of log trucks, wood sorting, bucking and processing; and use of RFID-marks for tracing wood legality.

Nearly all modern technologies used in the Russian wood processing sector are imported. The share of imported equipment for the pulp and paper sector is as high as 95% especially for digesters, drying equipment, and recovery boilers. In wood harvesting the respective share is around 60% as domestic production of harvesters, forwarders, feller-bunchers, and skidders is nearly zero. Heavy transport is the only segment where domestic vehicles are competitive. The reason behind these trends is that many R&D institutions of the forest sector ceased to exist at the beginning of 1990s due to lack of financing. Back then there were over 70 R&D institutions and development labs employing 6 000 researchers—compared to where the situation stands now, the number of institutions has decreased by 30 times and the staff they employ by 10 times. R&D spending is currently 0.01% of the sectoral GDP, which is considerably lower than the average levels in other countries standing at 1.4% (and even more when compared to the leaders of forest sector R&D—Finland and Norway at 2% and 3.1% respectively). Forest sector R&D is lacking interest from young researchers, and the researcher pool is aging (according to some estimates, the average age of leading researchers is over 65 years). According to optimistic forecasts, the total staff involved in the sectoral R&D will increase by 3% per year, however, only in case if supportive measures are introduced and properly implemented.

According to the *Strategy of the development of forest sector of the Russian Federation until 2030*, the most relevant and potential R&D topics for the Russian forest sector are forest breeding and forest management aimed at growth acceleration, technology of multilayer and

alternative forming in production of paper and cardboard, development of wood-based materials for wood construction, and alternative wood-based materials.

Annex 4

Canada, Ontario



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FOR/Maine

Global Market Analysis and Benchmarking Study – Canada (East Coast, Ontario)

Final Report

Helsinki, Finland
June 29, 2018

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ID 122621



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1. TIER 1 – DETAILED ANALYSIS

1.1 Raw material

1.1.1 Harvest levels

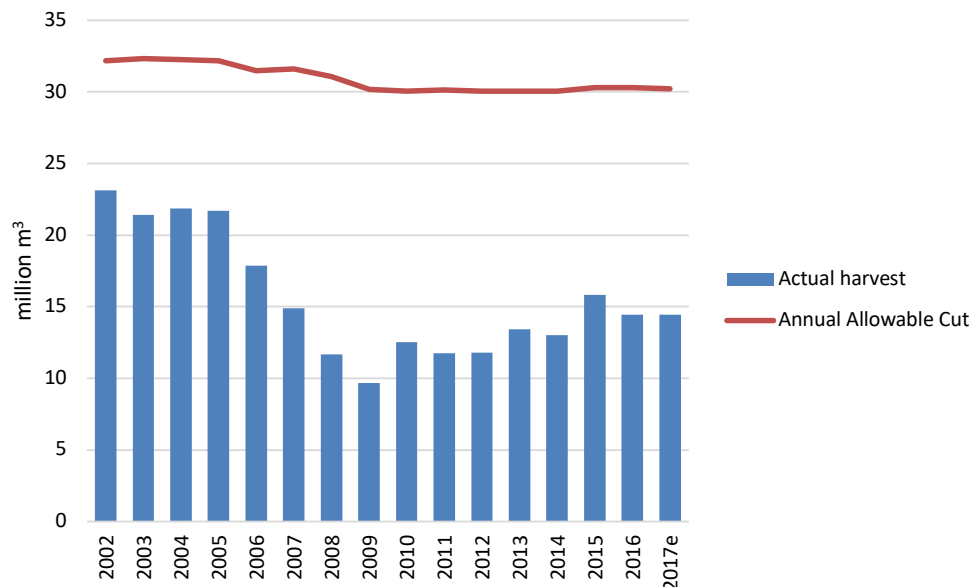
Annual harvests have decreased by over 5 million m³ since 2005 and levelled to around 15 million m³ in recent years. The annual allowable cut (AAC) level was decrease to approximately 30 million m³ in 2009 from an earlier level of about 32 million m³. The additional harvest potential is 16 million m³.

The decline in harvest volumes is a result from the decline of Ontario's forest industry. The entire forest industry suffered in Canada, first starting in 2005 and quickly increasing at the onset of the financial crisis. Additionally, the forest industry in Ontario faced multiple mill shutdowns prior to the global financial crisis. The forest industry in Ontario had made significant investments into processing technologies reducing dependency on workers, simultaneously increasing the energy consumption through automation. During this period, electricity costs increased rapidly and also the wood sourcing distance grew significantly beginning the downfall of Ontario's forest industry due to poor competitiveness in comparison to other regions. The decline of the forest industry was exacerbated by the global financial crisis in 2008 and 2009 reducing the annual harvest level below 10 million m³. In some forest management units, some of the reduction in the wood supply can also be attributed to uneven age class structure of the forests.

The majority of the sawmills are located in South Ontario, while other forest industry sectors are spread out in the rural areas throughout the province.

No significant investments have been announced to Ontario, except by International Wood Industries announcement to invest CAD 140 million in constructing a new sawmill with lines for value-added products as well as a pellet plant.

Figure 1.1 Harvest volumes and annual allowable cut (AAC) Ontario, 2002-2017e



Source: Ministry of Natural Resources and Forestry, National Forestry Database.



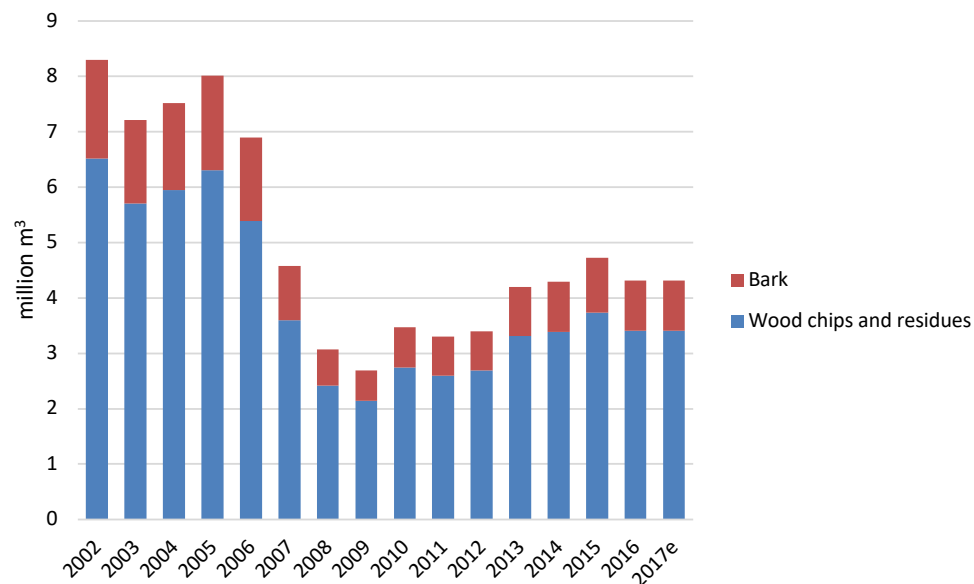
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1.1.2 By-products

Based on the historical consumption of roundwood assortments by different industries, Indufor estimated the by-product production volumes in Ontario using Indufor's databases on by-product streams from different production operations. In the last five years the by-product production is estimated at around 4 million m³ (Figure 1.2). There are seven composite manufacturing plants, one manufacturing laminated strand lumber (LSL), four oriented strand board (OSB) plants, and one particle board and medium density fibreboard plant (MDF). Typical capacity of these plants is 200 000 m³, or a consumption of about 1 to 1.5 million m³ of by-products.

The pulp and paper mills in Ontario consume approximately 4 million m³ of pulpwood annually with a total pulp production capacity of 1.8 million m³. Considering an average roundwood to pulp conversion factor of 3.3 it can be deduced that the by-products are to large extent also utilized by the pulp mills. In addition, the annual recycled fibre consumption is some 100 000 metric tonnes. However, the pulp mills do not run at full capacity and have been reported to be reducing their production.

Figure 1.2 By-product volumes in Ontario, 2002-2017e



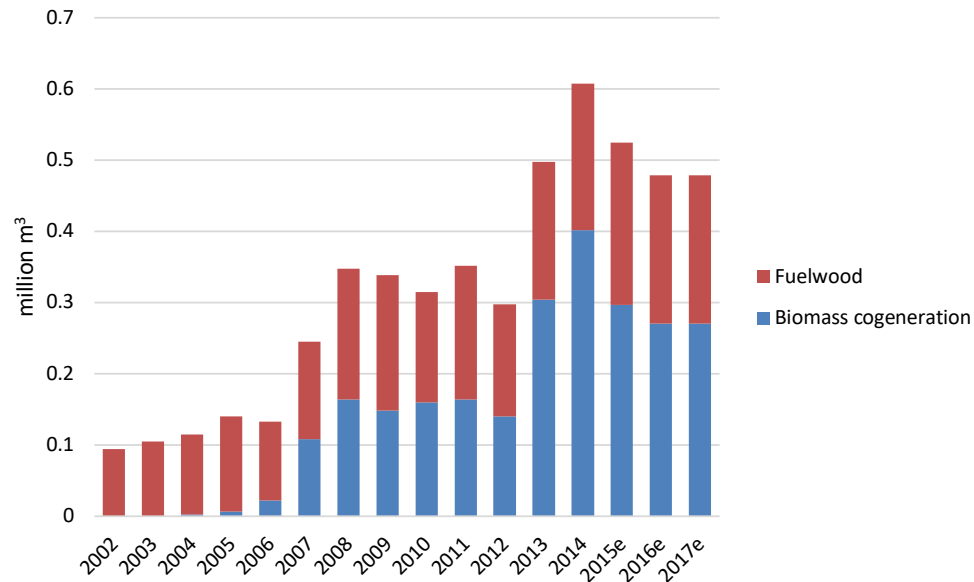
Source: National Forestry Database and Indufor analysis.

The use of by-products and fuelwood have increased significantly in the past 10 years in Ontario (Figure 1.3). The forest industry has made efforts to become more self-sufficient with regards to its power consumption and introduced new technologies to use the forest and other residues in combined heat and power, i.e. in cogeneration. Also, the *Ontario Green Energy Act* has encouraged industrial operators to phase out from fossil fuels and convert into using renewable energies such as biomass cogeneration.



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Figure 1.3 Wood consumption in biomass cogeneration and fuelwood in Ontario, 2002-2017e



Source: National Forestry Database and Indufor analysis.

1.1.3 Forest ownership

Ontario has 71 million hectares of forests. Government of Ontario, i.e. the Crown, owns 91% of the forests. The share of privately owned and owned by Federal government are 8% and 1%, respectively. Ontario Woodlot Association promotes the sustainable and profitable use of Ontario's privately-owned forests.

1.1.4 Delivered wood cost

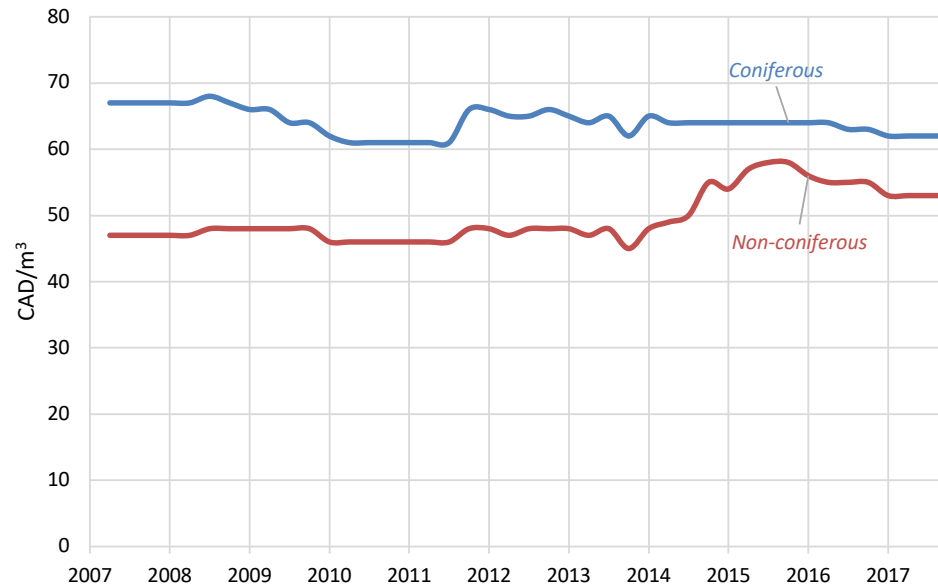
Historically, the delivered wood cost in East Canada has been considered as the highest wood raw material cost in North America. In this case, East Canada constitutes of Ontario and Quebec. However, in the recent years the wood cost has started to decrease, and particularly the modest decrease of coniferous sawlog and wood chip prices have made the industry more competitive on the international markets. The pulpwood price has remained stable and non-coniferous pulpwood price even increased to above 50 CAD/m³ in 2014 (Figure 1.4).

The pulp industry is shrinking in Ontario while the sawmilling industry is running at record levels, which has caused the wood chip price to decline (Figure 1.5). Despite the boost in sawmilling production the sawlog prices have remained at the historically low level of 55 CAD/m³ (Figure 1.6).



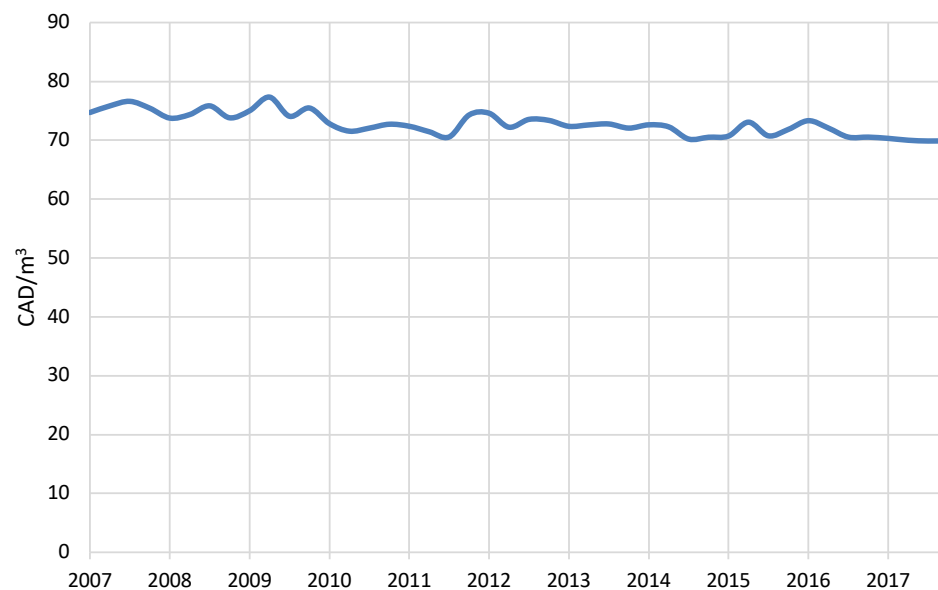
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Figure 1.4 Delivered quarterly pulpwood cost, 2007-2017



Source: Wood Resources Quarterly.

Figure 1.5 Delivered quarterly coniferous sawlog cost, 2007-2017

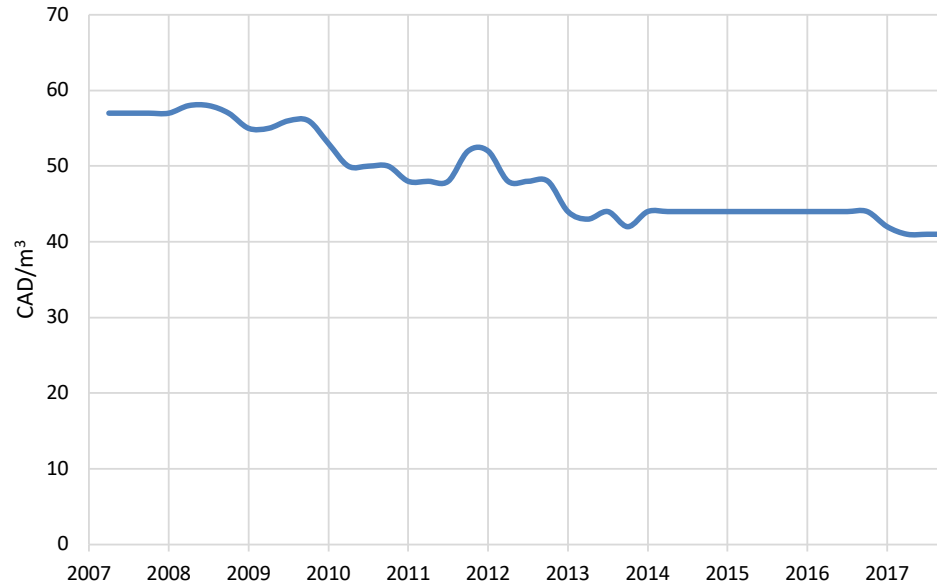


Source: Wood Resources Quarterly.



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Figure 1.6 Delivered quarterly coniferous wood chip cost, 2007-2017



Source: Wood Resources Quarterly.

1.1.5 Wood procurement practice

The forest owner estimates the volume of the wood by assortment to be sold, after which they contact loggers to find interested parties in purchasing the wood. The contracted loggers, i.e. licenced harvesters, locate interested wood buyers and sell the different wood assortments.

Procuring wood from Crown forests for commercial purposes requires a Sustainable Forest Licence, Forest Resource Licence, and wood supply agreement from the Crown or an arrangement to buy trees from an existing licensed harvester. In wood supply agreements from the Crown, the commercial operator will secure a supply of wood to the mill, by obtaining the entire standing stock (with the potential of unwanted assortments). The public forest management units produce forest inventories, which offer wood supply information. The forest management units then notify the mills of the available supplies. The availability of supplies is updated along with procurement deals with mills.

1.2 Workforce

1.2.1 Demographics

The total population of Ontario is over 14 million people and 94% of the population lives in South Ontario (Table 1.1). People are continuing to migrate from the North of Ontario to South of Ontario. The overall population growth rate in Ontario was 1.6% in 2017 and is forecast by Ontario's Ministry of Finance to grow by 1.8% annually. The population is heavily urbanized and only 10% live in the rural areas. The unemployment rate is low to moderate, 5.5% of the total labour force. Employment grew by 2.5% (176 000 employees) in Ontario in 2017. The level of education is also relatively high, 65% of the total population has a higher education than secondary school diploma or equivalent.



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Table 1.1 Key demographic indicators

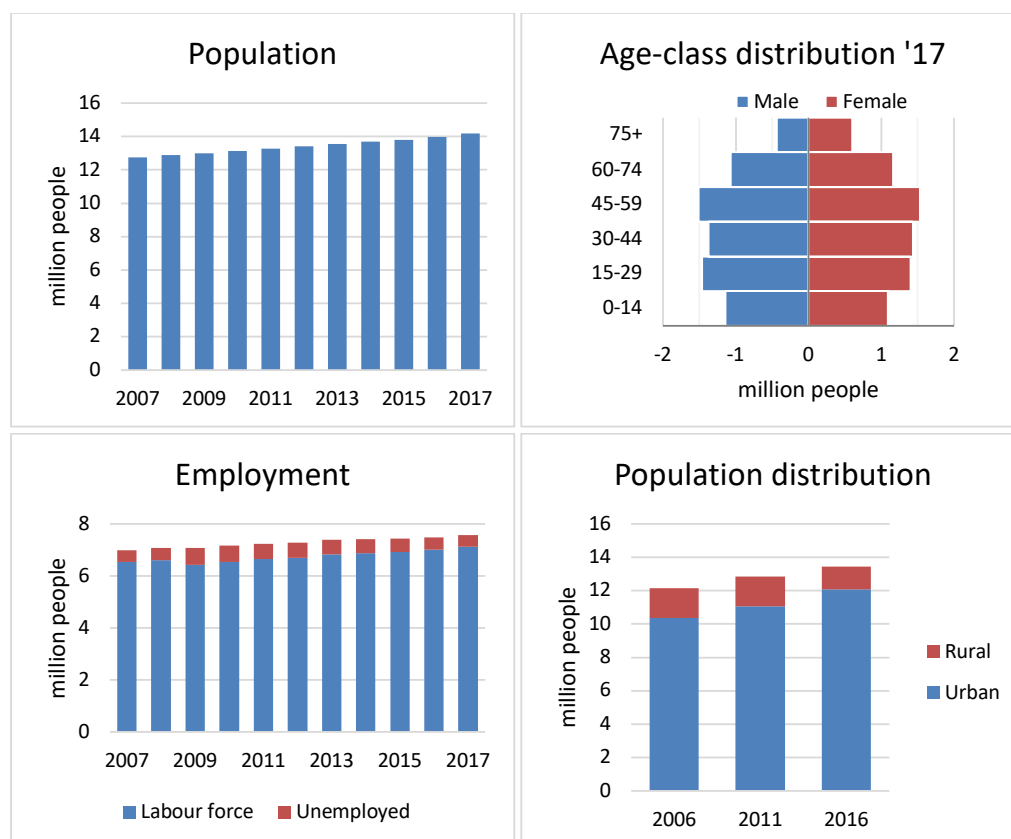
Indicator	Current situation
Total population (Jan. 2018)	14 318 800
Population growth rate (2017)	1.6%
Population urbanization, rural vs urban (2016)	10% vs 90%
Unemployment rate (2017)	5.5%
Level of education ⁽¹⁾ (2016)	65.1%

⁽¹⁾ Ages 25 to 64, people with higher than secondary school diploma or equivalent.

Ontario has relatively high population growth rate compared to other developed countries (Figure 1.7). However, the population growth can be attributed to recent migrations. Ontario is projected to continue to have a strong net migration rate of 73% of all population growth over the 2016-2041 period.

Ontario has relatively uniform age-class structure, and the baby boomer generation of ages 45 to 59 does not stand out significantly (as is the case in many other regions). Unemployment rate has been low throughout the last decade and has continued to diminish. Urbanization has increased in the recent years, and already 90% of the population lives in urban centers. The Greater Toronto Area is the fastest growing region in the province and is expected to increase by 42% and to reach 9.6 million people by 2041.

Figure 1.7 Historical demographic development



Source: Statistics Canada.

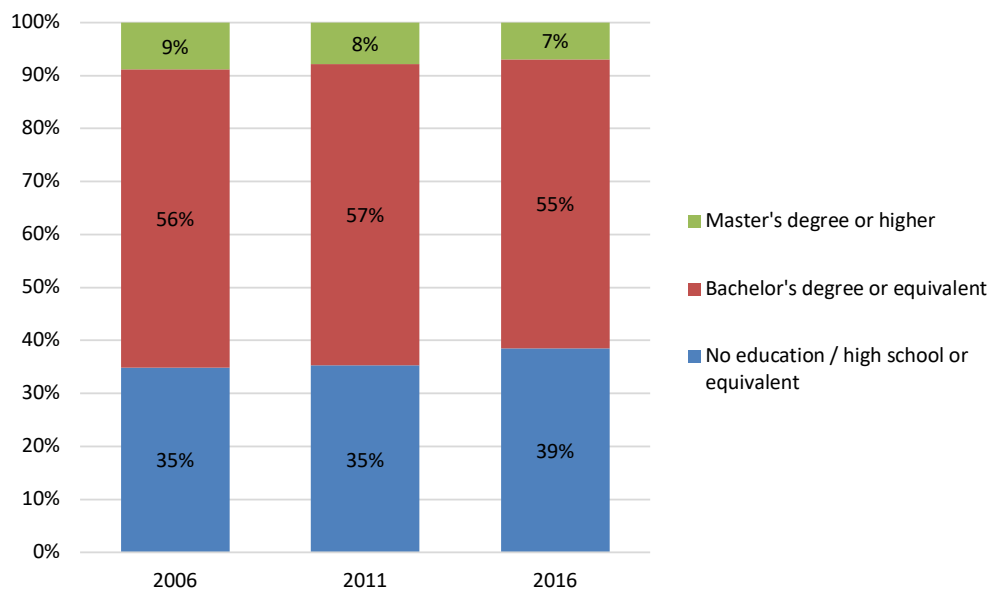


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1.2.2 Level of education and the skill levels required

Ontario has highly educated population with 65% of population having at least secondary level education (Figure 1.8). Investments to modern nanocellulose, cellulosic sugars or pyrolysis oil bioproduct mills requires skilled labor with secondary and tertiary level education in biochemicals and relevant engineering. Investments in MDF and LVL would require labor mainly with secondary level education with a background from applied sciences in engineering. The aforementioned unemployment rate, urbanization particularly to Thunder Bay area and consequent lapse in labor availability is considered a more significant bottleneck than the level of education in Ontario.

Figure 1.8 Level of education in Ontario, 2006-2016



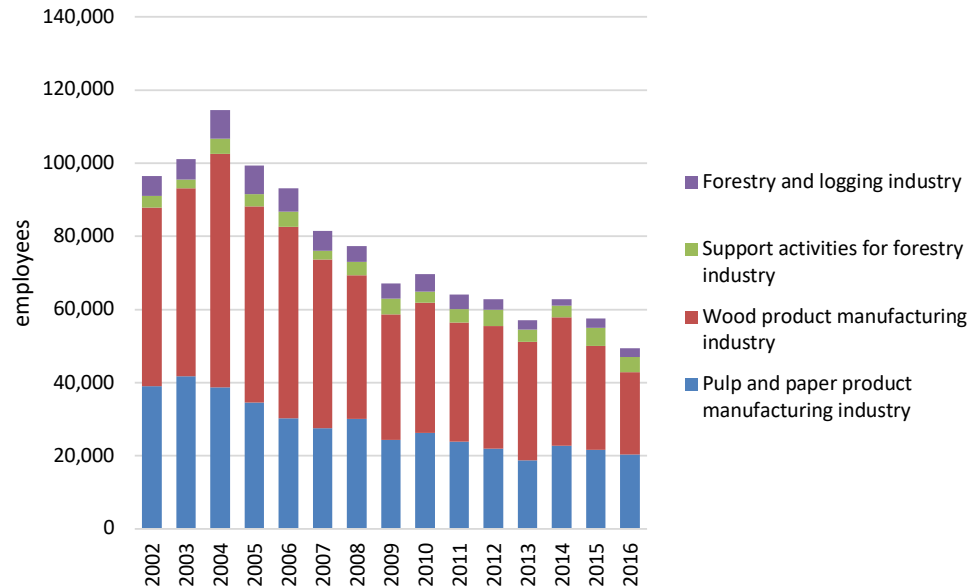
Source: Natural Resources Canada, Labour Force Survey.

The forest sector labor force in Ontario has been diminishing drastically from over 110 000 jobs to just under 50 000 jobs from 2004 to 2016 (Figure 1.9). The decrease in jobs has been fastest in the wood product manufacturing and namely in sawmilling industry. Sawmill industry jobs are typically low-paid and do not require high education levels.



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Figure 1.9 Forest sector direct employment in Ontario, 2002-2016



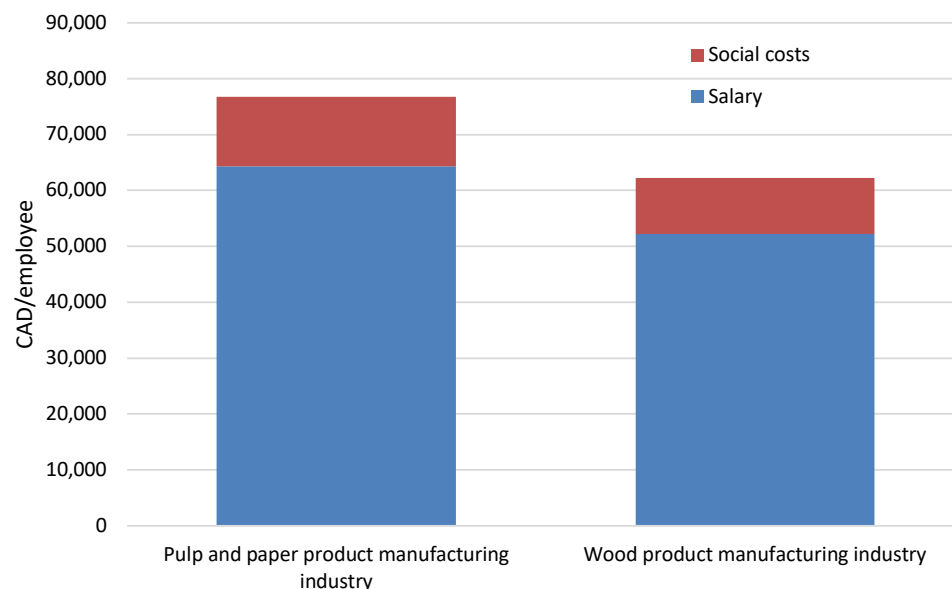
Source: Natural Resources Canada, Labour Force Survey.

1.2.3 Typical labor costs

The average labor cost in the pulp and paper manufacturing in Ontario is CAD 64 500 per employee. The labor cost is significantly lower in the wood product manufacturing industry, which comprises mainly of sawmills, where the average labor cost is CAD 28 400 per employee. According to the statistics for the whole of Canada, the social cost is 16.2% on top of the salaries in pulp and paper and wood product manufacturing industries.



Figure 1.10 Forest sector total salaries in Ontario



Source: Statistics Canada, Natural Resources Canada.

1.3 Regulatory climate

Regardless of number of regulatory acts influencing forestry and forest industry, the regulations can be perceived to have low negative impacts to the commercial operations. In fact, there are some bioeconomy policies that support the forest industry. As a result, the regulatory climate is considered neutral in Ontario.

1.3.1 Federal

Forests

Four percent of forest land in Canada is owned and regulated by federal government through the *Forestry Act*, while 90% of Canada's forest land is owned by provinces and territories and six percent is privately held. The *Forestry Act* aims to develop and research forests and provides timber regulations, including the cutting and removal of timber on federal lands. Under the *Forestry Act*, the Governor in Council is allowed to manage a forest experimental area on land that belongs to the State (Crown) or lands provided to the State (Crown) through an agreement with a province. Good forest management is promoted under the *Forestry Act*.

Although responsibility and authority regarding timber yield, rate of harvesting, and forest tenure and management are held by the provinces under the *Constitution Act*, with the exception for First Nations reserve land and national parks, sustainable forest management principles have been adopted nationwide in 1992. Sustainable forest management refers to forest management that maintains the environmental, social, and economic values and benefits of forests over time.

While there are no federal laws regarding timber harvesting levels, the Canadian government measures and ensures that harvests remain below sustainable limits through an indicator that compares the amount of timber harvested with the wood supply, also known as the maximum sustainable harvest. The maximum sustainable harvest is referred to in this study as the annual allowable cut (AAC). The indicator is part of the Federal Sustainable Development Strategy (FSDS) aimed at establishing goals and targets, and identifying actions to achieve them. The 2016–2019 FSDS is the third strategy prepared, which promotes clean growth, ensures healthy



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ecosystems, and builds safe, secure and sustainable communities over the next three years. It includes the following targets regarding forests:

- By 2020, at least 17% of terrestrial areas and inland water are conserved through networks of protected areas and other effective area-based conservation measures.
- Between now and 2020, maintain Canada's annual timber harvest at or below sustainable wood supply levels.

Forest Operational Regulations

The following regulations are the most important for forestry operations:

- *Under the Fisheries Act*, The Pulp and Paper Mill Effluent Chlorinated Dioxins and Furans Regulations the deposit of deleterious substances from pulp and paper mills into waters frequented by fish is managed. It requires that operators sample their effluents and it prohibits the release of chemicals. In addition, the regulation sets limits for the maximum quantities of biochemical oxygen demand matter (which consumes oxygen dissolved in water) and suspended solids that can be deposited from pulp and paper mills under prescribed conditions.
- Under the *Canadian Environmental Protection Act* (CEPA), regulations regarding formaldehyde emission standards for composite wood products help to reduce exposure to formaldehyde emissions from certain wood product, produced domestically or imported into Canada. In addition, it ensures that these regulations are aligned with those set out under Environmental Protection Agency (EPA) of the USA. Canadians will have the opportunity to provide comments on the regulatory proposal, which is anticipated to take place in fall 2018 and last 75 days.
 - As it stands, Formaldehyde was added to the List of Toxic Substances in Schedule 1 of CEPA 1999 and current controls focus on reducing formaldehyde emissions to outdoor air.
- Under the *Canadian Environmental Protection Act* (CEPA), the Code of Practice for management of air emissions from pulp and paper mills recommends and promotes best practices to facilitate and encourage ongoing improvements in the environmental performance of pulp and paper mills with respect to sulphur dioxide (SO₂) and total particulate matter (TPM) air emissions from combustion sources.
- *The Regulatory Framework for Air Emissions* (2007) mandates reductions in emissions of greenhouse gases and air pollutants from the following industrial sectors: electricity generation produced by combustion, oil and gas, forest products (including pulp and paper and wood products), smelting and refining, iron and steel, iron ore pelletizing, potash, cement, lime, and chemicals production, including fertilizers.

Environmental and Forest Management Regulations

The following regulations refer to general environmental and conservation management practices for forestry operations:

- *Canadian Environmental Assessment Act* (2012) assesses the affect a project has on the environment and aims to protect the environment from adverse effects from human activities, as well as to promote cooperation with aboriginal communities, and to ensure public participation. The act applies to federal lands where the federal government is financially supporting activities. Under the Act the Canadian Environmental Assessment Agency, who assists the Minister of Environment, will assess if a project requires an Environmental Assessment (EA).
- *Species at Risk Act* (2002) aims to prevent wildlife species from extinction or from extirpation, which refers to "wildlife species that no longer exist in the wild of Canada, but exist elsewhere". Furthermore, it intends to recover those species that have been extirpated from an area or experienced severe declines from human activities, and to manage species of special concern. Forestry operations will have to consider if there are species at risks in the area of their operations and if there are species at risk in the



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area of operations, it requires adjustment of activities and planning around these species.

- *Migratory Bird Convention Act* (1994) aims to protect and conserve migratory birds (as a population and individually) and their nests. There are general prohibitions under this Act and regulations that protect migratory birds and their nests and eggs; in addition, there are prohibitions on polluting areas and waters frequented by migratory birds with harmful substances.
- *Fisheries Act* (1985) concerns the managing of fish that are part of a commercial, recreational or Aboriginal fishery, or fish that support such a fishery. The Act prohibits the release of substances that could potentially degrade or alter the quality of water in ways that are harmful for fish. Industrial forestry operations have to manage the use and storage of chemicals and petroleum products in accord with this act.
- *Pest Control Products Act* (2002) manages chemicals that can be used in forest management, and is affected by the Canadian Environmental Protection Act.
- *First Nations Land Management Act* (1999) provides signatory First Nations the authority to make laws in relation to reserve lands, resources and the environment.
- *National Parks Act* (updated 2000) regulates protection of natural areas of national significance.
- *The Canada Water Act* contains provisions for formal consultation and agreements with the provinces and allows polluting contaminants to enter the water in low concentrations under some circumstance. The two goals of the federal government are to protect and enhance the quality of the water resources and to promote the wise and efficient management and use of water. All provinces and territories in Canada have pollution control regulations.

Bioeconomy

In 2015, the Canadian Council of Forest Ministers' (CCFM) committed to the Kenora Declaration of Forest to advance innovation and the bioeconomy in the forest sector. As part of their commitment, the CCFM developed a four-year Innovation Action Plan 2016-2020 aimed at implementing the three pillars of the declaration: 1) collaboration to accelerate and enhance sustainable, market drive investments to commercialize process, product and market innovation, with a focus on environmental excellence; 2) engage prospective partners and new entrants in non-traditional industries and academic fields, making concerted efforts to facilitate connections with the forest sector; and 3) mobilize the best talent and technologies to address the future needs of the forest sector.

The following regulations are of importance to bioeconomy:

- Greenhouse gas emissions: The government is committed to reducing Canada's total emissions of greenhouse gases, relative to 2005 levels, by 20% by 2020 and by 30% by 2030 under the Paris Agreement. As part of governmental commitment, in 2016 *The Clean Fuel Standard Regulations* was adopted try to achieve 30 Mt of annual reductions in GHG emissions by 2030, contributing to Canada's effort to achieve its overall GHG mitigation target of 30% emission reduction below 2005 levels by 2030. The design of the draft regulations will be published in late 2018. Furthermore, a Carbon Tax will be introduced in 2019, starting at CAD 20 per ton of emissions, climbing to CAD 50 per ton by 2022.
- Under *The Renewable Fuel Regulations* fuel producers and importers are required to have an average renewable fuel content of at least 5% based on the volume of gasoline that they produce or import into Canada (commencing December 15, 2010) and of at least 2% based on the volume of diesel fuel and heating distillate oil that they produce or import into Canada (Commencing July 1, 2011). A trading system was designed to enable primary suppliers to acquire compliance units from others, if needed, in order to meet their renewable fuel content requirement(s) under the Regulations.



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- There are standards for 1) Solid Biomass Fuels, 2) Graded Wood Pellets, 3) Graded Wood Briquettes, 4) Graded Wood Chips, and 5) Graded Firewood.

1.3.2 Ontario

Forests

Most of Ontario's forest land is owned by the government of Ontario (the Crown). Only eight percent is privately-owned, and one percent belongs to the federal government. Different legislations apply for land owned by the government and privately held land.

Crown Land

The policy framework for sustainable forests governs forest land owned by Ontario (the Crown) and outlines the broad direction of forest policy and sustainable forest management. *The Crown Forest Sustainability Act* (CFSA) is at the center of this framework and regulates forest management planning, collection and reporting of forest management information, forest operations, compliance and enforcement, forest resource allocation and licensing, setting and payment of Crown charges, and independent forest audits. Under the CFSA, sustainable forest management became a legal requirement, which is implemented by CFSA's manuals and guidelines.

Other important legislations are the federal *Environmental Assessment Act* (1990), the *Environmental Bill of Rights* (1993), and the *Environmental Assessment Act* (EAA) among others. In addition, the *Ontario Forest Accord*, an agreement by government, industry, and conservation groups to a mutually acceptable approach to the establishment of new parks and protected areas while also ensuring the security of the forest industry, includes a commitment to streamline the forest management planning guides and regulations created under the *Crown Forest Sustainability Act*.

Private Land

The federal Forestry Act, the Trees Conservation Act, the Trees Act, and the Municipal Act may apply on some private lands, as well as the federal environmental legislation previously mentioned.

- The Forestry Act "gives the Minister of Natural Resources authority to enter into agreements with landowners such as municipalities or conservation authorities for forest management purposes. In addition, the Minister is given power under the Act to create programs to protect, manage, or establish woodlands and to encourage management that is consistent with good forestry practices."
- The Municipal Act allows all levels of municipalities in Ontario to pass forest conservation by-laws to regulate tree cutting.
- The Trees Conservation Act (1946), the Trees Act (1950) allow municipal councils to enact forest conservation by-laws.

However, in general, "forest management is not heavily regulated by the Government of Ontario. In some municipalities, municipal governments have passed tree cutting bylaws, under the Municipal Act, which may influence the harvest of timber on private lands. Otherwise, forest management is a voluntary activity on private land. To encourage good forest management, the Ontario government provides tax incentives to landowners who develop and commit to implement forest management plans."

Forest Management – Harvest

In general, Ontario does not determine an annual allowable cut on all the land, and timber agreements are allocated in three forms: supply agreements, sustainable forest licenses, and forest resources licenses.

Sustainable forest licensees are required to operate under a forest management plan, which is updated every 10 years, including an annual work schedule, with a validity for a 20-year term



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and a minimum of 160 years of strategic planning horizon. Every 5 to 7 years the license will be reviewed, which then can be extend for an additional 5 years. All forest management plans require an EA approval.

Harvest: Under the sustainable forest license, an allowable harvest level is determined, as well as renewal, access and maintenance activities. A maximum clearcut area of 49 hectares is allowed, while forest legislation restricts the size of clearance in state forests to 260 ha in Ontario (FPAC, 2015. Forest companies in Ontario pay Crown charges (stumpage) for every cubic meter of timber they harvest, within the Crown land.

Environmental: There are also buffer requirements (watercourse protection measures) in place for herbicide application of pesticides in forest to protect wildlife features under Ontario's Forest Management Guide for Conserving Biodiversity at the Stand and Site Scales (2010). Within set buffers, activities such as harvest and renewal are also constricted. To further conserve biodiversity, Ontario incorporates the coarse/fine filter approach, which focuses on conserving entire plant and animal communities (coarse), as well as individual species (filter), such as white-tailed deer and pine marten.

Forest Resource License are short-term (no longer than 5-years) licenses that authorize the harvest of timber in a smaller geographic area. Licensees are only responsible for operational activities, such as harvesting and the associated road construction.

Supply agreements: As stated by the government of Ontario, under supply agreements, the government makes a specific supply of Crown forest resources available to a licensed forest resource processing facility for a specified period. Supply agreements obligate the holder of a forest resource license (the harvester) to make forest resources available to the supply agreement holder.

Forestry Operations Regulations for Crown Land

Forest resource processing facilities are regulated under the CFSA, which requires licensing for all forest resource processing facilities (e.g. pulp and paper mills, sawmills) which consume more than 1 000 m³ of forest resources per year. A forest resource processing facility license defines how a person can operate or construct a facility, increase the productive capacity of a facility or convert a facility to another type of facility. Before a facility license can be issued, the Ontario government must be satisfied the facility has a sufficient supply of forest resources to operate.

Bio Economy

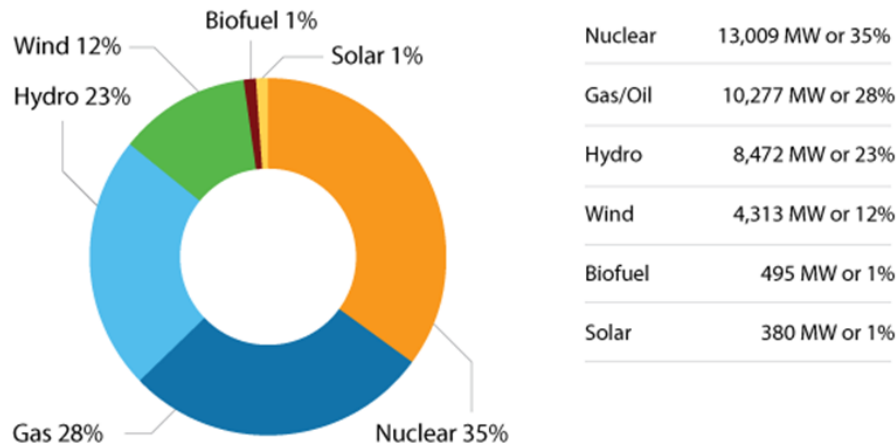
Several Acts and Plans govern (renewable) energy strategies in Ontario.

- Under Ontario's Action Plan on Climate Change, Ontario is committed to reducing its greenhouse gas emissions to 6% below 1990 levels, and 15% by 2020.
- *Ontario Green Energy Act* aims to phase out coal-fired electricity and switch to renewable energy supplies. Renewable energy sources include biomass, biofuel and biogas. Key measures to facilitate development of renewable energy sources include the Feed-in Tariff program that guarantees specific rates for energy generated from renewable sources, streamlined energy approvals, and mandatory connection and priority access. Only stands identified in existing forest management plans are utilized (i.e., small stands that would not be conventionally logged are excluded), and in those stands any undesirable/unmerchantable trees can be taken, but green-tree retention guidelines still apply.
- Ontario's Long-Term Energy Plan lays out target plans of the province for clean, renewable energy (wind, solar, and bioenergy) of 10 700 MW by 2018. In 2015, Ontario's installed generation capacity totalled 36 945 MW, including over 5 000 MW of renewable energy as can be seen from Figure 1.11.



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Figure 1.11 Ontario's installed power generation capacity



Ontario's Integrated Power System Plan (Ontario Power Authority 2007) aims to double renewable energy capacity from 2007 to 2027, including a goal to add 800 MW of biomass-based power generation capacity.

Ontario's Forest Management Guide Conserving Biodiversity at the Stand and Site Scales outlines the regulations regarding biomass harvesting to ensure there will be sufficient retention of trees, downed woody material, soil protection, maintenance of understory, and protection of important wildlife features throughout forestry activities including biomass harvesting (Waito and Johnson 2010). Moreover, *Ontario Forest Biofibre Policy* aims to improve the utilization of forest products. The goal is to seek for forest residues that are underutilized. The policy does not apply to residual by-products of mill operations such as wood shavings, sawdust, bark, or wood chips. Ontario has clearly defined restrictions on what can and cannot be removed through forest harvesting.

Other applicable regulations

- The Environmental Bill of Rights, which aims to prevent, reduce, and eliminate the use, generation, and release of pollutants that are an unreasonable threat to the integrity of the environment among other things. For instance, biofuel production facilities require a certificate of approval for discharge into air and water. In addition, the Liquid Fuels Regulation, under the Technical Standards and Safety Act, applies to facilities, such as forestry operations, where gasoline or an associated product is handled, loaded, or dispensed to be used as a fuel in motor vehicles or as a fuel oil. These facilities require a license, registration, or certificate as outlined in the regulation.
- Ontario's Greener Diesel Regulation (2014) requires both a minimum volume of bio-based diesel (at least 4% of total diesel) to be blended into petroleum diesel as well as minimum reductions in lifecycle GHG intensity (70% reduction). Implementation of the regulation is being phased in over 3 years, with final requirements, which came into effect in 2017. Ontario's Ethanol in Gasoline Regulation (2007) requires at least 5% ethanol in gasoline and provides a regulatory incentive for cellulosic ethanol (1-liter cellulosic ethanol is equivalent to 2.5 liters of ethanol).



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1.4 Taxation

In Canada, taxation, deductions, exemptions, and credits can simultaneously be applied for the same service or product on federal, provincial, and county level.

Total corporate tax rate is 49.5% in Ontario, one of the highest within North America when no exemptions are in place. The corporate tax rate comprises of Federal basic rate of 38% and Ontario's provincial tax rate which is 11.5% for large businesses and 3.5% for smaller businesses. The basic rate is usually reduced by 10% to 28% through federal tax abatement or by 15% to 23% after general tax reductions. Consequently, the effective tax rate is 26.5% which is the lowest in North America.

Canada has a sales tax on both federal and provincial level. Ontario has a total sales tax rate of 13%, including the federal tax rate of 5% and provincial sales tax rate of 8%.

Canada has programs in place to reduce the corporate tax rate, such as deducting the entire cost of equipment purchases from a company's taxable income as well as reducing an employer's federal income tax liability when increasing employment. In Canada these programs are constructed to explicitly exempt biotechnology start-ups.

Ontario provides lower corporate income tax rate for manufacturers and small businesses, as well as offers numerous tax credits and incentives that can be used to reduce income tax to encourage scientific research and experimental development (SR&ED). The latter incentives make the after-tax-cost of SR&ED lower in Ontario than in many other jurisdictions, including the United States.

For corporations that derive at least 10% of their gross revenue for the year from manufacturing or processing goods in Canada for sale or lease, can claim the manufacturing and processing profits deduction (MPPD). The MPPD reduces the 38% tax with a rate of 13% on income that is not eligible for the small business deduction to 25%.

Ontario Tax Exemption for Commercialization: Newly established corporation, such as bioeconomy/clean technologies, may be eligible for a refund of the corporate income tax and corporate minimum tax for business paid in its first 10 taxation years.

Sale of standing and cut timber is taxed on a federal level in Canada. The sale of both standing and cut timber are taxed as ordinary income in Canada. Many costs related to the production of wood or growth of timber are eligible for a deduction or credit in Canada through the federal Common Reporting Standard (CRS). In Canada, the logging tax paid on a provincial level may be eligible for credits through the CRSs. Ontario has a provincial tax of 7.26 CAD/m³ on Crown land, which comprises of Forestry Futures Trust Charge, Forest Renewal Trust Charge and Crown Stumpage Fee.

Ontario and Canada do not have trade tariffs on imports of sawnwood, wood pulp and waste paper, LVL, pyrolysis oil, nano cellulose or cellulosic sugars. However, there is a 6% tariff for MDF which exceeds in density 0.8g/cm³.

In Ontario, regarding investments, a maximum of CAD 4 million tax credit can be obtained in addition to the federal credits. Also, the Ontario Innovation Tax Credit (OITC) is a 10% refundable tax credit on up to CAD 3 million of qualifying SR&ED expenditures of an associated group and is subject to phase-out limits.

Canada is in the process of developing a federal carbon taxing system, with carbon prices of min. 10 CAD/ton, while Ontario already introduced a cap-and-trade system. Ontario passed legislation introducing a cap-and-trade system in May 2016 and held its first carbon allowance auction in March 2017. Participation in the cap and trade program is not mandatory for facilities that generate less than 25 000 ton of greenhouse gas emissions per year.



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2. TIER 2 – GENERAL ANALYSIS

2.1 Policies

2.1.1 Incentives Canada Ontario

Incentives for the forestry sector are high in Canada on a federal level and medium for Ontario, while incentive for the bioeconomy are high in Ontario, but low on a federal level.

Forest Sector:

In reaction to the imposition by the US to impose duties on imports of certain Canadian softwood lumber, the Government of Canada formed a task forces and implemented immediate action, including CAD 867.5 million in funding over the coming years.

Ontario also responded to the US imposition, with direct funding of \$30 million over three years. Although direct funding is lower, the government of Ontario will invest up to 50% of the costs of eligible forestry projects, as well as reduce electricity costs up to \$20 million per year for forestry businesses in the northern part of Ontario.

Bioeconomy:

The Government of Canada mainly supports innovation and research through networks aimed at creating an enabling environment to develop Canada's bioeconomy, with an additional fund of CAD 500 million for biofuels.

Ontario on the other hand has a cumulative budget of CAD 1.1 billion over 10 years for technology funds, CAD 2.1 billion for green bonds and banks, and supports technology, research and energy efficiency projects anywhere between CAD 80 000 to CAD 10 million per project. In addition, Ontario supports its regional productivity, export and businesses with CAD 285 million in funds over 3 to 10 years.

2.1.2 Direct federal and provincial incentives in the forestry sector

The government of Canada has a history of supporting the forest economy. For instance, from 2009 to 2012, the government aimed to improve the environmental performance of Canada's pulp and paper mills, by providing a funding of CAD 1 billion. Moreover, in 2016, the federal government partnered with Quebec through the Transformative Technology Program to develop nano crystalline cellulose technology pilot plan, with CAD 32.4 million in funding. In the same year the federal government and Quebec provided respectively CAD 9 million and CAD 3.5 million in funding to install a plant to produce dissolving pulp from birch wood.

In 2017, the government pledged to invest CAD 867.5 million over a period of 2 to 4 years, in a reaction to the imposition by the US department of Commerce of duties on imports of certain Canadian softwood lumber products into the US.

Of the CAD 867.5 million, CAD 173 million (over three years) will go directly to research and development projects, supporting expanded use of wood in everything from innovative construction materials to biofuels. While, CAD 605 million will be in form of loans and loan guaranteed through the Business Development Bank of Canada, and CAD 99.5 million will go to help employment and community development, including helping employers avoid layoffs and retain skilled workers (CAD 9.5 million over 4 years) and assist provinces to help workers transition to new employment opportunities (CAD 80 million over two years).

On annual average, starting in 2018, the Canadian Government will directly fund the forestry sector with CAD 77.75 million. Although lower in direct funding, the province of Ontario funds the forestry sector with CAD 10 million on average per year through the Forestry Growth Fund as well as CAD 7.8 million through the Mass Timber Program. In addition to direct funding, Ontario will invest up to 50% of the costs of eligible forestry projects, as well as reduce electricity costs up to CAD 20 million per year for forestry businesses in the northern part of Ontario. Furthermore, businesses can find support through the Centre for Research and Innovation in



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the Bio-Economy, which is mandated to find new novel uses for forest biomass; to bring the forest industry beyond the traditional markets of newsprint, pulp and lumber.

Overall, the federal government supports innovation and research mainly indirectly through networks aimed at creating an enabling environment to develop Canada's bioeconomy. In addition to networks, the federal government implemented a CAD 500 million Next Generation BioFuel Fund to invest with the private sector in establishing large scale demonstration facilities to produce next-generation biofuels.

Ontario on the other hand provides many funds, (grants and loan) programs, which can be roughly categorized into the following buckets: forestry, technology, low carbon economy, research, regional economy, and trade.

2.2 Access to financing

Canada's banking system is stable and is considered one of the safest in the world. Canada's current credit rating is AAA stable/A-1+, which provides low interest rates. Although Moody downgraded the credit ratings of Canada's six largest banks in 2017, it noted that the country's banks remain among the highest rated globally.

As of May 2018, the Bank of Canada has kept the interest rate relatively low at 1.25%, due to slightly weaker economic performance. The Bank expressed their intention to hike rates gradually over the coming months. The Bank of Canada has struggled to maintain an inflation rate of 2%, as rates have recently increased. In 2017, the Inflation rate was 1.6%, while for 2018, it is expected to average between 2.2 to 2.3% and between 2.0 to 2.1% in 2019, according to the Focus Economics Consensus forest and the Bank of Canada respectively.

Overall the banking sector in Canada is favorable to large scale investments. The Government of Canada provides loans and loan guarantees. In 2017, the Government made commercial financing and risk management solutions, valued at CAD 500 million, available for forestry companies, through Export Development Canada (EDC). This move came as a reactionary measure to the United States government's introduction of import duties on certain Canadian softwood lumber. The Business Development Bank of Canada (BDC) additionally made CAD 105 million available in commercial financing to help forestry companies in the short and medium term.

In terms of private funding, in 2016, Canada ranked third in global attractiveness for private equity and capital venture. Although private equity investing and venture capital has soared in Canada in the recent years, these investments have primarily focused on sectors outside of forestry (ICT, Life Sciences, and Oil Gas).

In Ontario, the finance system is stable and offers a wide variety of potential finance sources from venture capital to commercial banks. Ontario's credit rating is Aa(2) N according to Moody's, which indicates a very low credit risk and subsequently a low interest rate. In 2017, the inflation rate based on the consumer price index was 1.7 percent.

The forestry sector largely benefits from the available financial sources in Ontario. According to the Government of Ontario, total annual investment in the forest industry averaged CAD 777.4 million over 2009-2013—down significantly from CAD 1 116.3 million in 2004-2008. Investment by the wood products industry averaged CAD 189 million annually over 2009-2013 (representing 15 percent of total amount invested in sector across Canada)—down from CAD 343 million in 2004-2008. Additionally, investment by the pulp and paper industry averaged CAD 568 million annually over 2009-2013 (representing 27 percent of total amount invested in sector across Canada)—down from CAD 690 million in 2004-2008. Investment amounts in Ontario indicate a favorable investment environment.

Ontario has created numerous government programs to fund environmentally minded projects and infrastructure. The government of Ontario offers a green bonds program, as part of its Climate Change Action Plan, aimed at reducing GHG by 80% compared to 1990. The program was launched in 2014 with CAD 500 million, quickly followed by other rounds of funding, with



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CAD 750 million in 2016, CAD 800 million in 2017, and CAD 1 billion in 2018. Furthermore, in 2018, a Green Bank with CAD 1.1 billion in funding was established by the Government to support large commercial and industrial projects, by working with commercial banks to help aggregate projects to reduce risk.

Although the climate seems favourable to large scale investment, innovative early-stage companies, with limited profits and tangible assets, still find it difficult to secure financing from traditional sources. According to the government, venture capital and risk capital mechanisms are needed to fill the gap. To compensate the government offers programs, such as the Ontario Angel Network Program, the Ontario Venture Capital Fund, the NorthLeaf Venture Catalyst Fund, and the ScaleUP Ventures Fund. Additionally, Ontario Capital Growth Corporation (OCGC), which was established by the Ontario Capital Growth Corporation Act, 2008, manages Ontario's interests in venture capital funds to ensure that more high-potential technology companies have access to the capital required to grow and prosper. As a result, the venture capital market is flourishing in Ontario with many networks around the province, focused especially on innovation start-ups and regional economic development.

Conclusion:

Given that Canada's banking climate is stable, provides large loan guarantees focused on forest sector, and has an attractive private equity market, the score for financial access is high.

Given Ontario's many incentives and stable banking sector, the environment can be considered favourable to the forestry sector in general and innovative technologies specifically.

2.3 Logistic infrastructure and transportation costs

Holding 2% of the world's forests, Ontario is abundantly wealthy in wood resources. Due to the remote locations of most forest sites, publicly maintained forest access roads play a large role in cost efficiency of transport and overall market prices. The most recent forest access roads data available from 2013 indicates 26 618 km of roads were maintained, 3 915 km of roads were constructed, and 1 004 km were decommissioned by physical or natural means. The Ministry of Natural Resources and Forestry (MNRF) incurred costs of nearly USD 39 million for the construction, maintenance, and monitoring of primary and branch roads, as well as stream crossings. USD 32 million was spent on primary roads and USD 5.93 million on branch roads.

According to a study by Public Sector Digest Inc. in 2015, Ontario's infrastructure identified more than one third of roads and bridges as in poor or very poor condition. The nearly 40 000 km of highway lanes, built mainly in the 1990s, have struggled to deal with the harsh Ontario climate, leaving the provincial government with massive expenditures for annual maintenance. Issues with reliability and subsequent congestion of commercial transit for these roads in the Southern regions of Ontario have a significant impact on overall expenses—with estimates of USD 4.62 billion in costs to the regional economy (Greater Toronto and Hamilton Area). The United States accounts for more than 95% of all wood products from Ontario, with 71% utilizing trucks, 20% using railways, and a further 9% through marine and air transit.

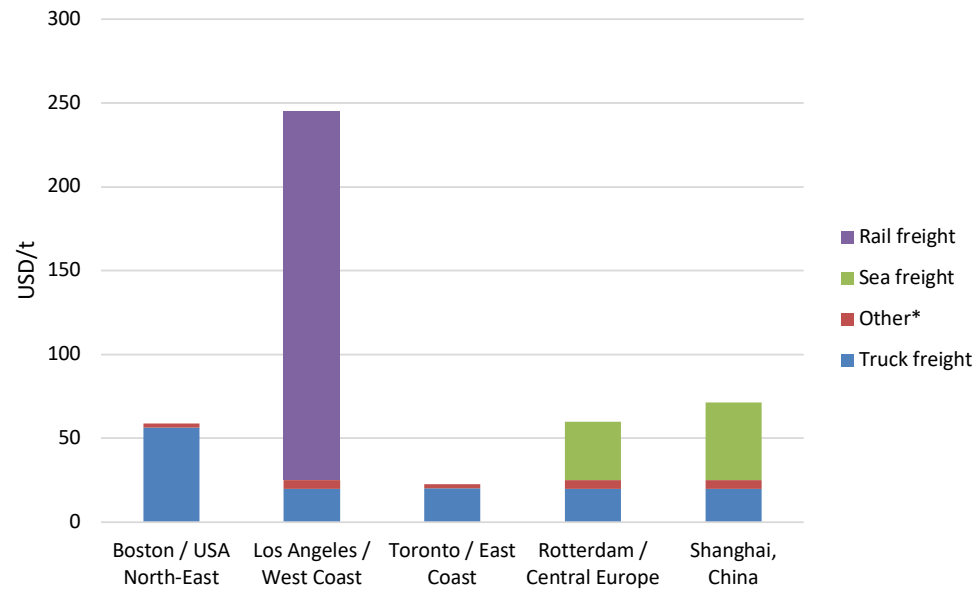
Rail and marine transit, while less represented in Ontario, are a vital part of Canada's economy. Interprovince connections and access to the United States have broadened the reach of Canada's forest products industry beyond the Mid-West. Short line railways connected to the Canadian National Railway (CN) often suffer from similar inadequacies that are found in the United States (lack of track carrying capacity, double stack capabilities, or reach into forested regions). Nonetheless, the CN railways make a significant contribution to overall forest products exports. Marine transport through the Great Lakes region, specifically the Port of Hamilton at the West end of Lake Ontario, which captures 28% of all Great Lakes cargo.

Pulp, paper or allied products have a Canada/Mexico freight carload average rate of USD 6 379 below 180% RVC and an average of USD 9 191 above 180% RVC. Chemical or allied products have a Canada/Mexico freight carload average rate of USD 3 794 below 180% RVC and an average of USD 6 527 above 180% RVC. The estimated freight carload rate from Toronto to Los Angeles is USD 15 406 with a maximum weight capacity of 70 tonnes.



Using Greater Sudbury as a proxy the transportation cost to Toronto is reasonable at 20 USD/t (Figure 2.1). The market in Boston is within a distance that is relatively far using truck transportation, but too close for affordable train transportation. Consequently, shipping to Europe is equally attractive due to the relatively low sea freight rate.

Figure 2.1 Transportation costs



(*) Port costs, unloading and loading.



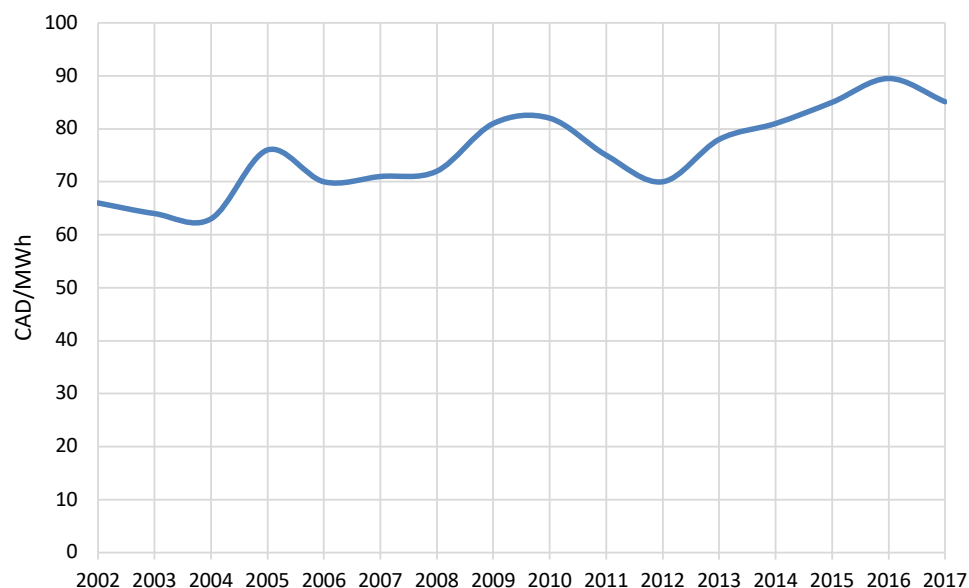
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3. TIER 3 – HIGH LEVEL ANALYSIS

3.1 Energy

The transmission connected electricity price for industrial operators has been around 80 to 90 CAD/MWh in Ontario in the recent years (Figure 3.1). The distribution connected electricity price is about 10 CAD/MWh higher. The electricity prices are significantly higher in Ontario than in the neighbouring jurisdictions. The price level in Ontario is 25 CAD/MWh than in New Brunswick and over 40 CAD/MWh higher than in Quebec.

Figure 3.1 Delivered industry electricity price (Class A), 2002-2017



Source: Independent Electricity System Operator (IESO) of Ontario.

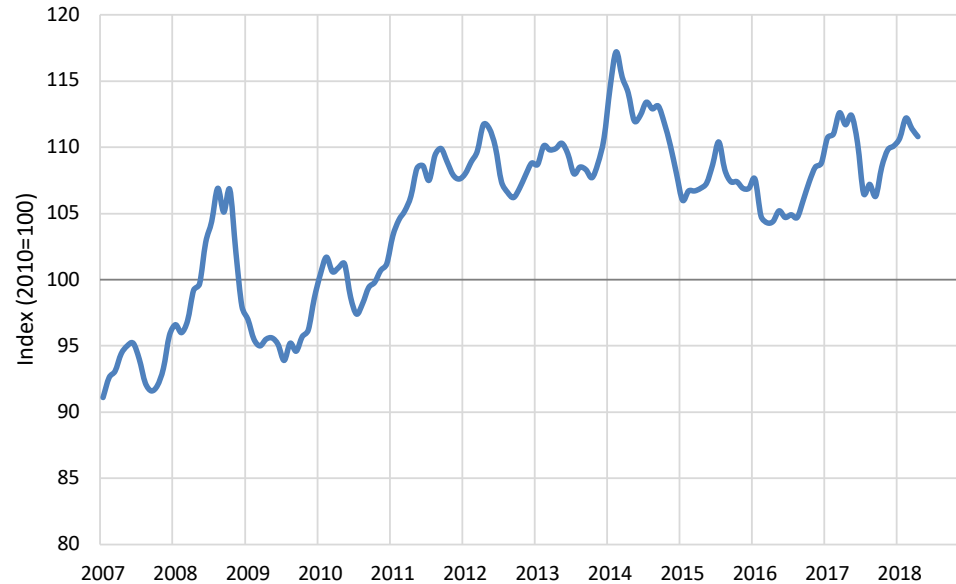
3.2 Key supplies

Ontario has Canada's largest chemical manufacturing sector with top-15 global chemical firms manufacturing in the province. There are nearly 700 chemical manufacturing establishments in Ontario. Consequently, supply of chemicals for forest industry is conveniently available from local sources. The chemical price index has remained stable during the last seven years indicating that the chemical prices have remained competitive during the economic boom of Canada (Figure 3.2). There are also a number of dedicated service providers for distribution of the wood waste towards end-users.



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Figure 3.2 Chemicals and chemical product price index, 2007-2018



Source: Statistics Canada.

3.3 R&D

The investments into forest industry research and development declined severely during the global financial crisis in 2007 to 2009, but has increased notably since then. Ontario's forest industry has primarily invested into research and development (R&D) through FPInnovations, a Canadian non-profit member organization which conducts research and development for the Canadian forest industry. Ontario's forest industry investments to FPInnovations have been CAD 250 000 annually. The total annual investments are shown in Figure 3.3. FPInnovations and more specifically its wood products research division Forintek, focus on optimizing manufacturing process, developing higher value-added products and managing customer's expectations related to the end-products performance, durability and affordability.

In addition to investments into R&D through FPInnovations, Ontario's forest industry has research and development partnerships with universities, colleges and corporate partners. Private sector spending on R&D decreased significantly during the economic downturn in 2007 to 2009. The Ministry of Natural Resources and Forestry has started to prioritize its investments in science research under its Integrated Science Action Plan. The Ontario government is funding with CAD 5.8 million a pilot project to produce and commercialize biochemicals derived from wood at Resolute Forest Products' pulp and paper mill.

Ontario has also significant support in R&D in the biochemical sector and there are several ongoing R&D programs and establishments such as Bioindustrial Innovation Canada, Bioproducts Discovery and Development Centre, Centre for Research and Innovation in the Bio-Economy (CRIBE), GreenCentre Canada and MaRS Discovery District.

University of Guelph received CAD 6 million funding for bio-composites research in May 2018. This includes two initiatives researching ways to turn waste into new products and related technologies. The focus of the research will be to develop and commercialize technologies to produce sustainable plastic packaging from recycled and renewable plastics.



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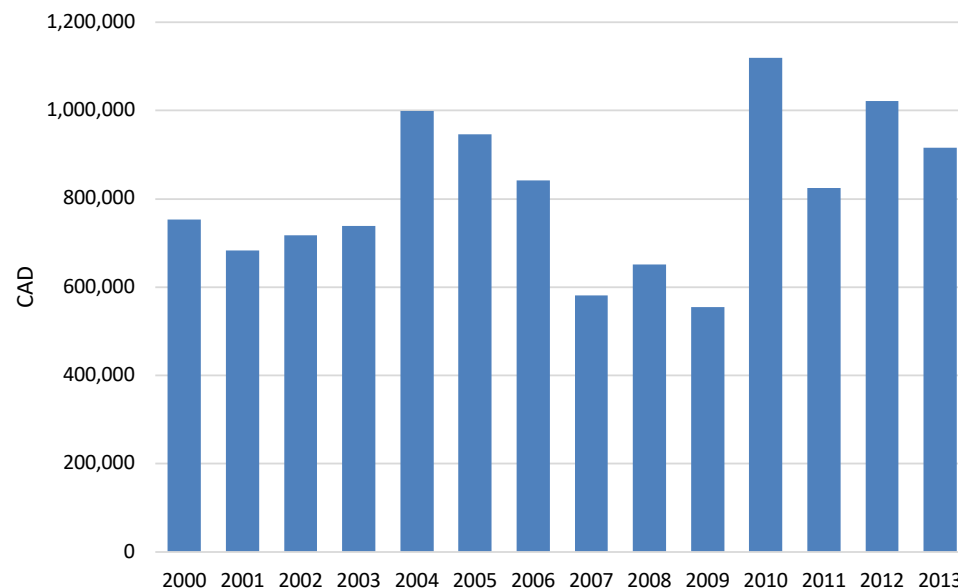
Ontario government is also spending CAD 6.7 million on pilot programs to help rural and indigenous communities to transition from fossil fuels to wood and pellet heating systems. The programs are launched through Green Ontario Fund (GreenON).

Ontario has a Wood Promotion Program which builds workforce capacity to support the industry in the future. It aims to connect the primary and secondary forest industries, federal and provincial governments and industry organizations. The program helps producers and their associations develop domestic opportunities for Ontario wood products and supports research and development for the next generation of forest products. The program provides technical advice to wood products producers to help them take advantage of new markets or enhance their productivity. Under the program, in most cases, Ontario invests up to 50% of a project's eligible costs.

Ontario also has the following programs to fund research:

- **New Directions Research Program** offers maximum of CAD 200 000 in funding for research that stimulates the sustainable growth and competitiveness of Ontario's agri-food, agri-business and rural sectors, with a focus on disruptive technologies.
- **Ontario's Alternative Renewable Fuels 'Plus' Research and Development Fund - Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA)** funds CAD 200 000 max for exploration of new markets and uses for bioproducts, alternative renewable fuels and their co-products and contributes to the long-term sustainability of Ontario's agri-food, energy and rural sectors.
- **Ontario Ministry of Agriculture, Food and Rural Affairs and University of Guelph Research Agreement** funds research in seven theme areas that include: Bioeconomy-Industrial Uses with grants **between CAD 80 000 to 150 000 per project per year.**

Figure 3.3 Ontario forest industry investment, 2000-2013



Annex 5

US, Minnesota



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FOR/Maine

Global Market Analysis and Benchmarking Study – United States (Midwest, Minnesota)

Final Report

Helsinki, Finland
June 29, 2018

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ID 122626



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1. TIER 1 – DETAILED ANALYSIS

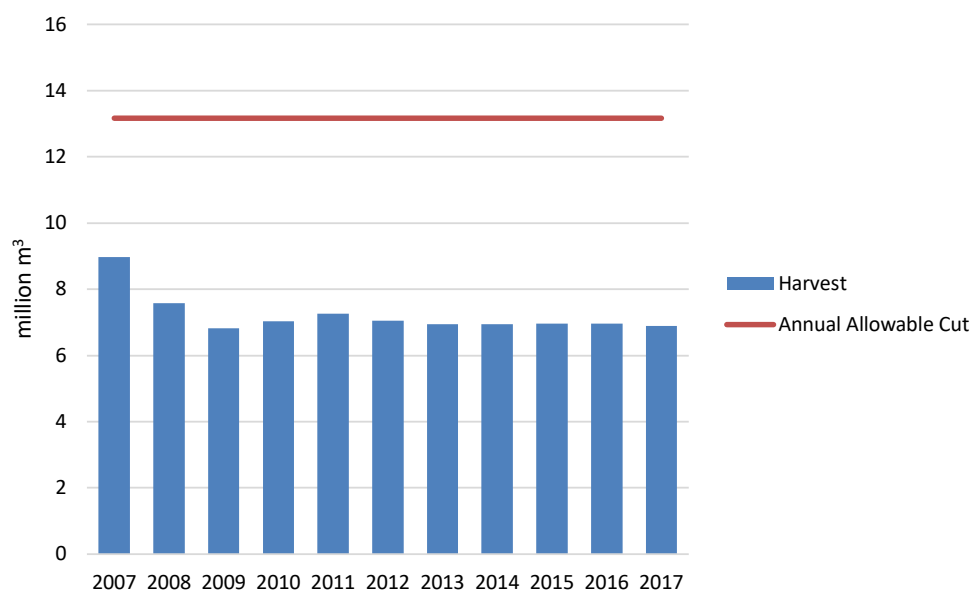
1.1 Raw material

1.1.1 Harvest levels

Harvest levels have decreased in Minnesota since 2005 due to downsizing in P&P sector. Current harvesting level is estimated 7 million m³ a year (Figure 1.1). The total forest growth in 2017 was estimated at 25 million m³ and annual mortality was 12 million m³, which led to annual net growth of 13 million m³. Annual sustainable harvesting level is estimated just above the annual net growth, due to potential substitution of some mortality with timely harvesting. Thus, there is biological potential to increase current harvesting levels by 6 million m³ or relatively by 48% compared to net growth. Majority of the increased potential is in private forests.

However, the biological potential is limited by technical and economic restrictions. For example, protection areas, willingness to sell, forest accessibility, distance to mill and stand species composition can limit harvest levels. A realistic capture in short-term could be 9–10.5 million m³, meaning potential to increase harvest by 2 – 3.5 million m³. Collection of wood residues could be increased significantly.

Figure 1.1 Harvest and AAC in timberlands in Minnesota, 2007-2017e



Use unit conversion factor 1 cord = 2.4 m³

Source: Minnesota Department of Natural Resources, Forest Resources reports and Indufor analysis

Xcel Energy has announced its plans to close two wood using biomass plants in Minnesota, which would significantly impact the wood residue and energy wood demand in Minnesota. Furthermore, UPM shut a paper machine in Blandin Paper Mill in Grand Rapids in early 2018. The paper machine had a capacity of 128 000 tonnes. Together, the downsizing by Xcel Energy and UPM could decrease wood flows by 0.5 - 1 million m³, further increasing harvesting potential in short-term for other products.

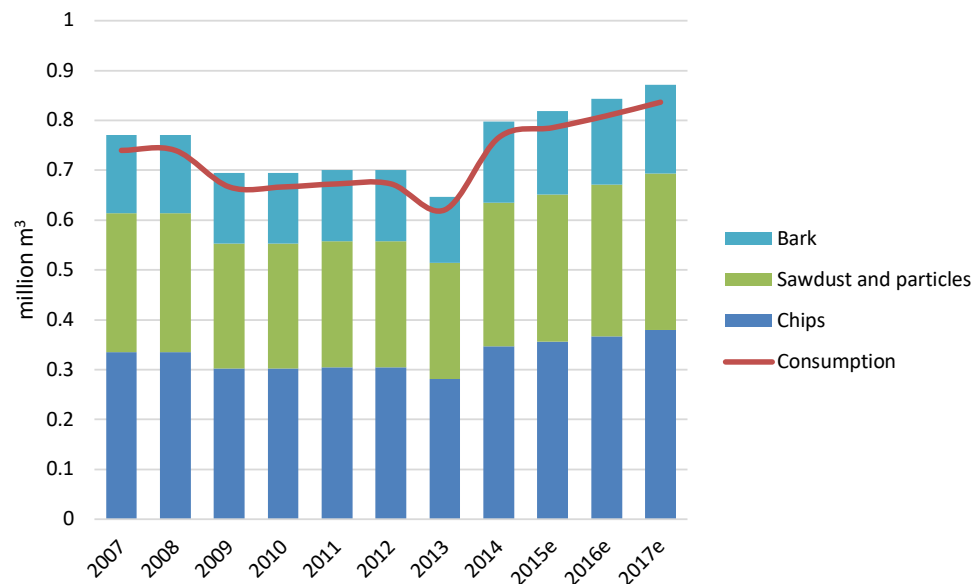


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1.1.2 By-products

There is little potential (5%) to increase consumption of by-products (Figure 1.2). The majority of the by-products are chips that can be used for pulp production. Sawdust and particles and bark are mostly burned for energy. The production of by-products could double if all sustainably available saw logs would be harvested and processed.

Figure 1.2 Estimation of wood processing residues production and consumption, 2007-2017e



Source: Indufor estimation based on saw log consumption and experience from other geographies

1.1.3 Forest ownership

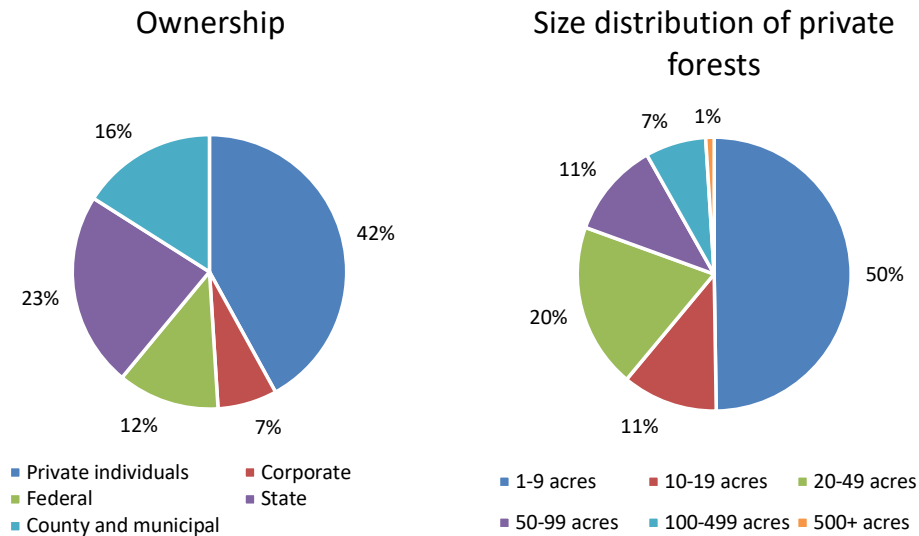
The total timberland area is approximately 17.4 million acres (7 million hectares). Approximately 49% of timberlands in Minnesota are privately owned – majority by private individuals (Figure 1.3) and 51% is public, with the state being the largest public owner followed by county and federal ownership. Minnesota is an important wood seller, selling stable timber permits from year to year, based on the forest authority's long-term forest management goals. The timber permits are sold transparently at auctions, where the location and details of the offered tracts are pronounced beforehand, and the results of the auctions are available afterwards.

Majority of the individual owners are smallholders. Half of the private individual forest owners in Minnesota own less than 9 acres (3.6 hectares) of timberland.



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Figure 1.3 Timberland ownership in Minnesota



Source: Minnesota Department of Natural Resources and USDA.

1.1.4 Delivered wood cost

The delivered wood cost of pulpwood was estimated at 43 USD/m³ in 2016 (Figure 1.4). Average stumpage cost for all species according to their share in pulpwood harvest was 10 USD/m³ in 2016. Harvest and transportation costs were estimated based on costs in Lakes States area of US. The stumpage price varies greatly between species. Aspen and balm, followed by spruce species, are the most harvested species for pulpwood. Their stumpage prices can be double to other less harvested species.

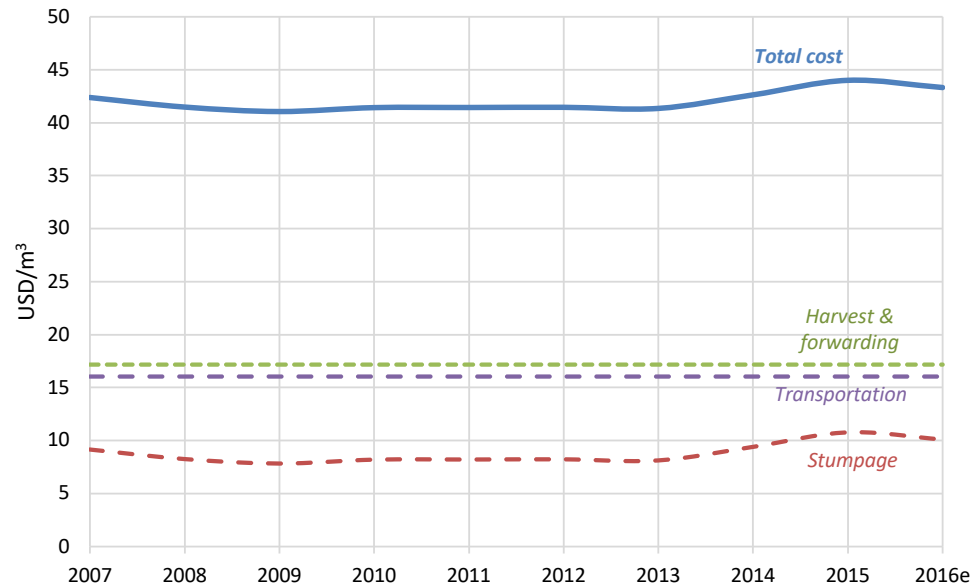
Stumpage price of biomass sold for energy has varied between 0.8 and 1.1 USD/ton. Data is insufficient to estimate the delivered cost of biomass for energy. However, the delivered cost of fuelwood in the Lake States area is estimated at approximately 32 USD/ton, which could be close to the price of ton of biomass.

Delivered cost of residual chips in Minnesota was estimated based on average prices in the Lake States area. The average cost of residual chips was 46 USD/m³ in 2016 (Figure 1.5).



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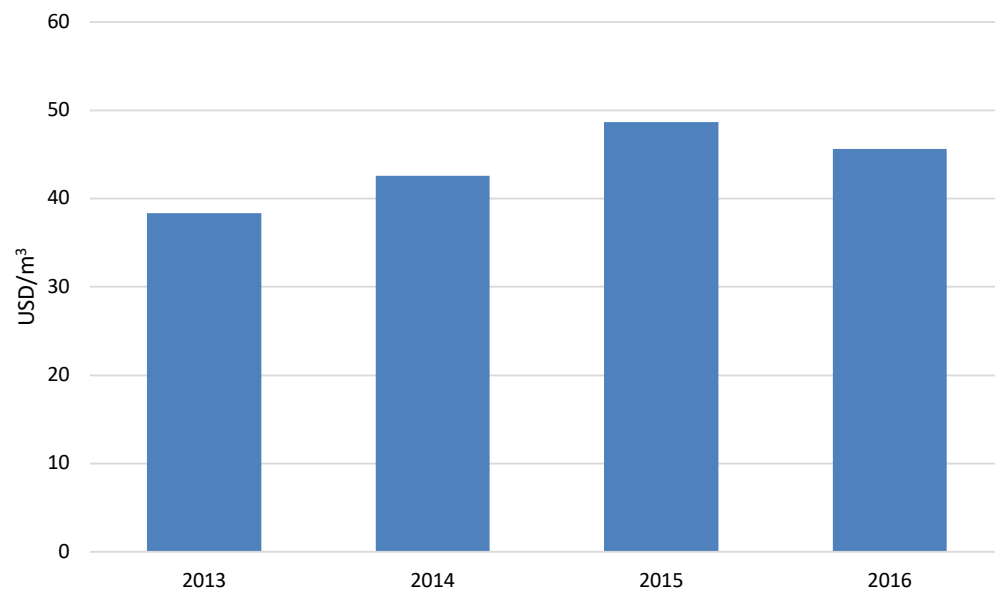
Figure 1.4 Estimated delivered pulpwood cost for Minnesota 2007-2016e



Used conversion factor 1 cord = 2.4 m³

Source: Minnesota Department of Natural Resources, Forest2Market, Indufor estimation

Figure 1.5 Estimated delivered cost of residual chips, 2013-2016



Source: Indufor database and analysis



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1.1.5 Wood procurement practice

Approximately 30% of the wood is sourced from state forest. State sells timber permits through public auctions. Loggers and industry professionals often secure timber permits instead of business owners. Loggers need to follow *Voluntary Site-Level Forest Management Guidelines for Landowners, Loggers and Resource Managers* on best logging practices in state land. Standing sale is the common practice in private forest.

Various harvesting methods are used. Cutting is done either with a feller buncher or a cut to length harvester. Forwarding can be done either with a skidder or a forwarder. Harvesting may be done as group selection, clear cut or shelterwood harvest. Majority of the harvests are done in the winter due to restriction in soil and road carrying capacity in other seasons. Furthermore, long-distance trucks can carry limited loads in the winter.

1.2 Workforce

Table 1.1 **1.2.1 Demographic comparisons**

Indicator	Current situation
Total population (2017)	5 577 000
Population growth rate (2017)	0.9%
Population urbanization, rural vs urban (2017)	15% vs 85%
Unemployment rate (2017)	3.5%
Level of education ⁽¹⁾ (2016)	11.7%

¹ Share of master's degree or higher in all population aged 25 and above

Total population of Minnesota is 5.6 million people. The population is increasing steadily by 0.7-0.9% annually. Post-war baby boom generation is still the largest age-class, but contrary to many other developed country populations, the size of younger age classes has remained constant (Figure 1.6).

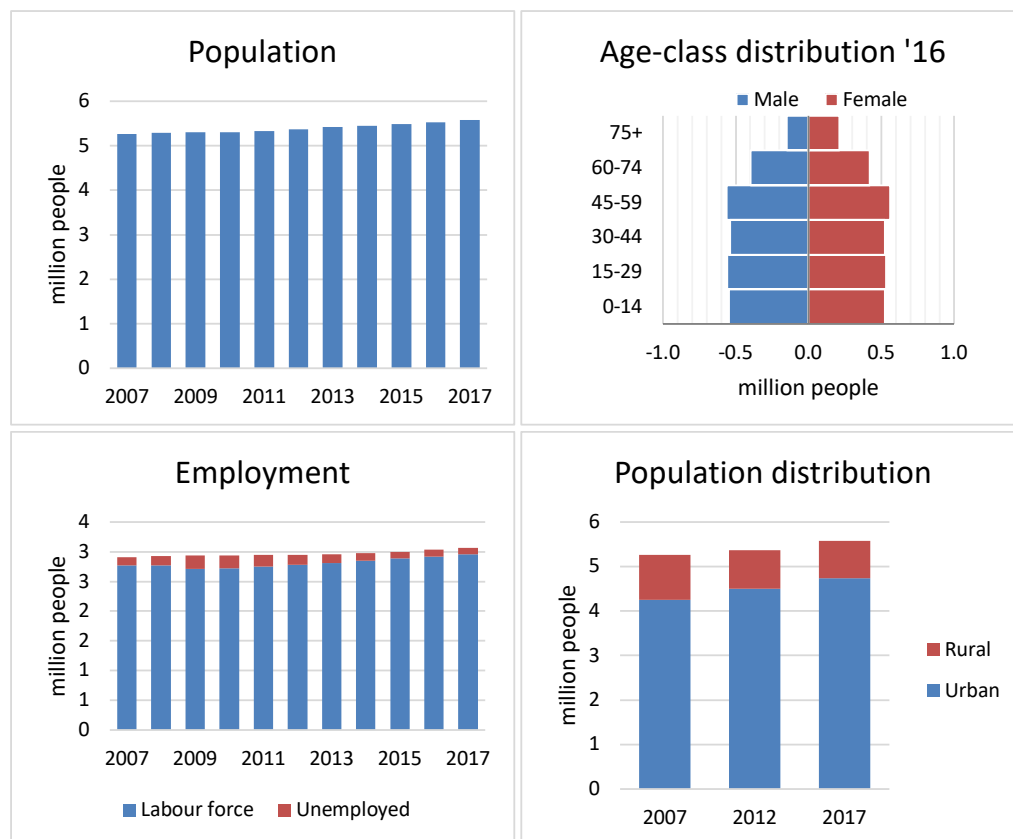
Unemployment increased significantly after the recession of 2008. However, the increase was short-term. Currently, the unemployment is only 3.5%, which limits labour availability to new ventures.

The population is highly urbanized, and the share of urban population continues to increase. The driver for urbanization has not come from rural areas. Rather, the population increases faster in urban areas than in rural areas, which increases the relative share of urban dwellers.



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Figure 1.6 Historical development of demographics



Source: The Minnesota Department of Administration, The Minnesota State Demographics Center; United States Census Bureau, American Fact Finder; The Minnesota Department of Employment and Economic Development, Greater Minnesota Refined & Revisited by Minnesota Department of Administration, Minnesota State Demographic Center; Indufor estimate based on United States Census Bureau, Decennial Census.

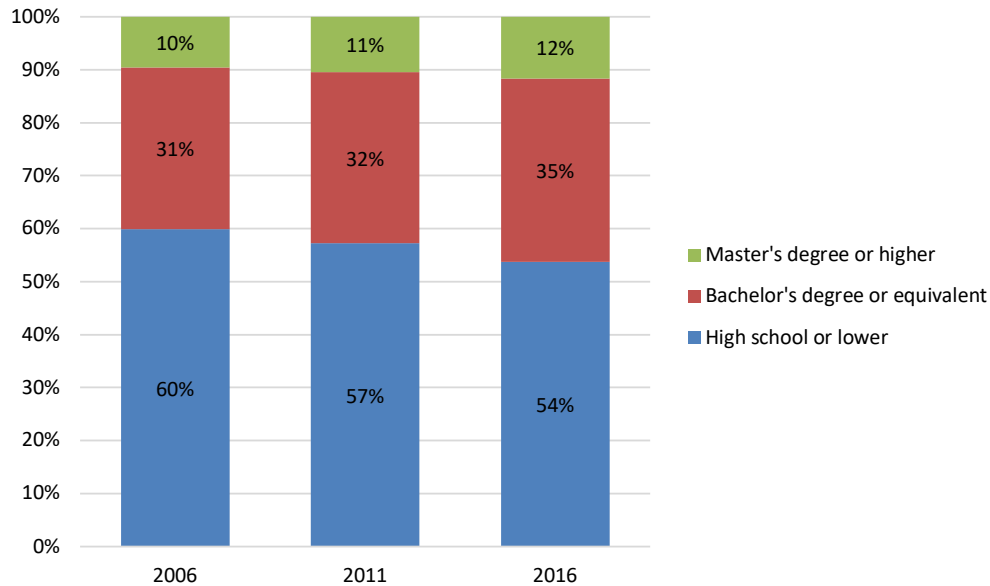
1.2.1 Level of education and the skill levels required

Approximately half of the people in Minnesota have at least a bachelor's degree or equivalent, which means that the labour force contains large-share of educated white-collar workers (Figure 1.7). Yet, only 12% of the population has at least a master's degree from university, which can be a limiting factor when it comes to new sophisticated wood products that require specific chemical and engineering knowledge. However, the number (12%) is an underestimation for the active labour force, because it includes all the population aged 25 and above, including retired people who have on average lower education level than the younger generations.

Manufacturing sector in Minnesota has had difficulties to find educated and experienced workforce. The unemployment rate is low, which means that there is little available workforce, and companies have to invest to obtain suitable workforce, either by rephrasing the calls for applications, training new employees more, increasing starting salaries or working with local educational institutions to modify curricula to better answer to the sector's needs.



Figure 1.7 Educational attainment of all population aged 25 and above



Source: United States Census Bureau, American Fact Finder

1.2.2 Typical labor costs

Average labor costs are high in P&P industry. Companies pay approximately 30% on top of the direct salaries. Different benefits include insurance costs, social costs, paid leaves and supplemental pays (Table 1.2). The average salary in P&P industry is almost 70 000 USD, which leads to a total average labor cost of almost 100 000 USD (Figure 1.8). The labor costs are much smaller in wood product manufacturing industry, where the average direct salary is just below 50 000 USD/year and the total labor cost approximately 70 000 USD/year.

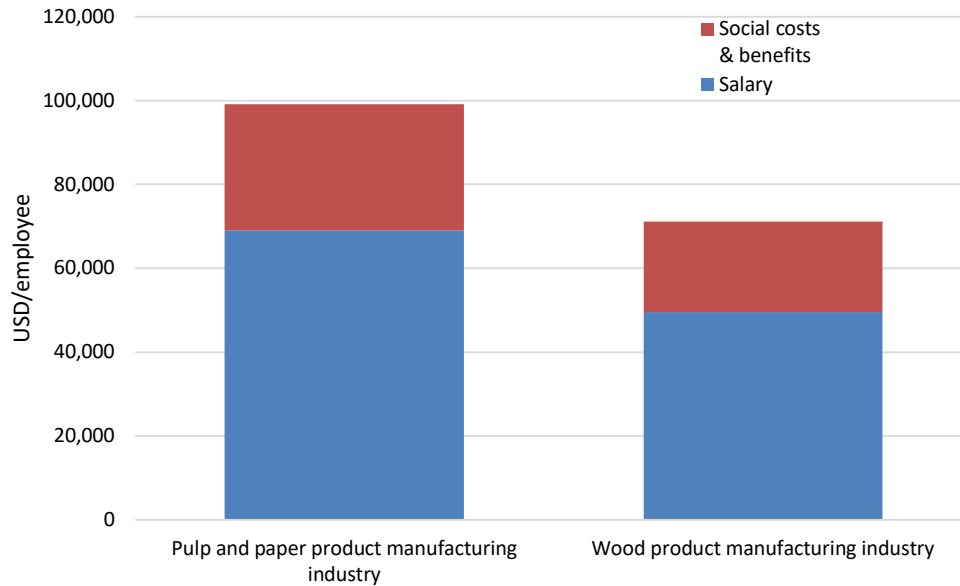
Table 1.2 Structure of labor costs in private industry in West North Central part of Midwest region, 2017

Cost item	%
Wages and salaries	69.7%
Total benefits	30.3%
<i>Paid leave</i>	6.6%
<i>Supplemental pay</i>	3.1%
<i>Insurance</i>	8.7%
<i>Retirement and savings</i>	3.9%
<i>Legally required benefits</i>	8%

Source: United States Department of Labor, Bureau of Labor Statistics



Figure 1.8 Labor costs in P&P and wood product manufacturing industry, 2017



Source: The Minnesota Department of Employment and Economic Development and United States Department of Labor, Bureau of Labor Statistics

1.3 Regulatory climate

Raw material supply

There are no federal regulations on harvest levels or the conversion of natural forests to plantations. Other relevant regulations pertain to the protection of endangered species and the environment. The U.S. Fish and Wildlife Service administers *Endangered Species Act* criminalizes harming endangered species. The Environmental Protection Agency (EPA) regulates the use of insecticides in forestry under authority of the *Insecticide, Fungicide and Rodenticide Act*. The federal *Clean Water Act* obligates authorities to identify any non-point pollution sources in silviculture and sets forth procedures and methods (including land use requirements) to control to the extent possible such sources. The discharge of dredge or fill material from normal silvicultural activities (e.g., timber management) is not prohibited under this Act (with some exceptions). Control of nonpoint source pollution depends on the use of Best Management Practices, as well as the participation in a number of other voluntary incentive programs.

Minnesota Forest Resources Council (MFRC) develops policy recommendations to the Governor and federal, state, and local governments and to encourage the adoption of sustainable forest management policies and practices. The council operates under the Minnesota Sustainable Forest Resources Act and has published voluntary Forest Management Guidelines, which cover environmental protection and harvesting topics. The Minnesota Wetland Conservation Act (WCA) regulates work activity in non-public wetlands, but exempts forestry if the following conditions are met: impacts to hydrology and biology are limited in the wetland; no dikes, ditches, tile lines, or buildings are constructed; the wetland is not drained; and, the placement of fill is avoided when possible.

Environmental regulations for manufacturing

In the United States, federal and state authorities are responsible for regulating and enforcing environmental protections relevant to forestry products. Generally, the federal regulations apply,



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and enforcement responsibility is determined on a state-by-state basis. The EPA must authorize state agencies to regulate issues like water and air quality. States must, at a minimum, uphold the federal standards, but they can also pass more stringent regulations. The current administration has announced its intention to review or rescind many of the environmental regulations put in place by previous administrations, which the current administration claims are a hindrance to business. Nonetheless, air and water quality regulations are relevant to the production of the short-listed products in this study.

The *Clean Water Act* is the main federal law governing water pollution. The Act identifies point and nonpoint pollution sources, with manufacturing facilities for forest products considered point sources. Point sources require permits for any discharge into water bodies under the *National Pollutant Discharge Elimination System* (NPDES). State authorities can administer and enforce the permitting system if authorized by state laws and the EPA (all states in this study have been delegated such authority). NPDES permits must be reissued every five years. Sector-specific effluent guidelines set the standard for polluted runoff and are enforced by the NPDES permitting process. The *Pulp, Paper and Paperboard Effluent Guidelines* set the standards for permitting. Some trade groups claim that the guidelines are too strict and impose undue costs on the producers without commensurate impact on human health.

The *Clean Air Act* governs air pollution in the United States. The EPA has overall responsibility for the Act but states are mainly responsible for ensuring compliance and permitting. Permitting for stationary sources of pollution (volatile organic compounds) is required with renewal every five years. The standards used in the permitting process relevant to forestry products include the Kraft Pulp Mills: New Source Performance Standards (NSPS), *Plywood and Composite Wood Products Manufacture: National Emission Standards for Hazardous Air Pollutants*, *Pulp and Paper Production (MACT I & III): National Emissions Standards for Hazardous Air Pollutants (NESHAP) for Source Categories*, and *Compliance for Industrial, Commercial, and Institutional Area Source Boilers*. The Clean Air Act requires permits to build or add to major stationary sources of air pollution (the New Source Review (NSR)). Additionally, the production of ethanol requires on-site emissions control equipment to obtain a permit under the *National Emission Standards for Hazardous Air Pollutants (NESHAP) for Chemical Manufacturing Area Sources (CMAS)*.

Sulfur emission regulation

Ocean-going vessels and large ships traditionally used “bunker fuel” with sulfur levels as high as 5%, or 50,000 ppm, sulfur. Bunker fuel burned on these ships was a large source of harmful air pollution in the U.S. An international treaty designated two Emission Control Areas (ECA) covering U.S. waters. The North America ECA extends 200 miles from the shores of North America, and the U.S. Caribbean Sea ECA covers waters around Puerto Rico and the U.S. Virgin Islands. The sulfur content of the fuel used in marine vessels operating in these ECAs may not exceed 0.10 weight percent (1000 ppm).

EPA's national ambient air quality standards for SO₂ are designed to protect against exposure to the entire group of sulfur oxides (SO_x). National Ambient Air Quality Standards (NAAQS) for SO₂ specify maximum amounts of sulfur dioxide to be present in outdoor air. Limiting SO₂ in the air protects human health and the environment. The sulfur content of gasoline is limited to a maximum of 10ppm beginning in 2017.

Emission markets

EPA's Clean Air Markets Division (CAMD) runs programs that reduce air pollution from power plants to address several environmental problems, including acid rain, ozone and particle pollution, and interstate transport of air pollution. CAMD programs include the Acid Rain Program (ARP), the Cross-State Air Pollution Rule (CSAPR), and the CSAPR Update.

Each year, EPA holds an auction for SO₂ emissions allowances set aside in an Auction Allowance Reserve to let interested parties such as electric power plant owners, environmental groups, emissions brokers and others acquire up to 125,000 tons of emissions allowances under



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Phase II of Title IV of the Clean Air Act Amendments. This program provides a source of allowances beyond those initially allocated and facilitates price discovery.

SO₂ allowances are then allocated to affected units serving generators greater than 25 megawatts. All new units based on their historic fuel consumption and specific emission rates. Each allowance permits a unit to emit one ton of SO₂. Sources may choose among several options to reduce emissions. Sources may sell or bank (save) excess allowances if they reduce emissions and have more than they need, or purchase allowances if they are unable to keep emissions below their allocated level. At the end of the year, each source must hold sufficient allowances to cover its SO₂ emissions (each allowance represents one ton of emissions). In 2018, the price for SO₂ was 0.06 USD per ton.

The NO_x program embodies many of the same principles of the SO₂ trading program, in that it also has a results-oriented approach, flexibility in the method to achieve emission reductions, and program integrity through measurement of the emissions. However, it does not "cap" NO_x emissions as the SO₂ program does, nor does it utilize an allowance trading system.

The Minnesota Pollution Control Agency is responsible for permitting facilities that emit pollutants, which adheres to the federal Kraft Pulp Mill NSPS. Minnesota's environmental quality standards align with the federal Clean Water Act and Clean Air Act.

Market access

Key market access regulations related to the short-listed products relate to formaldehyde standards and the use of cellulosic ethanol in renewable fuels standards.

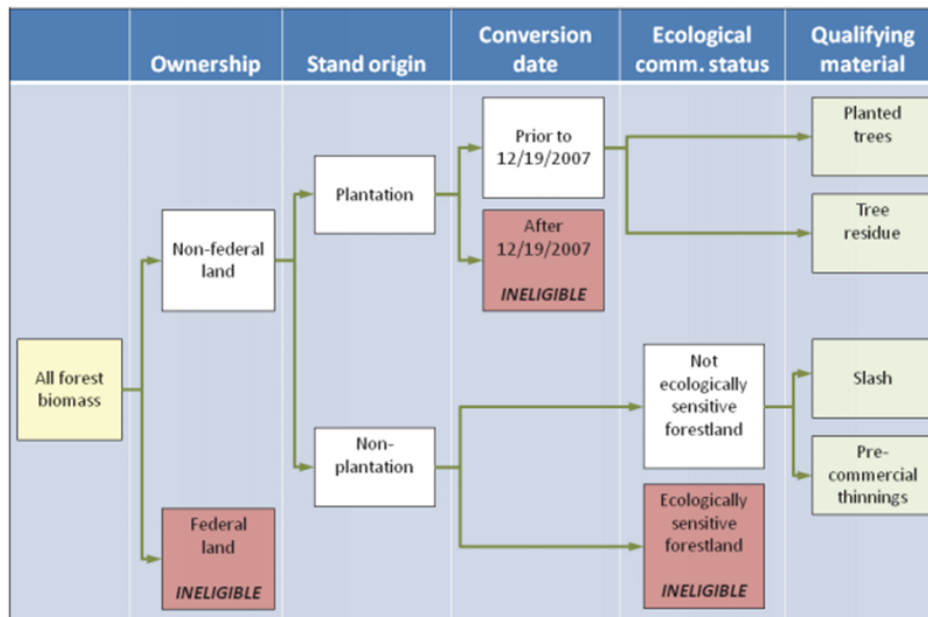
Specific to MDF, CARB2 and the Formaldehyde Standards for Composite Wood Products Act apply only to interior use products such as hardwood plywood, medium density fiberboard, and particleboard. The formaldehyde emissions standards go into effect beginning on December 12, 2018. Products used in the construction of a building's frame are exempt from emission requirements. There are no small entity exemptions and there is no de minimis standard based on the size of smaller panel producers.

Administered by the EPA, the Renewable Fuel Standard requires transportation fuel sold in the United States to contain a minimum volume of renewable fuels. Under the standard, Cellulosic bio-fuel is its own category and is considered an Advanced Biofuel. Advanced biofuels are required to meet stricter air pollution requirements than regular corn-based ethanol. Cellulosic biofuel must be produced from cellulose, hemicellulose, or lignin and must meet a 60% lifecycle GHG reduction. The minimum volume determinations are subject to change year-to-year, which provides uncertainty to supply market. For 2018, the EPA set a volume requirement of 288 million ethanol-equivalent gallons, which is lower than the 2018 target of 7 billion gallons set by the *Energy Independence and Security Act* of 2007. The lower requirement is due to the limited supply of cellulosic biofuels on the market. To qualify as renewable cellulosic biofuels used for liquid transportation fuels, the fuel must be produced from logging residues, "pre-commercial" thinning materials, or biomass originating from forest plantations established before 2007 (Figure 1.9). These criteria require the producer to maintain records and proof of plantation establishment.



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Figure 1.9 Categories of renewable biomass



In April 2018, the EPA Administrator announced a policy making clear that future regulatory actions on biomass from managed forests will be treated as carbon neutral when used for energy production at stationary sources.

Minnesota passed a statute in 2013 that bans products for children that intentionally contains formaldehyde.

Voluntary actions for sustainable forest management

Minnesota has a large number of certified forests. In 2012, the total certified area was 8.5 million acres (3.4 million hectares), but 7.5 million acres are public and less than 1 million acres are private, and most of those are corporate owned forests. FSC® and SFI® are the most common certification schemes.

Conclusion

Minnesota's regulatory climate is neutral, with forest management driven by more than just commercial harvesting concerns and water and air quality regulations meeting federal standards.

1.4 Taxation

The main taxes in Minnesota are the corporate tax (30.8%) and the sales tax (6.875%), wood sales tax (varies) and property tax (1% of the market value).

Within North America, the USA has programs in place to reduce the corporate tax rate, such as deducting the entire cost of equipment purchases from a company's taxable income as well as reducing an employer's federal income tax liability when increasing employment. Minnesota provides a variety of incentives and financial assistance to help companies startup, expand, and relocate in Minnesota. However, none of these incentives reduce the corporate tax rate, while some reduce the sales tax, including materials used or consumed to produce a product. Manufacturers can be exempted from paying sales tax on electricity.



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The Greater Minnesota Job Expansion Program provides sales tax benefits to businesses located in Greater Minnesota that increase employment. Qualifying businesses that meet job-growth goals may receive sales tax refunds for purchases made during a seven-year period.

The Border-Cities Enterprise Zone Program provides sales tax credit on construction equipment and materials, while materials used or consumed to produce a product may qualify for the industrial production sales exemption.

Electricity, gas or steam used or consumed in agricultural or industrial production is exempt from sales and use tax. Exemption does not apply to space heating, lighting or water used or consumed in non-production areas such as office or administrative areas.

Sale of standing and cut timber is taxed on a federal level in USA, with the sale of standing timber taxed as capital gain, while the sale of cut timber is taxed as ordinary income. The tax for standing timber can be 0% - 15% - 20%. In addition to a tax on the sale of timber, all US states have some sort of tax on the harvest of timber. In Minnesota, standing timber is to be defined as real property and when it is sold a deed tax must be paid.

Many costs related to the production of wood or growth of timber are eligible for a deduction or credit within the USA through the federal IRS or CRS.

Property tax for (forest)land is applied on a state level as ad valorem in Minnesota. It taxes the value of the land as it is currently being used. The property tax is ad valorem, with net rate of 1% of the market value. Property taxes can be lowered in all states when a landowner adopts a sustainable forest management plan, resulting in 35% decrease in Minnesota.

Environmental taxes are applied on both federal and state level in USA. The tax for diesel and gas is 0.53 and 0.47 cents per gallon respectively.



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2. TIER 2 – GENERAL ANALYSIS

2.1 Policies

Federal

In the USA, the Wood Innovation Grant is the most important mechanism to expand and accelerate wood products and wood energy markets, with 8 million USD in funding in 2018. In total, the Forest Products Program has 359 million USD budgeted in 2018. In addition, the Forest Stewardship Program helps to create jobs in rural communities by sustaining local forest products markets and increasing demand for qualified private forestry consultants. The 2018 budget provides 20.5 million USD in support of this program.

Under the Obama administration, the USA set a renewable energy target of 20% of renewables on electricity use for all agencies, the largest energy consumer in the country. However, states have been adopting and increasing renewable energy standards (RET). As part of these standards, utilities are required to sell specific amount of renewable electricity, which can be designated only for investor-owned utilities (IOUs) or incorporate government run utilities.

Utilization of biobased products in US is encouraged with several programs. The BioPreferred Program aims to increase the consumption of biobased products by setting a mandatory purchasing requirement for federal agencies and their contractors, but also by a voluntary labelling initiative. With a label granted by United States Department of Agriculture, the consumer is provided information about the bio content of the product. Biorefinery, Renewable Chemical, and Biobased Product Manufacturing Assistance Program may provide a loan guarantee up to 250 million USD for projects that use emerging technologies to convert outputs of biorefineries or biobased product manufacturing facilities into end user-products. However, the program is part of Farm Bill 2014 agreement that will be renewed in 2018, but most likely in smaller scale.

Use of biomass as an energy source is supported by the federal government with a variety of programs. From the point of view of forest biomass, some of the relevant programs are BioEnergy Engineering for Products Synthesis, Process Development for Advanced Biofuels and Biopower and State Energy Loan Program. The Renewable Fuel Standard set by the Environmental Protection Agency requires transportation fuel sold in the US to contain a minimum volume of renewable fuels, for example fuel derived from cellulosic biofuel.

Minnesota

Similar to Maine and Oregon, Minnesota has set renewable energy standards and GHG emission targets, with the aim to have 26.5% of electricity produced by renewable energy sources by 2025, and to reduce GHG emissions by 30% by 2025. In addition to these targets, Minnesota requires utilities to invest 1.5% of their annual income in conservation programs under the Conservation Improvement Program (CIP), which may include promoting the startup, expansion, and attraction of renewable energy projects. Because of the CIP program, Xcel Energy, one of Minnesota's utility facilities, developed the Renewable Energy Fund, which provided 100.9 million USD for legislatively-mandated projects and programs, since its inception in 2002, predominately focused on solar energy.

Minnesota also has programs to stimulate the production of advanced biodiesel. As of May 1, 2018, Minnesota requires all #2 diesel to contain 20% biodiesel, between May 1 to September 31, and to contain 5% biodiesel, between October and March. 1# diesel is exempted from the biodiesel requirement. Furthermore, eligible production facilities may receive financial incentives to produce biodiesel from cellulosic biomass (\$2.1053 per MMBtu), to produce chemicals which have at least a 51% biobased content (\$0.06 per pound), and to produce thermal energy from biomass combustion, gasification, or anaerobic digestion (\$5.00 per MMBtu).

In terms of forest programs, Minnesota offers federal programs, such as the Forest Legacy Program, The Forest Stewardship Program, and the Healthy Forests Reserve Program. In addition, Under the Sustainable Forest Incentive Act (SFIA) landowners are encouraged to no



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develop forests. Overall the aim of the programs is to preserve and maintain forest land. The forestry industry does not seem to benefit directly from these programs.

The forest industry may benefit from the presence of the forest products management development institute. As current forest policies do not go above and beyond federal policies or similar state policies on sustainable forest management, the policy environment can therefore be considered medium. However, as Minnesota's policy environment is high for the development of (clean) technology-driven economy by offering grants, loans, and other incentives, with a focus on biofuels (produced from cellulosic biomass), the policy environment can be considered high. Minnesota has a renewable energy standard (2007) of 26.5% by 2025 (IOUS) and 25% by 2025; In addition, Excel Energy Xcel Energy has a separate requirement of 31.5% by 2020; 25 percent must be from wind or solar. Solar: 1.5% by 2020 (other IOUs); Statewide goal of 10% by 2030.

The Community Energy Efficiency & Renewable Energy Loan Program, also known as the "Rev It Up" Program, is a revolving loan program that allows up to 100 million USD in revenue bonds to be issued for low-cost loans to local units of government, industrial and commercial businesses.

Green Business Loan Program: This revolving loan program provides low-interest loans to Minnesota businesses seeking financing to install energy retrofits. Loan amounts range from 20,000—300,000 USD.

Small Business Environmental Assistance Program provides low-interest loans up to 50,000 USD to qualified small businesses to finance environmental projects such as capital equipment upgrades that meet or exceed environmental regulations, including idle reduction technologies.

Grants are available to biofuel producers for up to 2.1053 USD per million British Thermal Unit (MMBtu) for advanced biofuel produced from cellulosic biomass. Total payments to all producers are limited by statute to the equivalent of 17,100,000 MMBtu of advanced biofuel. The Minnesota Department of Agriculture offer funding assistance to fuel retailers for the installation of equipment to dispense ethanol fuel blends ranging from E15 through E85.

Renewable Chemical Production Incentive Program: Chemicals must have content that is at least 51% biobased to be eligible for the production incentive. Materials may be from agricultural, forestry, or solid waste sources. The subsidy is 0.06 USD per pound of production from cellulosic biomass.

The Conservation Improvement Program (CIP), requires utilities to invest 1.5% of their annual income in conservation programs. For instance, the Renewable Development Fund promotes the startup, expansion, and attraction of renewable energy projects and companies across Minnesota and Wisconsin.

RDF Grant Program has provided over 276 million USD for renewable energy initiatives including 90.6 million USD for Renewable Energy Production Incentive (REPI) payments, 100.9 million USD for legislatively-mandated projects and programs, and 2.3 million USD for general program support. Mandated programs have included the appropriation of 25 million USD to the University of Minnesota for the Initiative for Renewable Energy and Environment (IREE), 21 million USD for the Minnesota Bonus Solar Rebate Program, 25 million USD for the Solar Energy Incentive Program, and 120 million USD for the Made In Minnesota Solar Energy Production Incentive Account.

The forest industry may benefit from the presence of the forest products management development institute. As current forest policies do not go above and beyond federal policies or similar state policies on sustainable forest management, the policy environment can therefore be considered neutral. However, as Minnesota's policy environment is high for the development of (clean) technology-driven economy by offering grants, loans, and other incentives, with a focus on biofuels (produced from cellulosic biomass), the policy environment can be considered beneficial.



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2.2 Access to financing

Overall, the banking sector is stable and favorable to investment in the United States. Investment spending should remain strong and cost of capital low. The credit rating is AA+/Stable/A-1+, enabling low interest rates. There is an abundance of private equity investors in the United States, both domestic and foreign. The United States ranks first for private funding in attractiveness for private equity and capital venture. The current federal funds rate is 1.75%, although the Federal Reserve signaled it will raise rates to 2% in 2018, 2.5% in 2019 and 3% in 2020. Inflation was on average 2.1% in 2017.

Many options exist for loan guarantees for investments; the USDA's Business and Industry (B&I) Guaranteed Loan Program provided guarantees of 60, 70 or 80 percent (depending on loan size) to a variety of business purposes, including forestry projects.

Minnesota's banking system is stable and the credit rating AAA/Aa1. Minnesota offers several funds and loans, with a focus on developing small businesses, creating opportunities for Native Americans, and to a lesser extent developing (small) manufacturers. Through its State Small Business Credit Initiative, Minnesota stimulates private sector lending and improves access to capital (up to USD 15.4 million) for small businesses and manufacturers. In addition, small businesses may benefit from low interest-loans (up to 50 000) to finance environmental projects, such as capital equipment upgrades that meet or exceed environmental regulations, including idle reduction technologies. Moreover, the Growth Acceleration Program, provides grants up to USD 50,000 and consulting service to help small manufacturers become more efficient. As for larger businesses, Minnesota offers Renewable Energy Loan and Green Business Loan Programs, which respectively allows up to 100 million in revenue bonds to be issued for low-cost loans to industrial and commercial businesses. It also provides the Federal Business and Industry Loan Guarantee Program with an upper limit of USD 10 million, in line with other states.

Private equity and capital venture investment opportunities are present in Minnesota, albeit in lower quantities than other states.

Ease of access to financing provides an advantage over many other countries that do not have substantial private investment, however, the United States lacks substantial national level forestry incentives and green capital incentives that are found in the EU and Canada. Although Minnesota enjoys a stable banking environment and access to Government backed finance is aimed at small businesses (of which some may be manufacturers)—the state lacks forest-based financial incentives. Additionally, there is a major shortage in early financial backers or strong venture capital interest. Therefore, access to finance can be defined as low to neutral in relation to forest industry investments.

2.3 Logistic infrastructure and transportation costs

As a Great Lakes state, Minnesota is centrally situated to access Canadian and Central United States markets. 56% of forestland is held by the public, while the remaining 44% is held by private individuals, companies or organizations. Minnesota's forest products industry is almost entirely based on exports within the continent (just under 7% is transported internationally with the overwhelming majority to Canadian markets). The lack of open water ports has shifted Minnesota's forest products economy to neighboring states of Wisconsin, Illinois, and Michigan. Transportation of products has primarily relied on trucking (2.71 billion commercial miles on Minnesota state highways) and rail shipments (248 million tons). An additional 58.4 million tons traveled through ports on Lake Superior, and 9.2 million tons through river ports on the Mississippi River.

The relatively high level of privately held remote forest land, requires a significant forest road network to reach the state and national transport networks. While accurate statistics are not available, it is likely that forest roads are used in a similar capacity as other highly forested states. Using Annual Highway Construction costs, Minnesota ranks as the thirtieth most expensive state for road construction (\$24 190 per lane mile). General forest road construction costs and maintenance are likely higher than average due to the harsher winter climate,



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especially in the Northeast where forests are concentrated. Public roads in Minnesota are ranked twenty-fifth in overall quality and ROPAs in poor condition are ranked thirtieth (1.41%). Overall road infrastructure in Minnesota therefore slightly worse than the national average, although urban interstates and congestion impacts are significantly worse than national levels. The maximum total gross weight (97 000 lb) for Minnesota is relatively lower than the average allotted weight for forest trucking, driving up transport costs.

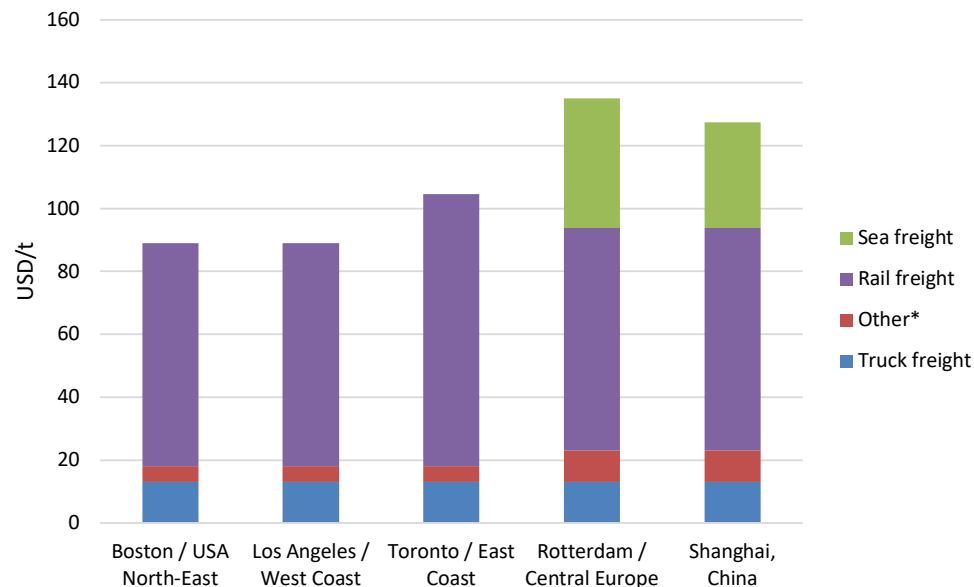
However, Minnesota experiences harsh winters and frost, which enables harvesting using less developed forest roads in the winter, when the frost supports heavy machinery. Therefore, forest roads for winter harvesting can be constructed lightly. Additionally, the region is rather flat, which decreases road construction costs to for example Oregon.

There are four class I railroads in Minnesota, comprising over 80% of all railroad track (3 623 miles) while class II, III and private railroads make up the remaining 821 miles. Rail is a key mode of transportation for shipping paper and wood products in Minnesota, however, much of this traffic is due to construction lumber imports into the state. There is minimal short line rail connection between forests and manufacturing plants in the Northeast, leaving the majority of forestry transit to short- and long-haul trucking. The rail networks provide a continued link between the continental United States and Canada, as well as access to ports on Lake Superior.

Pulp, paper or allied products have an Upper Mid-West freight carload average rate of USD 4 017 below 180% RVC and an average of USD 6 452 above 180% RVC. Chemical or allied products have an Upper Mid-West freight carload average rate of USD 2 906 below 180% RVC and an average of USD 4 454 above 180% RVC.

Minnesota's rail freight costs to the selected North American markets are moderate estimated at USD 4 961 per freight carload to both West Coast and East Coast U.S with a maximum carload of 70 tonnes (Figure 2.1). Assuming access to international markets through Boston the transportation costs from Minnesota are high.

Figure 2.1 Transportation costs



(*) Port costs, unloading and loading.



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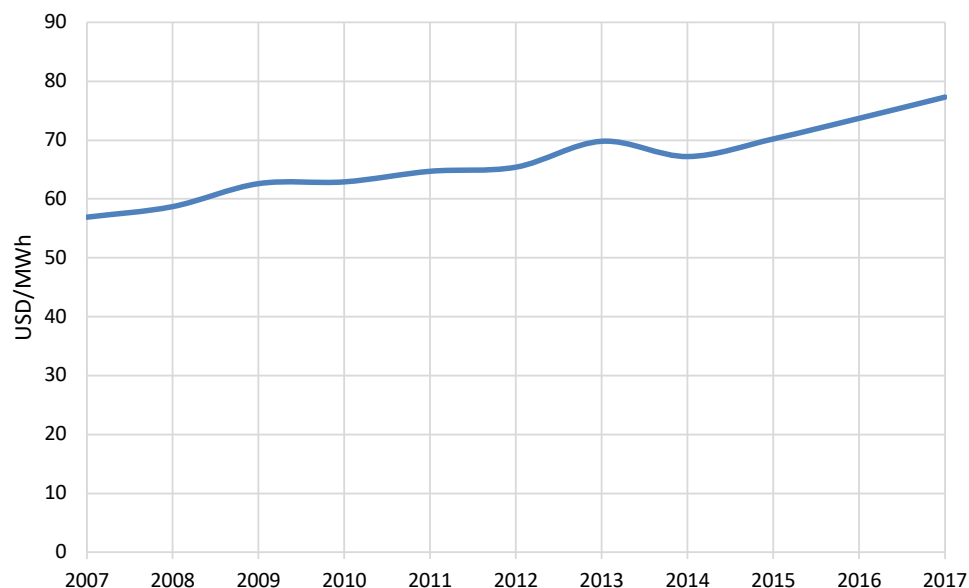
3. TIER 3 – HIGH LEVEL ANALYSIS

3.1 Energy

The nominal price of electricity has increased steadily from 2007 to 2017, and the trend seems to continue. The power cost less than 60 USD/MWh in 2007, but now the price is closing to 80 USD/MWh (Figure 3.1). The residential price of electricity is 70% higher than the industrial price.

Industrial electricity costs more in Minnesota than in US on average. However, the price is competitive in the Mid-West Region. The electricity costs less in Iowa to the South, approximately the same in Wisconsin to the East, but more in both North and South Dakota to the West.

Figure 3.1 Nominal retail price of electricity for industry, 2007-2017



Source: U.S. Energy Information Administration

3.2 Key supplies

Minnesota has lots of machinery and chemical products manufacturing. It is home to many multinational conglomerates that produce wide variety of products, such as 3M. Costs of machinery and chemical products can be higher in Minnesota than for example Oregon and Maine. However, the central location of Minnesota permits to import key supplies from Canada or domestically from other states, but as mentioned, the cost can be higher in Minnesota than in other states.

Key supplies are neither a hindering nor a benefiting factor in Minnesota.

3.3 R&D

While overall private R&D funding has declined, the US Forest Service, universities and other public-private partnerships contribute to the advancement of forestry innovation.

Expenses on research and development or investment may be eligible for tax credit. In Minnesota, the credit is 10% up to the first 2 million USD, and 2.5% for eligible expenses above



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2 million USD. Investors may receive a 45% tax credit on their investment, up to 112 500 USD per year, when investing in innovative business located in the Minnesota border cities of Breckenridge, Dilworth, East Grand Forks, Moorhead, and Ortonville. The credit is non-refundable and may be carried forward up to four years.

Much of the private and public research is done in conjunction with the University of Minnesota. The University provides academic careers in e.g. Bioproducts and Biosystem's Engineering that offer studies related to production of bioenergy and biobased products.

The Industrial Partnership for Research in Interfacial and Materials Engineering (IPRIME) at the University of Minnesota researches interfacial and materials science. The Initiative for Renewable Energy and the Environment (IREE) researches bio-based and other renewable energy resources and processes. IREE has a state funding of 5 million USD annually.

R&D in relation to forestry sector is at medium level in Minnesota, lacking R&D in the private sector.

Annex 6

US, Oregon



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FOR/Maine

Global Market Analysis and Benchmarking Study – United States (Pacific Northwest, Oregon)

Final Report

Helsinki, Finland
June 29, 2018

8117
ID 122624



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1. TIER 1 – DETAILED ANALYSIS

1.1 Raw material

Oregon is United States' biggest producer of softwood lumber and plywood. In 2013, Oregon was a net importer of timber. Only 66% of Oregon's sawmill capacity was utilized in 2013, but the utilization rates have greatly improved since then. Contrary to the low utilization of sawmill capacity, plywood, veneer and chipping facilities were highly utilized. Engineered wood products (such as LVL) manufacturers purchase large amounts of veneer and lumber for raw material, meaning that future increase in EWP production could further increase the sawmill capacity utilization, when they acquire more raw material. However, the sawmill capacity utilization is mainly driven by the number of housing starts in the Western U.S.

Increases in pulp and paper production capacity are not likely in Oregon, because general attitudes are against new pulp mill investments. However, exports and wood construction are a potential source of future growth for Oregon's forest industry. An example of future capacity increase is a new Red Rock Biofuels plant, which is estimated to initiate production in 2020. Plant's expected use of woody biomass is 136 000 tonnes annually.

One of the key factors impacting raw material availability in the West is the log exports to China and Japan. Log exports especially to China have increased during the last decade, and this has made the log supply situation in Oregon very competitive.

1.1.1 Harvest levels

Harvest levels in Oregon declined between 2007-2009 due to economic recession which slowed down construction. By 2016 the total harvest levels had returned to the pre-recession levels. Most of the harvests occur in private forests, even though the total area of public-owned forest is larger than total area of privately owned forest.

In most of the public forests, only 9% of annual growth is harvested, while 62% of annual growth is added to standing stock. In private forests, 75% of annual growth is harvested, while per year only 14% is added to the standing stock. In total, 41% of annual growth is harvested, 21% is subject to mortality and 38% is added to growing stock. Almost all of harvested timber is softwood, while 60-70% of harvested timber is douglas fir and approximately 10% is hemlock.

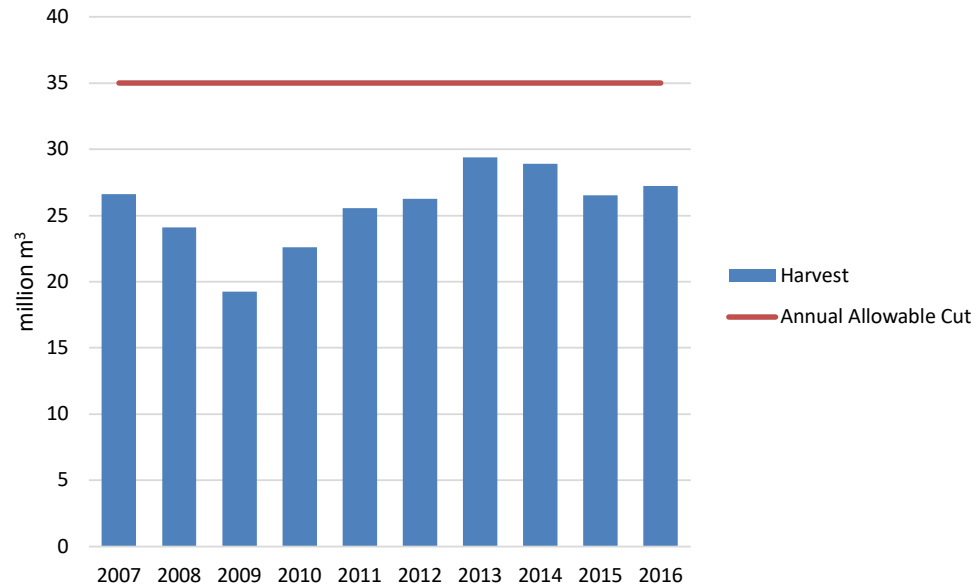
Harvest levels in Figure 1.1 indicate potential to increase harvest level. However, harvests in private forests are already at a high level, while harvest level in public forests is low. Public forests consist of forestland managed by either state, Bureau of Land Management, US Forest Service or other agency. Increase of harvests in public forests is unlikely, because of the focus on environmental management. Before the 1990s, harvest levels in public forests were significantly higher.

In 2013, 75.3% of harvested timber was used to produce lumber, 14.8% to produce plywood/veneer, 9% to pulp production or fuel and 0.9% to other timber products.



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Figure 1.1 Harvest levels and AAC



Note: Unit conversion factor used was 1 MBF = 7 m³

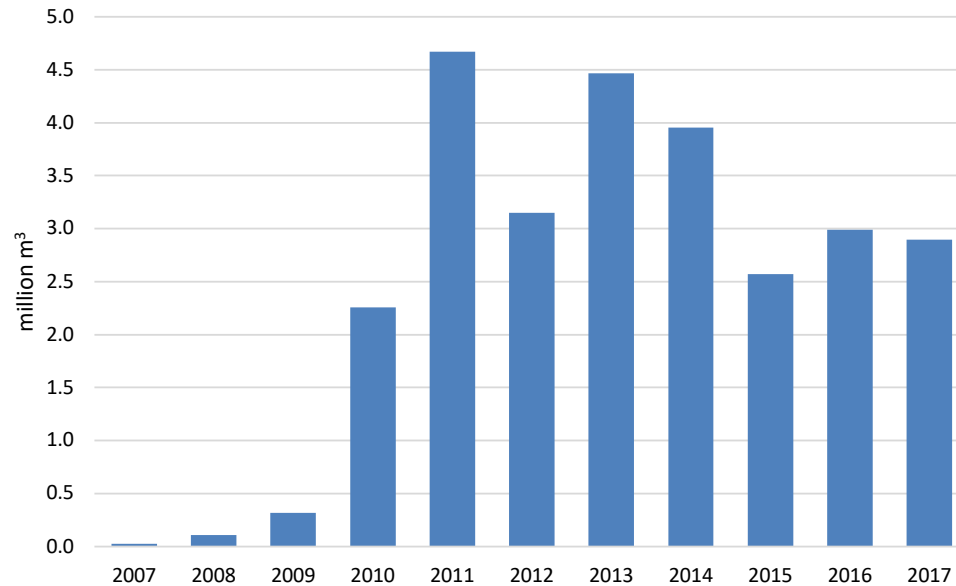
Source: Oregon Department of Forestry

Log exports to China increased dramatically during the recession after 2007. While still significant, the export volumes have declined somewhat in the last few years. The export logs have typically been of the highest grades and larger than average logs used by the sawmills in Oregon. Figure 1.2 illustrates the development of softwood log exports volume from ports on the Oregon coast and the Columbia River (mainly Port of Longview). These log volumes originate from western Oregon and western Washington.



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Figure 1.2 Softwood export volumes from Oregon and Washington to China



Source: US Census Bureau: Economic Indicators Division

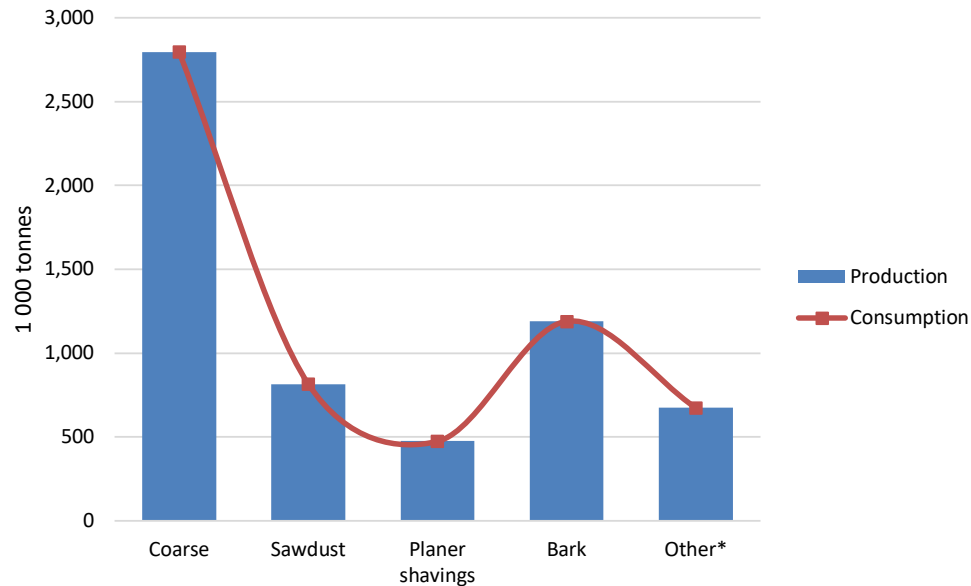
1.1.2 By-products

Utilization of wood processing residues is at a high level. In 2013, less than 1 percent of residues produced was left unutilized. Pulp, paper and panel production used approximately 60 percent of residues, while most of the remaining residues were used as fuel. Sawmill residues are the largest source of raw material for pulp, paper and board mills. In 2013, the total value of sawmill residues sold was 185 million USD, which makes residues an important source of revenue for the mills. As the utilization rate of sawmill capacity and overall demand for softwood lumber increases in the future, more sawmill residues will become available for e.g. MDF production or for new products such as biofuels.



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Figure 1.3 Production and consumption of sawmill and plywood/veneer plant residues in 2013



Source: United States Department of Agriculture

1.1.3 Forest ownership

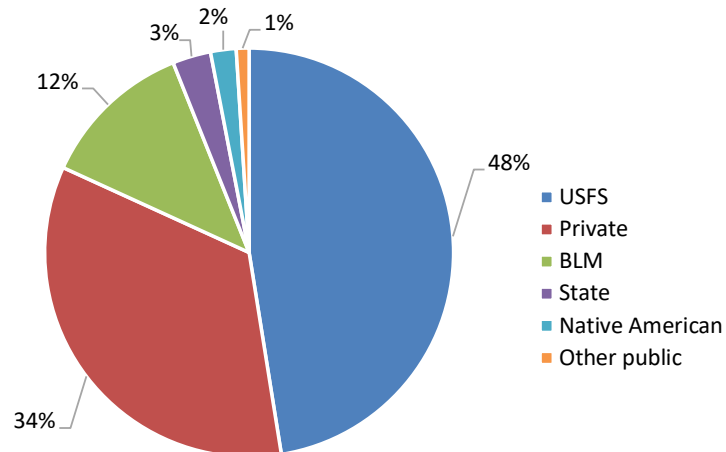
The total forest area of Oregon is approximately 12.1 million hectares (30 million acres). Figure 1.4 presents structure of forest ownership in Oregon. The total public forestland is 64% of forest area, while the total private forestland accounts for only 34%. Only 24% of harvests are conducted in public forests, mainly from the state forests. Most of the public forestland is managed by US Forest Service, but approximately 5% of public forestland is owned by the state of Oregon. In state-owned forests 58% of annual timber growth is harvested. Large proportion of federal ownership can be seen as a hindering factor for harvest increases, since timber production is not an important goal for the federal forest management in Oregon.

Timber production has the biggest weight in privately-owned forests' management objectives, but environmental issues are added to privately-owned forests' management through The Oregon Forest Practices Act.



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Figure 1.4 Forest ownership structure



Total 12.1 million hectares

Source: Oregon Forest Resources Institute

1.1.4 Delivered wood cost

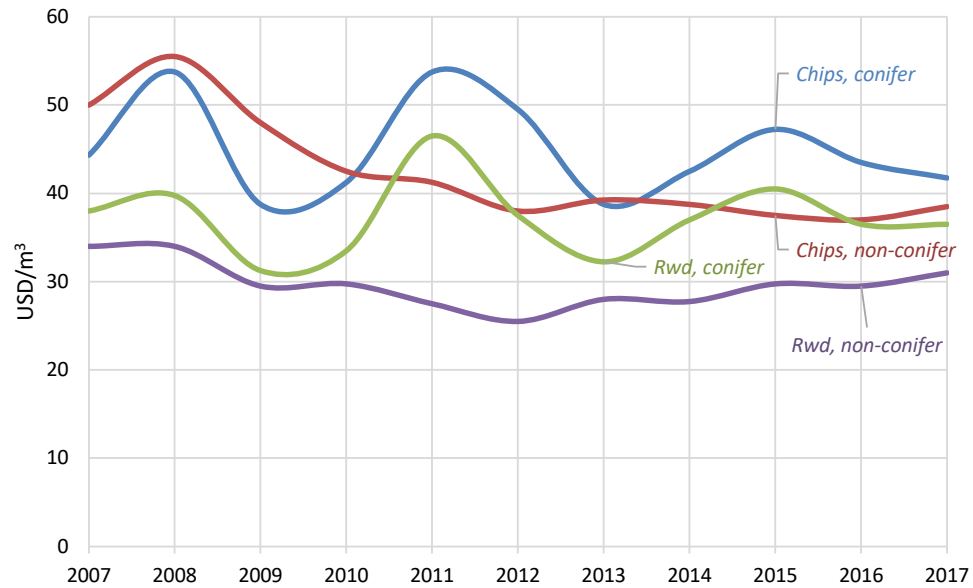
During 2009-2017, delivered price of conifer pulpwood reached 50 USD per cubic meter after the recession, but during the middle of decade the price has settled around 40 USD per cubic meter. Delivered price of non-conifer pulpwood has not yet reached the pre-recession price.

During 2012-2017 the price of conifer sawlogs has exceeded the pre-recession (2007) price level and is showing a trend of increase into the year 2018. Table 1.1 presents typical components of delivered price, including harvest and transport costs. As the softwood lumber demand in US is predicted to rise in the following years due to housing demand, also the price of sawlogs is expected to continue its rise.



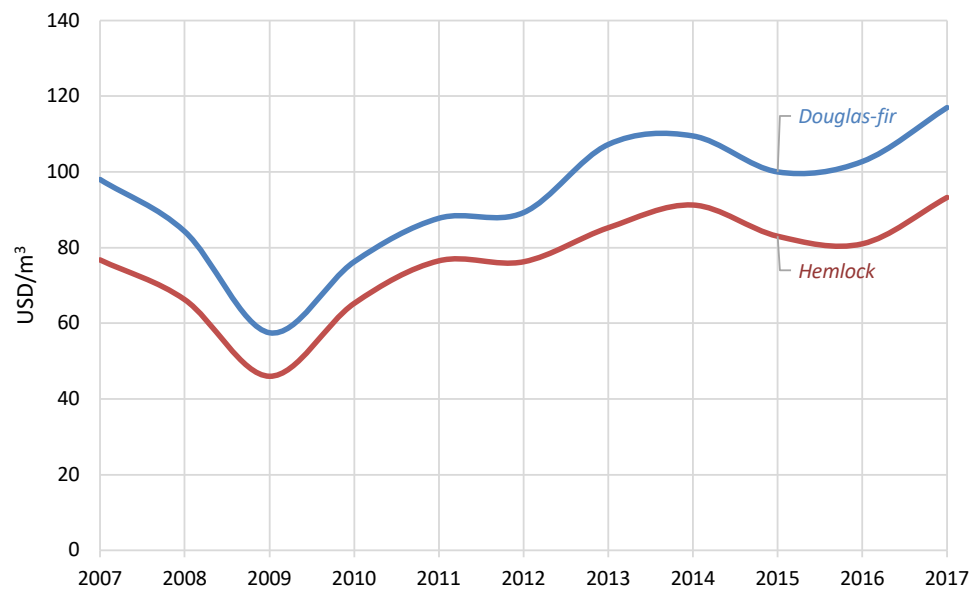
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Figure 1.5 Pulpwood delivered price in Pacific Northwest



Source: Wood Resource Quarterly

Figure 1.6 Sawlog delivered price in Pacific Northwest



Source: Wood Resource Quarterly



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Table 1.1 Typical components of delivered cost in Pacific Northwest (2017)

Stand age	Operation	Low	Med	High
Harvesting		USD/m ³		
28	Thinning	15	28	38
45	Clearfell	17	20	27
45	Transport	8	12	15
Stumpage		USD/m ³		
28	Thinning Sawlog/pulpwood	24	31	42
45	Clearfell Pulpwood	2	4	7
45	Clearfell Sawlogs	45	66	86

Source: Indufor databases.

Oregon has historically had higher costs for sawlogs than Washington state, and there has been a flow of logs directed to Willamette Valley from Western Washington. Southern end of the Willamette Valley has had the highest log costs and the tightest log supply/demand balance.

1.1.5 Wood procurement practice

A variety of procurement practices is used in Oregon. Bidding competitions for standing (stumpage) sales are often used in state-owned forests, while sale at delivered price is more common among large private forest owners. Some wood procurement companies buy standing timber from smaller private forest owners and sell the timber to manufacturers. Largest share of harvests in Oregon is done in private forests owned by the industry. The harvests are conducted by harvesting companies.

From all harvests in Oregon, approximately 10-15% of wood is used to pulp, paper and chipping. Pulpwood harvests in Oregon are rare when compared to Finland for example. In private forests, thinnings are not usually done, but the trees are left to grow to a sawlog size. Especially in steep slopes, wood that does not meet sawlog diameter demands is left to the forest. Most of the timber transported from the forest goes directly to sawmills, while pulp and board industry uses the sawmill by-products.

1.2 Workforce

In 2017, the total number of paper manufacturing workers in Oregon was quite low at 1080, while total number of sawmill workers and wood product manufacturing workers was 5270. Oregon's Employment Department estimates that the wood product manufacturing employment will grow by 13% between 2014-2024 due to economic growth. In addition to growing number of jobs, an aging workforce requires replacement employees. Total size of labor force in 2017 was 2.13 million people.

1.2.1 Demographics

In 2016, the total population of Oregon was approximately 4.1 million people. In 2010, shares of urban and rural population were 81% and 19%, respectively. According to latest census and American Community Survey data, employment rate of people aged between 25 to 64 is 56%, while proportion of unemployed people is 7%. 37% of population aged 25 to 64 are outside labor force, thus not classified as employed or unemployed. From 2007 to 2017, birth rate has declined from 13.2 to 11.2 births per 1000 people.



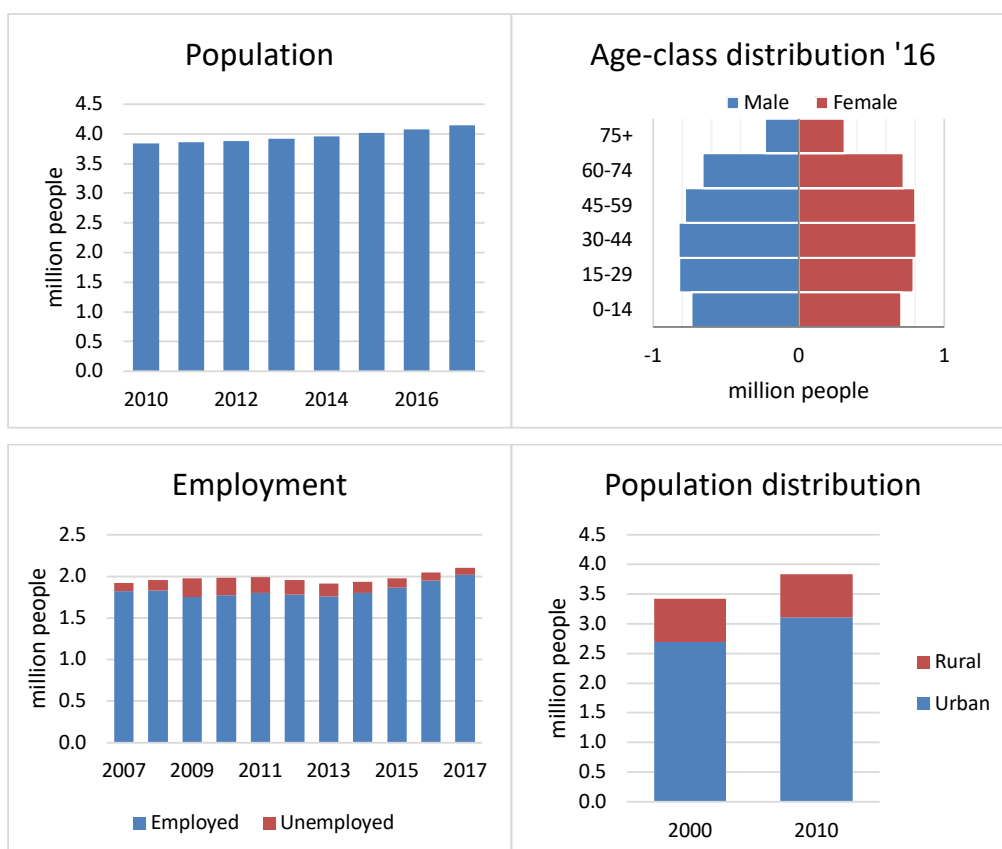
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Table 1.2 Key demographic indicators

Indicator	Current situation
Total population (2016)	4.1 million
Population growth rate (2017)	1.6%
Population density, rural vs urban (2016)	19% vs 81%
Unemployment rate (December 2017)	4.1%
Level of education ⁽¹⁾ (2016)	89.4%

⁽¹⁾ Ages 25 to 64, people with high school or higher education.

Figure 1.7 Historical demographic development



Source: US Census Bureau, Portland State University – Population Research Center, Oregon Employment department

Relative to many areas in the U.S., the population growth rate in Oregon is high, and the unemployment rate is quite low. Overall, the availability of skilled labor to work in forest industry is limited and may hinder future growth of the industry to a certain extent.

1.2.2 Level of education in each competitor country and the skill levels required

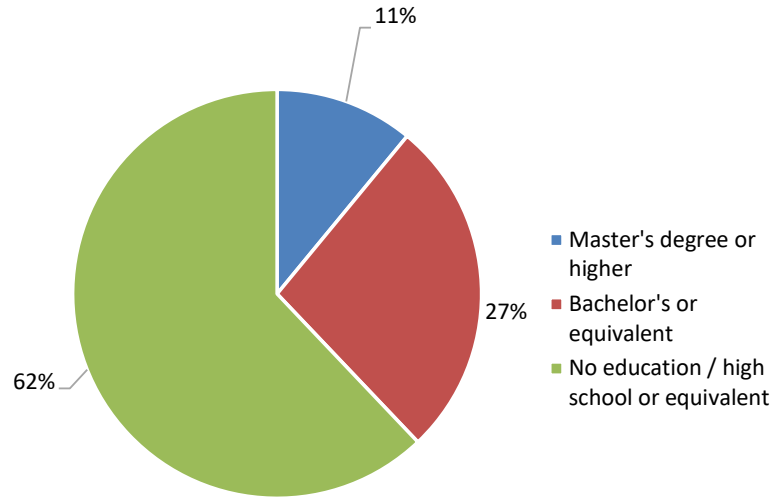
Figure 1.8 presents education level of people aged 25 or older. Upper secondary education in US terms means high school or equivalent degree. Figure 1.9 presents unemployment rate by



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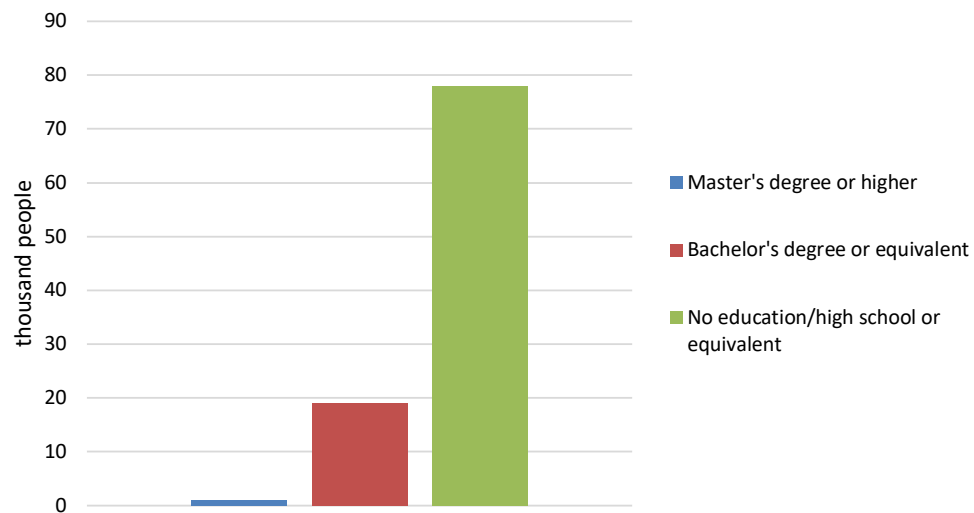
level of education. In 90% of wood product manufacturing jobs, only high school diploma or less advanced education is required. As approximately 90% of Oregon's adult population have at least high school or equivalent education, the education level is not the limiting factor in the industry. However, the skill sets required in the industry are increasing with increased level of technology and automation.

Figure 1.8 Education level in Oregon (25 and older)



Source: US Census Bureau, American Community Survey

Figure 1.9 Unemployment rate by level of education



Source: US Census Bureau, Current Population Survey

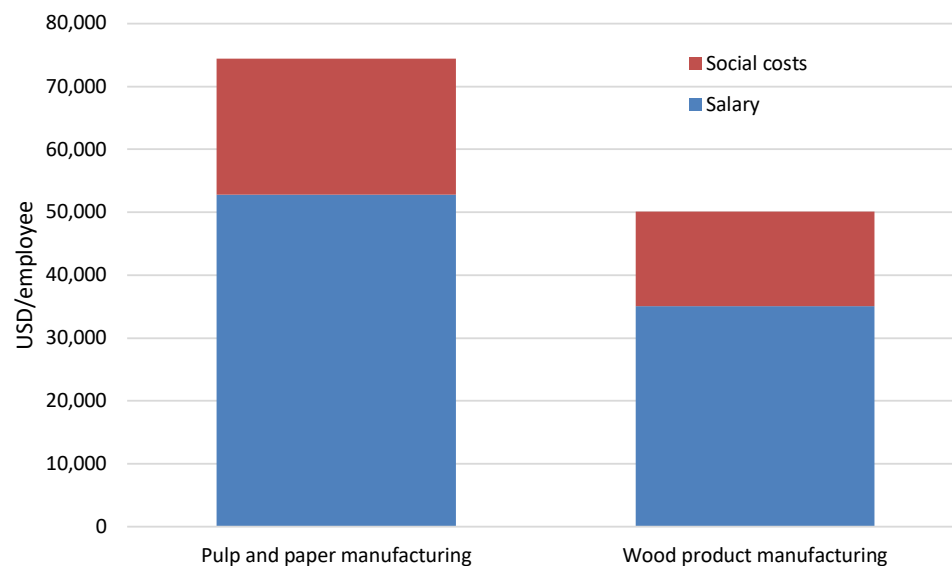


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1.2.3 Typical labor costs

Oregon has a minimum wage of 10.25 USD per hour, which is significantly higher than the national rate of 7.25 USD per hour. Figure 1.10 presents mean annual wages and benefits of paper and wood product manufacturing workers. Benefits are calculated in relation to mean annual wage and assumed to be the same as average private industry workers benefits in Western region of the US, including Oregon. In addition to legally required benefits, voluntary benefits also cause costs to employers.

Figure 1.10 Mean annual wages and benefits of paper and wood product manufacturing in Oregon, 2017



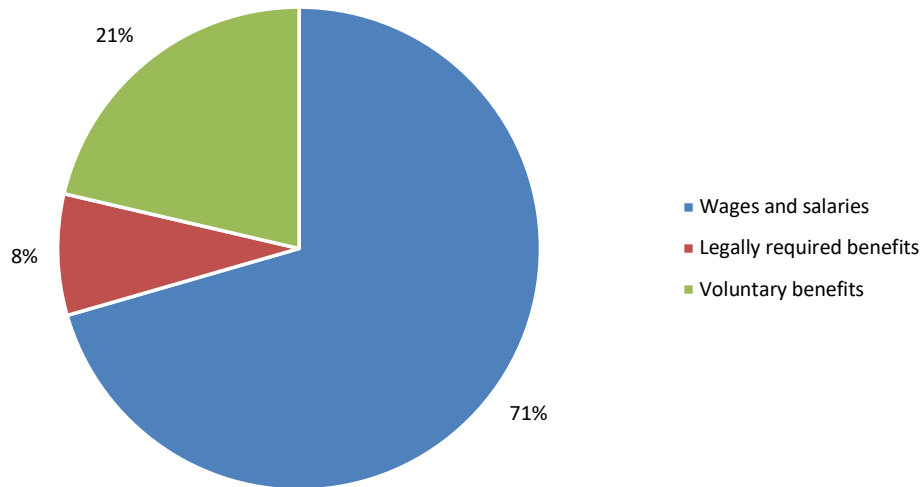
Source: US Department of Labor

Total labor cost consists of wage and benefits. Voluntary benefits consist of insurance and paid leave costs. Figure 1.11 presents the average structure of total labor cost in Western region of United States. The difference between annual average wage of the Western region compared to the whole country is only marginal, but relative to the U.S. South. While the hourly wages in Oregon sawmills are considerably higher. This is not reflected in the total annual comparisons, since an average worker in the South works significantly more hours than an average worker in the West.



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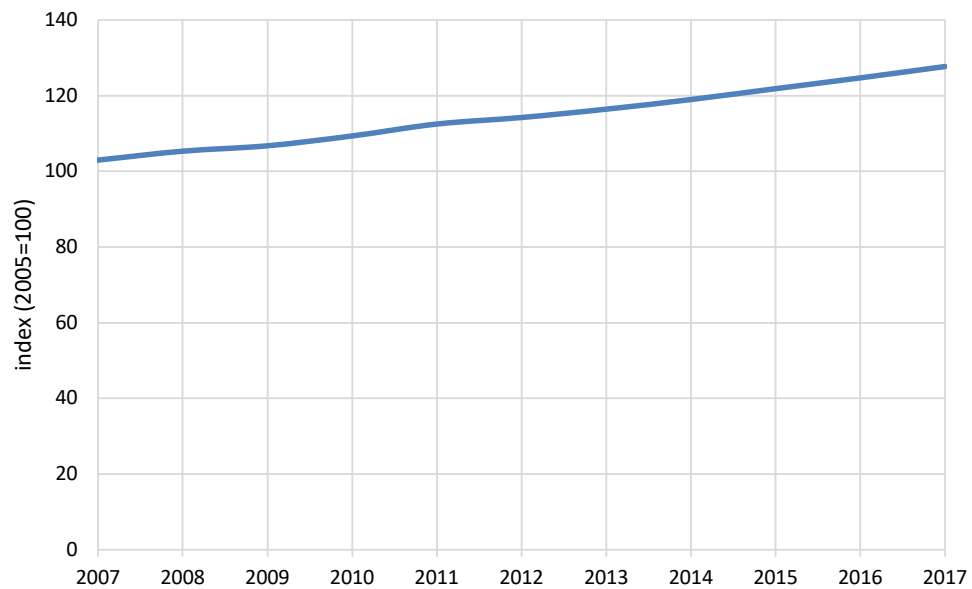
Figure 1.11 Structure of total employee compensation in US Western region



Source: US Department of Labor

Figure 1.12 describes the overall labor cost development in the US private industry manufacturing. General labor cost level has steadily increased the last 10 years.

Figure 1.12 Employment cost index in US, private manufacturing industry (2005=100)

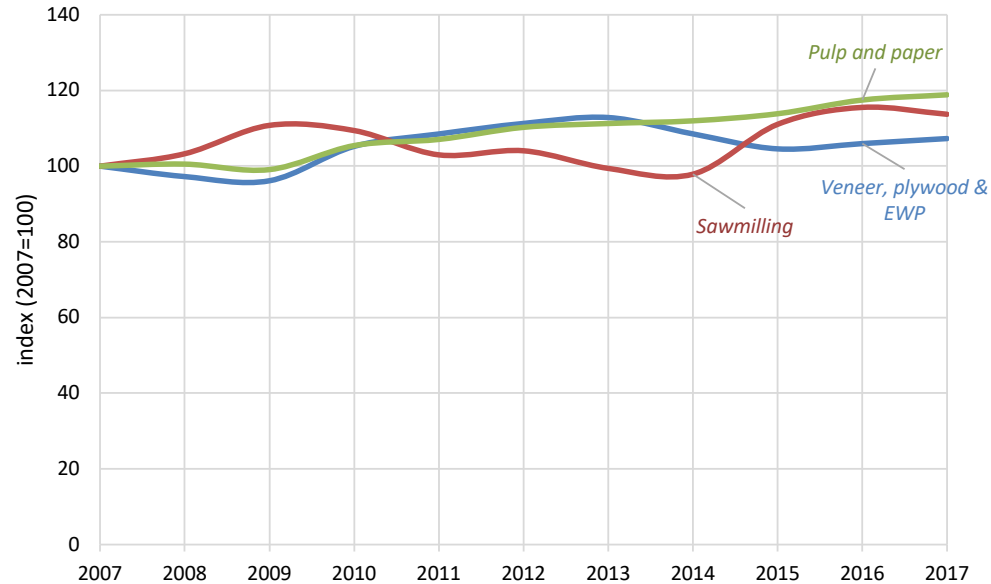


Source: US Department of Labor



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Figure 1.13 US labor productivity index (2007=100)



Source: US Department of Labor

1.3 Regulatory climate

US Federal level

Raw material supply

There are no federal regulations on harvest levels or the conversion of natural forests to plantations. Other relevant regulations pertain to the protection of endangered species and the environment. The U.S. Fish and Wildlife Service administers *Endangered Species Act* criminalizes harming endangered species. The Environmental Protection Agency (EPA) regulates the use of insecticides in forestry under authority of the *Insecticide, Fungicide and Rodenticide Act*. The federal *Clean Water Act* obligates authorities to identify any non-point pollution sources in silviculture and sets forth procedures and methods (including land use requirements) to control to the extent possible such sources. The discharge of dredge or fill material from normal silvicultural activities (e.g., timber management) is not prohibited under this Act (with some exceptions). Control of nonpoint source pollution depends on the use of Best Management Practices, as well as the participation in a number of other voluntary incentive programs.

Environmental regulations for manufacturing

In the United States, federal and state authorities are responsible for regulating and enforcing environmental protections relevant to forestry products. Generally, the federal regulations apply, and enforcement responsibility is determined on a state-by-state basis. The EPA must authorize state agencies to regulate issues like water and air quality. States must, at a minimum, uphold the federal standards, but they can also pass more stringent regulations. The current administration has announced its intention to review or rescind many of the environmental regulations put in place by previous administrations, which the current administration claims are a hindrance to business. Nonetheless, air and water quality regulations are relevant to the production of the short-listed products in this study.



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The *Clean Water Act* is the main federal law governing water pollution. The Act identifies point and nonpoint pollution sources, with manufacturing facilities for forest products considered point sources. Point sources require permits for any discharge into water bodies under the *National Pollutant Discharge Elimination System* (NPDES). State authorities can administer and enforce the permitting system if authorized by state laws and the EPA (all states in this study have been delegated such authority). NPDES permits must be reissued every five years. Sector-specific effluent guidelines set the standard for polluted runoff and are enforced by the NPDES permitting process. The *Pulp, Paper and Paperboard Effluent Guidelines* set the standards for permitting. Some trade groups claim that the guidelines are too strict and impose undue costs on the producers without commensurate impact on human health.

The *Clean Air Act* governs air pollution in the United States. The EPA has overall responsibility for the Act but states are mainly responsible for ensuring compliance and permitting. Permitting for stationary sources of pollution (volatile organic compounds) is required with renewal every five years. The standards used in the permitting process relevant to forestry products include the Kraft Pulp Mills: New Source Performance Standards (NSPS), *Plywood and Composite Wood Products Manufacture: National Emission Standards for Hazardous Air Pollutants*, *Pulp and Paper Production (MACT I & III): National Emissions Standards for Hazardous Air Pollutants (NESHAP) for Source Categories*, and *Compliance for Industrial, Commercial, and Institutional Area Source Boilers*. The Clean Air Act requires permits to build or add to major stationary sources of air pollution (the New Source Review (NSR)). Forestry trade groups argue that the review and permitting process is too lengthy (6 to 18 months) and hurts competitiveness. Additionally, the production of ethanol requires on-site emissions control equipment in order to obtain a permit under the *National Emission Standards for Hazardous Air Pollutants (NESHAP) for Chemical Manufacturing Area Sources (CMAS)*, which some groups argue will raise the cost of production.

Ocean-going vessels and large ships traditionally used “bunker fuel” with sulfur levels as high as 5%, or 50 000 ppm, sulphur. Bunker fuel burned on these ships was a large source of harmful air pollution in the U.S. An International treaty designated two *Emission Control Areas* (ECA) covering US waters. The North America ECA extends 200 miles from the shores of North America, and the US Caribbean Sea ECA covers waters around Puerto Rico and the US Virgin Islands. The sulphur content of the fuel used in marine vessels operating in these ECAs may not exceed 0.10 weight percent (1000 ppm). Outside the boundaries of ECA, a global sulphur cap of 3.50 weight percentages applies. In 2020, this limit decreases to 0.50 weight percent. EPA's *National Ambient Air Quality Standards* are designed to protect people against exposure to the entire group of sulphur oxides (SOx) by specifying the maximum amounts of sulphur dioxide present in outdoor air. For example, this regulation affects the composition of gasoline in the US.

Emissions Markets

EPA's Clean Air Markets Division (CAMD) runs programs that reduce air pollution from power plants to address several environmental problems, including acid rain, ozone and particle pollution, and interstate transport of air pollution. CAMD programs include the Acid Rain Program (ARP), the Cross-State Air Pollution Rule (CSAPR), and the CSAPR Update.

Each year, EPA holds an auction for SO₂ emissions allowances set aside in an Auction Allowance Reserve to let interested parties such as electric power plant owners, environmental groups, emissions brokers and others acquire up to 125 000 tons of emissions allowances under Phase II of Title IV of the Clean Air Act Amendments. This program provides a source of allowances beyond those initially allocated and facilitates price discovery.

SO₂ allowances are then allocated to affected units serving generators greater than 25 megawatts. All new units based on their historic fuel consumption and specific emission rates. Each allowance permits a unit to emit one ton of SO₂. Sources may choose among several options to reduce emissions. Sources may sell or bank (save) excess allowances if they reduce emissions and have more than they need, or purchase allowances if they are unable to keep emissions below their allocated level. At the end of the year, each source must hold sufficient



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allowances to cover its SO₂ emissions (each allowance represents one ton of emissions). In 2018, the price for SO₂ was 0.06 USD per ton.

NO_x: The NO_x program embodies many of the same principles of the SO₂ trading program, in that it also has a results-oriented approach, flexibility in the method to achieve emission reductions, and program integrity through measurement of the emissions. However, it does not "cap" NO_x emissions as the SO₂ program does, nor does it utilize an allowance trading system.

Market access

Key market access regulations related to the short-listed products relate to formaldehyde standards and the use of cellulosic ethanol in renewable fuels standards.

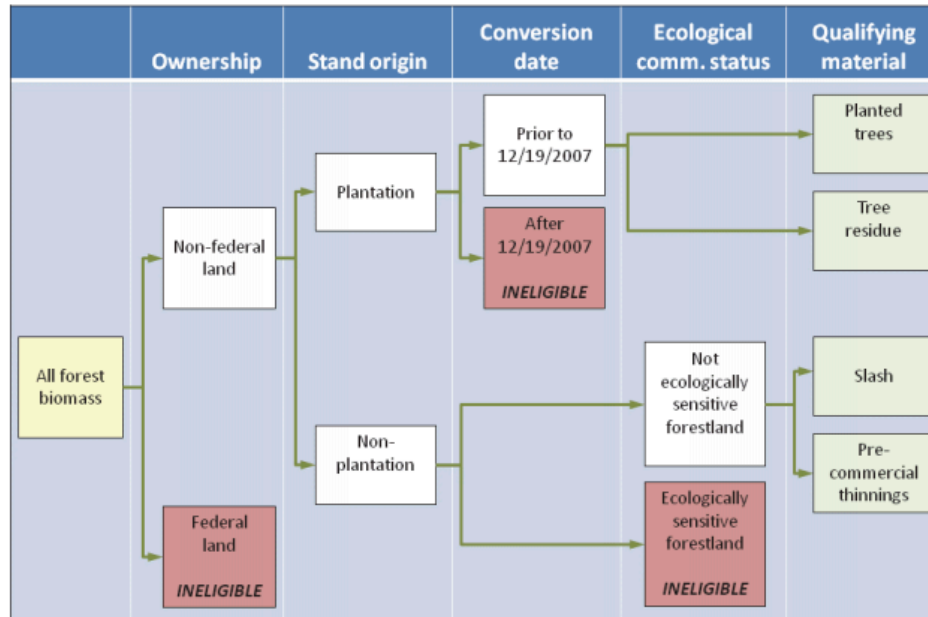
Specific to MDF, CARB2 and the Formaldehyde Standards for Composite Wood Products Act apply only to interior use products such as hardwood plywood, medium density fiberboard, and particleboard. The formaldehyde emissions standards go into effect beginning on December 12, 2018. Products used in the construction of a building's frame are exempt from emission requirements. There are no small entity exemptions and there is no de minimal standard based on the size of smaller panel producers.

Administered by the EPA, the Renewable Fuel Standard requires transportation fuel sold in the United States to contain a minimum volume of renewable fuels. Under the standard, Cellulosic bio-fuel is its own category and is considered an Advanced Biofuel. Advanced biofuels are required to meet stricter air pollution requirements than regular corn-based ethanol. Cellulosic biofuel must be produced from cellulose, hemicellulose, or lignin and must meet a 60% lifecycle GHG reduction. The minimum volume determinations are subject to change year-to-year, which provides uncertainty to supply market. For 2018, the EPA set a volume requirement of 288 million ethanol-equivalent gallons, which is lower than the 2018 target of 7 billion gallons set by the *Energy Independence and Security Act* of 2007. The lower requirement is due to the limited supply of cellulosic biofuels on the market. To qualify as renewable cellulosic biofuels used for liquid transportation fuels, the fuel must be produced from logging residues, "pre-commercial" thinning materials, or biomass originating from forest plantations established before 2007 (Figure 1.14). These criteria require the producer to maintain records and proof of plantation establishment.



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Figure 1.14 Categories of renewable biomass



In April 2018, the EPA Administrator announced a policy making clear that future regulatory actions on biomass from managed forests will be treated as carbon neutral when used for energy production at stationary sources.

US Forest Certification

In 2018, USA had 14.4 million hectares certified via FSC, while the total number of FSC-certificates was 106. PEFC has 7.5 million and 26.3 million hectares certified under ATFS (American Tree Farm) and SFI, respectively (December 2017). 8.3 million hectares of forest in USA have both FSC and PEFC-certificates.

The top twenty wood-using companies (58% of all wood-using capacity in the US) acquire all their wood-fiber raw material from SFI-certificated suppliers. Pulp, paper and panel industry all have high rates of certified raw material, while lumber mills are lagging behind. From mills with capacity of at least 300 000 tons per year, 75% of their capacity is covered by either SFI or FSC certification.

Oregon state level

Raw material supply

The Oregon Forest Practices Act regulates private timber harvesting aimed to protect soil productivity, water quality and wildlife habitat, and ensure replanting after harvest. The Act limits the size of clear-cuts to 120 acres, and it requires forested buffers around streams, leaving wood in place for wildlife and re-planting. Private forest landowners must notify the state of a planned timber harvest.

Environmental regulations

The Department of Environmental Quality (DEQ) has the responsibility for enforcing air and water quality regulations. Oregon received authorization from EPA to implement its own air, water, and waste management rules. To receive federal authorization, DEQ's air, water, and waste management rules must be at least as stringent as the federal rules. To maintain its



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federal authorization, DEQ is required to adopt EPA's latest environmental rules or impose more stringent state standards. In 2011, the state passed the strictest water standards in the country. On the other hand, in 2018, Oregon passed new toxic air regulations with the support of the pulp and paper industry. The new regulations allow for a doubling in the permissible emissions with cancer-risk. Industrial facilities must now conduct human risk assessments. The DEQ is also responsible for permitting facilities under the federal Clean Water Act using the guidance established by the EPA for NPDES.

Market access regulations

No specific market access regulations pertaining to the short-listed products was found.

Forest Certification

In 2016, Oregon had a total of 4 960 099 acres (2 million hectares), of which 795 100 acres (321 765 hectares) is certified by ATFS, 195 196 acres (78 993 hectares) by FSC, and 3 969 803 acres (16 065 522 hectares) by SFI.

Wood Building

Oregon adheres to the following building codes:

- International Building Code (IBC), 2012 Edition*
- International Residential Code (IRC), 2009 Edition*
- International Fire Code (IFC), 2012 Edition

* Statewide Alternate Means allows the use of the 2015 IBC and IRC

Oregon's regulatory climate is neutral with forest management regulations emphasizing commercial priorities for sustainable harvesting and a mix of very stringent to less stringent water and air quality standards.

1.4 Taxation

In the USA, taxation, deductions, exemptions, and credits can simultaneously be applied for the same service or product on federal, state, and county level. For instance, the USA federal corporate tax rate is 21% flat (since January 1, 2018), while the state of Maine has a graduated corporate income tax on all entities organized as corporations in the State of Maine, with rates ranging from 3.5% (for income up to 25 000 USD) to 8.93% (for income more than 250 000 USD).

In Oregon, the business tax rate totals 28.6%, consisting of the federal tax rate of 21% and a flat state tax rate of 7.6%. Oregon does not have a sales tax like some other US states but compensates these "lost earnings" with a higher personal income tax. As an exemption to some other states, in Oregon cities and counties have the right to impose sales tax.

Within North America, the USA has programs in place to reduce the corporate tax rate, such as deducting the entire cost of equipment purchases from a company's taxable income as well as reducing an employer's federal income tax liability when increasing employment. Oregon offers programs and incentives to reduce or eliminate both the income tax rate as well as the sales tax for up to 10 years.



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2. TIER 2 – GENERAL ANALYSIS

2.1 Policies

Federal policies

The Forestry Service of the USDA manages and implements USA's forest programs, through execution by the States. Most of these forest programs are aimed at conserving and protecting the forest, while some programs focus on assisting landowners to develop and manage their forests. For instance, the Forest Stewardship Program is the primary private forest landowner assistance program. The aim of the program is to conserve, protect and enhance private forest landscapes by connecting individual and family woodland owners with the information, technical assistance, and professional planning they need to achieve their stewardship goals. Participation in the program is voluntary and can include receiving technical assistance or educational programs or agreeing to manage property according to an approved Forest Stewardship Management Plan. The 2018 budget provides 20.5 million USD in support of this program.

In the USA, the Wood Innovation Grant is the most important mechanism to expand and accelerate wood products and wood energy markets, with 8 million USD in funding in 2018. In total, the Forest Products Program has 359 million USD budgeted in 2018.

Under the Obama administration, the USA set a renewable energy target of 20% of renewables on electricity use for all agencies, the largest energy consumer in the country. In addition, under the Energy Independence and Security Act (EISA), the USA tries to improve vehicle fuel economy and reduce U.S. dependence on petroleum, requiring transportation fuels to contain a minimum of 36 billion gallons of renewable fuels annually by 2022. A certain percentage of this renewable fuel must be advanced biofuel that have a minimum of 50% GHG emissions reduction, excluding corn starch-based ethanol. Advanced biofuels are divided in two categories: 1) Cellulosic biofuel derived from cellulose, hemicellulose, or lignin that achieves a 60% GHG emissions reduction. 2) Biomass-based diesel is renewable transportation fuel, transportation fuel additive, heating oil, or jet fuel, such as biodiesel or non-ester renewable diesel, and achieves a 50% GHG emissions reduction. As of November 30, 2017, the EPA set the following requirements for 2018: cellulosic biofuel (288 million gallons), biomass-based diesel (2.1 billion gallons), advanced biofuel (4.29 billion gallons), and renewable fuel (19.29 billion gallons). Through the National Clean Diesel Campaign, the EPA tries to reduce harmful emissions from diesel engines by offering grants and rebates to states to install emission reduction systems. However, states have been adopting and increasing renewable energy standards (RET). As part of these standards, utilities are required to sell specific amount of renewable electricity, which can be designated only for investor-owned utilities (IOUs) or incorporate government run utilities.

Utilization of biobased products in US is encouraged with several programs. *The BioPreferred Program* aims to increase the consumption of biobased products by setting a mandatory purchasing requirement for federal agencies and their contractors, but also by a voluntary labelling initiative. With a label granted by United States Department of Agriculture, the consumer is provided information about the bio content of the product. *Biorefinery, Renewable Chemical, and Biobased Product Manufacturing Assistance Program* may provide a loan guarantee up to 250 million USD for projects that use emerging technologies to convert outputs of biorefineries or biobased product manufacturing facilities into end user-products. However, the program is part of Farm Bill 2014 agreement that will be renewed in 2018, but most likely in smaller scale.

Use of biomass as an energy source is supported by the federal government with a variety of programs. From the point of view of forest biomass, some of the relevant programs are *BioEnergy Engineering for Products Synthesis, Process Development for Advanced Biofuels and Biopower* and *State Energy Loan Program*. *The Renewable Fuel Standard* set by the Environmental Protection Agency requires transportation fuel sold in the US to contain a minimum volume of renewable fuels, for example fuel derived from cellulosic biofuel.



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The *Loan Guarantee Program* provides loan guarantees to eligible projects that reduce air pollution and greenhouse gases and support early commercial use of advanced technologies, including biofuels and alternative fuel vehicles. The program is not intended for research and development projects. DOE may issue loan guarantees for up to 100% of the amount of the loan for an eligible project. Eligible projects may include the deployment of fuelling infrastructure, including associated hardware and software, for alternative fuels. For loan guarantees of over 80%, the loan must be issued and funded by the Treasury Department's Federal Financing Bank.

The policy environment can be considered medium. The forest industry directly benefits from certain programs, such as the Forest Products Program (\$359 million in 2018) and Wood Innovation Grant (\$8 million in 2018), but overall funding constitutes a small share of the country's GDP. In addition, although the USA is favorable to stimulating the Bio Economy, many programs have seen their funding decrease or were eliminated under the Trump Administration, with a notable exception for the program on nanotechnology. Given that only a small percentage of this program (20.7 million out of 1.2 billion) will be dedicated to research on nano-biomaterials derived from crops, woods, and other biomass-based by-products (\$17 million) and work on woody biomass-based nanocellulose (3.7 million), the environment is still considered medium.

State policies

Similar to Minnesota and Maine, Oregon has set a Renewable Portfolio Standard (RPS), with the aim to have 50 percent of electricity come from renewable resources by 2040, and a phase out of all generated electricity by 2030. Under the RPS, all gasoline must be blended with 10% ethanol and all diesel must be blended with 5% biodiesel, which refers to fuel derived from vegetable oil, animal fat, or other non-petroleum resources, that is designated as B100 and complies with ASTM specification D6751. Biodiesel blends containing at least 20% biodiesel derived from used cooking oil are exempt from the \$0.34 per gallon state fuel excise tax.

Despite the current administration to roll back the Clean Power Plan, Oregon plans to continue working towards the goals as established in the Plan. To reach the Renewable Portfolio goals, Oregon issues Renewable Energy Certificates for the generation of qualifying renewable power, including certain woody biomass products. In addition, it grants up to \$250,000 are rewarded to energy systems producing renewable energy.

In terms of forests, more than 44% of land is privately owned in Oregon, with total private forest land 10,380,200 acres, of which 5,984,100 acres belong to large private landowners with more than 5,000 acres and 4,324,100 acres belong to small private landowners with less than 5,000 acres. As ownership is split between large and small, Oregon tries to find a balance in offering financial incentives and technical assistance programs aimed at both small and large landowners. As a result, some programs are aimed at improving environmental quality of land, preventing forested land to be converted, and encouraging landowners to grow trees on non-forested land. While other programs focus on family landowners to protect forest from insects, with reimbursement of costs up to 50 percent, provided by the federal government. Additionally, Oregon helps to connect landowners with forest nurseries and tries to ensure that high-quality disease-resistant tree seeds are available through the Oregon Seed Bank. The latter, which can be seen as an extension service of the Oregon Forest Practices Act (FPA), sets standards for all commercial activities regarding forestland, including a reforestation requirement. As part of the FPA, Oregon ensures compliance through a civil penalty program.

As Oregon has a long history with the logging and timber industry, it has developed many institutions through past legislature that supports the forest sector. In 2017, the Oregon Built Environment & Sustainable Technologies (BEST) center was initiated, which focuses on innovative clean and advanced wood. In 2017, BEST studied advanced wood product manufacturing for cross laminated timber acceleration, with a fund from the federal government and co-funding from Oregon. Moreover, in 2017, a Portland based architecture business won a \$1.5 million award through the U.S. Tall Wood Building Prize Competition to conduct seismic and fire safety testing of CLT unique engineering system. As a result of these development, Oregon



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positions itself as frontrunner in the U.S. to construct more commercial and multifamily buildings with advanced wood products.

Although, the forest industry may benefit from some financial incentive programs and the presence of research institutions that study advanced wood products and offer seed capital, the present policy environment can be considered medium. Similar to other states, the bulk of the programs is aimed to increase environmental value of land for (smaller) landowners, and most of the research is financed by the federal government.

2.2 Access to financing

Near term, the United States banking sector is stable and favorable to investment. Investment spending should remain strong, as recent tax reforms have reduced the effective cost of capital. The current credit rating is AA+/Stable/A-1+, which provides low interest rates. While the United States is the largest economy globally, S&P famously stripped its AAA rating in 2011. There is an abundance of private equity investors in the United States, many with links to emerging green markets—although significantly fewer links than in the EU. The forestry industry has access to large US banks, with recent increases in foreign investment (especially from China).

As of May 2018, the current federal funds rate is 1.75%, although the Federal Reserve signaled it will raise rates to 2% in 2018, 2.5% in 2019 and 3 percent in 2020. The end of the Federal Reserve's quantitative easing program in 2013 (which made the effective benchmark rate zero to combat the 2008 recession) was followed in 2015 by a gradual increase in the rate. The April 2018 inflation rate was 2.5%, up from the 2017 average inflation rate of 2.1%. The core inflation rate as of April 2018 was 2.1%, up from 1.8% in 2017.

Many options exist for loan guarantees for investments; the USDA's Business and Industry (B&I) Guaranteed Loan Program provided guarantees of 60, 70 or 80% (depending on loan size) to a variety of business purposes, including forestry projects. The DOE's State Energy Program (SEP) provides annual funding and technical assistance to states to enhance energy security, advance state-led energy initiatives, and maximize the benefits of decreasing energy waste. While overall private R&D funding has declined, the US Forest Service, universities and other public-private partnerships contribute to the advancement of forestry innovation.

The United States ranks first for private funding in attractiveness for private equity and capital venture. Private equity in materials and natural resources is generally below 5 percent of total funding in the United States, accounting for just 27.05 billion USD of the total 648.67 billion USD private equity deals in the United States during 2016.

Ease of access to financing provides an advantage over many other countries that do not have substantial private investment, however, the United States lacks substantial national level forestry incentives and green capital incentives that are found in the EU and Canada. Given these factors, access to finance is medium (neutral) for the United States.

The state of Oregon's fiscal solvency is above average, ranked twenty-first by the Mercatus Center. The banking system can be considered stable with the state's a credit rating of AA+, according to Fitch and Aa1 according to Moody's. In addition, Oregon has 25 insured institutions, which include commercial banks and saving institutions, with combined asset of 32.497 million USD.

Oregon offers direct loans, bonds, and loan guarantees through Business Oregon, a state agency, funded by lottery money. There are a variety of loan types, including: direct loans to aid in early stage (post R&D) prototyping; loans for scalable, and high-margin small businesses to obtain short-term working capital to support rapid growth; and industrial development bonds to provide access to capital (primarily for value-added manufacturing). Oregon also offers a Business Retention Services Program, which is designed to help private sector companies with multi-industry expertise in finance, marketing, operations, turnarounds, restructurings, and feasibility studies. While not direct, the forest sector may benefit from the services offered through Business Oregon. For instance, Oregon's Business Retention Services Program helps private sector companies with multi-industry expertise in finance, marketing, operations,



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turnarounds, restructurings, and feasibility studies. In addition, Oregon Business Development Fund is a revolving loan that provides term fixed-rate financing for land, buildings, equipment, machinery and permanent working capital. Oregon also offers low- interest loans for eligible alternative fuel projects, including fuel production facilities, dedicated feedstock production, fueling infrastructure, and fleet vehicles.

Other financial vehicles that Oregon offers are still under development. In May 2018, Oregon announced that it would release 40 million USD worth of Sustainability Bonds, with proceeds to finance grants for the construction of affordable housing for low income residents .

Although, Oregon is home to several private equity funds and venture capital firms, it does not feature in the top 15 States that capture most of the venture capital funding in the US. Investments of Oregon's largest venture funds are primarily routed to technology, medical devices, and healthcare IT—on average 10 percent is invested in the advanced materials sector.

Although Oregon enjoys a stable banking environment and has access to various financial mechanisms, none are directly aimed at the forestry sector. Access to finance can therefore be defined as medium (neutral) factor in relation to forest industry investments.

2.3 Logistic infrastructure and transportation costs

During 2010-2018, the average cost of truck transportation in the US has increased from 1.10 USD to 1.85 USD per mile. Reasons behind the increased trucking cost are rise of driver pay and cost of diesel fuel.

General state of US's infrastructure is not great. The condition of roads, bridges and ports were one of the themes also in the Presidential Election Campaign of Donald Trump. The plans to improve the nation's infrastructure have received critic for relying on state and local funding, as well as for facing a lack of skilled construction workers. However, infrastructure in the state of Oregon is one of the best ones in the US. Even though need of maintenance exists, the road network condition and energy infrastructure are considered one of the nation's best. Oregon has 73 544 miles of public roads, of which 11% are estimated to be in poor condition. From the 8 118 bridges in Oregon, 5.3% of them are in need of maintenance.

Oregon's forests are mostly located in mountainous areas, which makes construction of new forest roads very expensive. However, most of the private forest area has had cuttings already in the past, which means that forest roads have already been constructed. When "second-growth" forests are cut again, maintenance operations are often done to the forest road network. Winters in Oregon are wet, which makes the mountainous roads susceptible to landslides. Mountainous forest roads are built for well-turning timber trucks, which makes them sometimes unpassable for chip trucks. Road network in general is not a limiting factor for harvests.

Business Oregon has a *Port Planning & Marketing Fund* program, which helps the ports of Oregon to fund planning and marketing activities. Wood product industry is highlighted as one of the important sectors the port's development has to take into account.

Oregon's economy is closely tied to the abundance of natural resources located in the state. As the state has expanded its agriculture and forestry economies, transit networks have attempted to keep pace. Oregon relies heavily on trucking to transport goods (74%) in and out of the state. Oregon is nationally twenty-first in overall highway performance in the *Annual Highway Report on the Performance of State Highway Systems*. Pertinent to the rural forestry operations, Oregon is ranked twentieth in percent of Rural Other Principal Arterials (ROPA) in poor condition (0.88%). Although overall quality of roads appears to give Oregon's logging transport system a comparative advantage, the state suffers from growing population stresses on road conditions in central Oregon—where 42% of pavement is only in fair or poor condition. Requirements for seismic resiliency, especially along the coast, have increased infrastructure costs and delayed maintenance.

Oregon's forests are split 64% public and 34% private. As such, Oregon also leads nationally with the most amount of National Forest roads at 70 952 miles. Under the National Forest Roads



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and Trails acts, federal forest roads are constructed and maintained to permit maximum economy in harvesting timber. This provides forestry operations in Oregon a large offset in overall transport costs as private road construction is only needed for first mile operations. Using Annual Highway Construction costs, Oregon ranks as the twenty-sixth most expensive state for road construction (26 395 USD per lane mile). A study in Southwest Oregon found a 5.5% total cost for construction and improvement of forest roads for a 724.5k gross value project. Average transit distances from timber source to mill are less than 100 miles. Oregon's road systems have a total gross weight allowed between 80 001 and 105 500 lb depending on double- and triple-trailer combinations. There is little highway redundancy, which increases likelihoods of supply chain disruptions during the winter and other extreme weather events, or during times of increased summer traffic. Additionally, rural forestry trucking operations have been unable to secure return cargo, leading to 'deadhead' miles that increase overall costs.

Overall forestry operations have a heavy reliance on highway and railroad systems, with a medium dependence on marine transit, while specifically wood and paper manufacturing also have a high dependence on marine transit. Multimodal transport is low for the forestry sector, however, when utilized the Oregon rail network can provide cost effective transport throughout the state and nation. Oregon's 2 400 miles of track, split evenly between two class I railroads and class III short line railroads connects the entire network to the national rail system. The rail system is concentrated in the West, where the forest products industry relies on significant freight volumes. Inadequate maintenance and insufficient capacity on some short line railroads has negatively affected shippers. The 23 marine ports (5 deep-draft and 4 shallow-draft) are connected to the rail and highway system allowing for transport from Northern Oregon to the West coast and Asia. Transit between freight corridors to the Columbia river in the North that connects to the Pacific Ocean suffers from congestion, leading to inefficient transit to the coast.

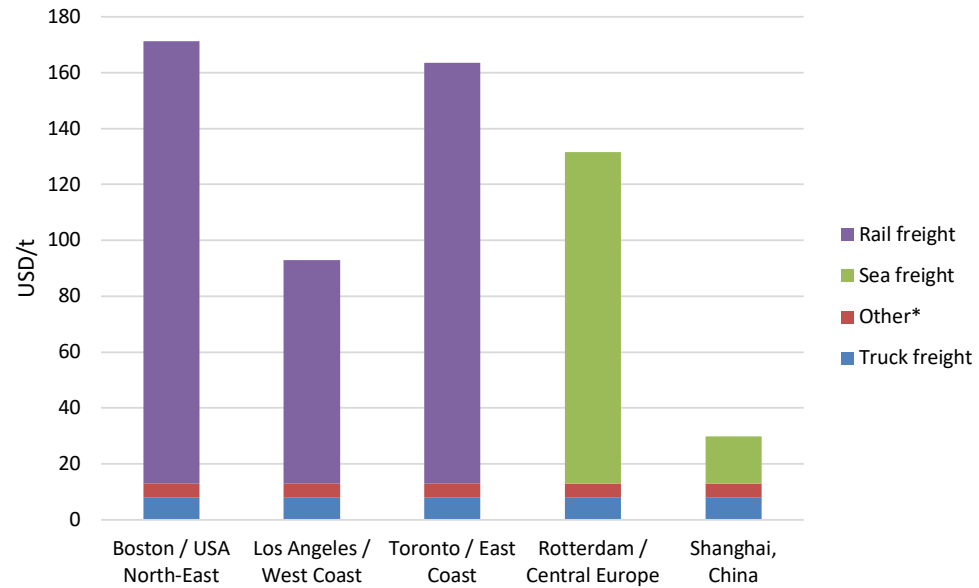
Pulp, paper or allied products have a Mountain-Pacific freight carload average rate of 5 267 USD below 180% RVC and an average of 6 465 USD above 180% RVC. Chemical or allied products have a Mountain-Pacific freight carload average rate of 3 585 USD below 180% RVC and an average of 5 951 USD above 180% RVC.

Oregon has high transportation costs across the country, but also the freight carload rate along the west coast to Los Angeles is relatively high (Figure 2.1). Sea freight is high to Europe and consequently the sea shipping activity to Europe is small. However, Oregon does have a very attractive transportation costs to China.



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Figure 2.1 Transportation costs



(*) Port costs, unloading and loading.



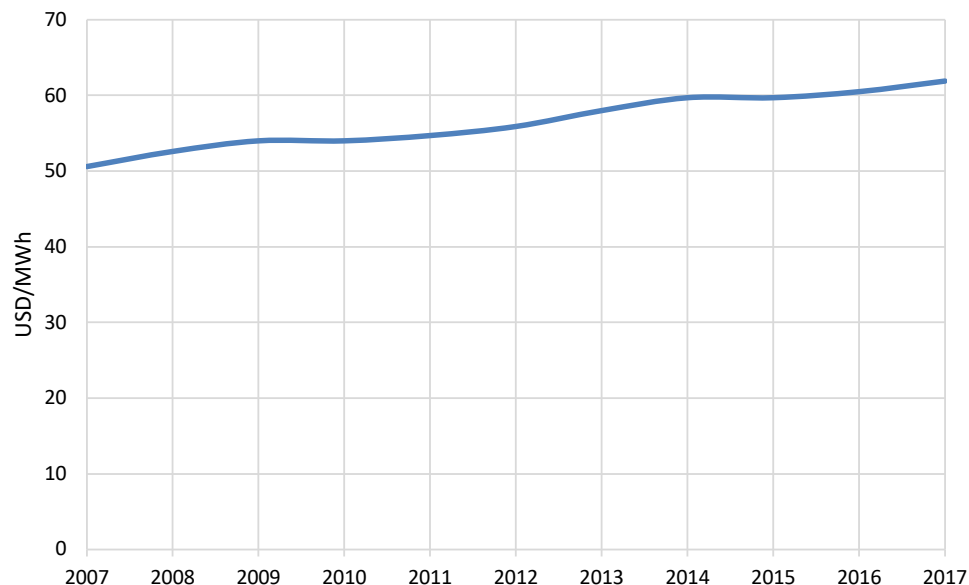
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3. TIER 3 – HIGH LEVEL ANALYSIS

3.1 Energy

Energy prices for industrial users in Oregon are 11% cheaper than US average industrial prices. In 2015, Oregon produced more energy than it consumed. Total electricity consumed in Oregon was approximately 48 million MWh. Largest shares of consumed energy were hydropower (40.5%) and coal (31.9%). Biomass' share of energy consumption was only 0.4%. Oregon has relatively large number of waterways, which makes Oregon a major producer of hydropower. Nonetheless, electricity prices in Oregon have risen (Figure 3.1). To maintain energy production resiliency and stability, Oregon Department of Energy is steering development to focus on distributed energy production, marine energy and energy storage.

Figure 3.1 Electricity price for industries in Oregon



Source: US Energy Information Administration

3.2 Key supplies

There are many wood product equipment manufacturers and suppliers of harvesting equipment in Oregon and southern Washington state. Therefore, the availability of parts and supplies locally is excellent. The freight cost for supplies is generally low in part due to lack of state sales tax. The same is true for the availability of maintenance services.

3.3 R&D

Oregon State University and Portland State University have been researching wood constructing using CLT. Some of the research subjects have been to test fire and seismic durability of CLT and to compare them to requirements of building code regulations.

TallWood Design Institute located in Oregon brings together forestry and engineering from Oregon State University and design from University of Oregon. The institute focuses on research of structural wood products and is a significant accelerator of wood constructing. The TallWood Design Institute also does direct co-operation with manufacturers to develop and operationalize new products.



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Oregon Innovation Council provides R&D support and contacts to potential investors for new companies, but also advises existing companies in innovation of new products. The Oregon Innovation Council has three Signature Research Centers, which specialize to connect universities with private sector and to commercialize new innovations.

In the private sector, the R&D spending has been fairly limited in Oregon, as Oregon based companies tend to be smaller or medium size, privately held companies, with typically a limited number of mills. The most notable recent results of private R&D include the introduction of a mass plywood panel product by Freres Lumber and the adoption of a soy based, formaldehyde free hardwood plywood resin by Columbia Forest Products.

Annex 7

US, Georgia



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FOR/Maine

Global Market Analysis and Benchmarking Study – United States (Southeast, Georgia)

Final Report

Helsinki, Finland
June 29, 2018

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ID 122622



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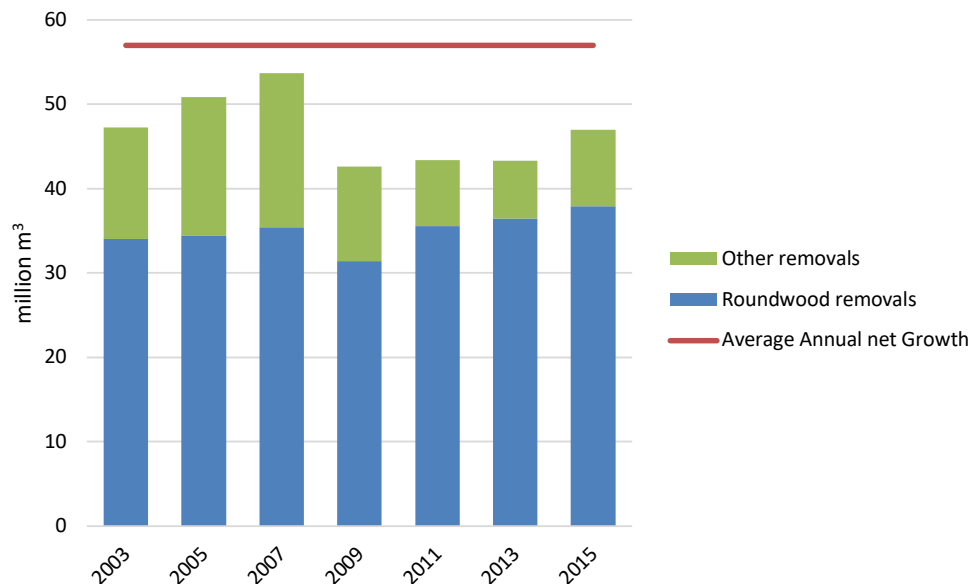
1. TIER 1 – DETAILED ANALYSIS

1.1 Raw material

1.1.1 Harvest levels

Georgia has the highest pure timber harvest levels in the US. Removal of roundwood products totalled 37.9 million m³ in 2015 (Figure 1.1). Some 86% or 32.7 million m³ was softwood. Loblolly pine (*Pinus taeda*) is the predominant species, followed by longleaf and slash pines (*Pinus palustris* and *Pinus elliottii*). Roundwood harvest levels have started to recover from the low of 2009, following the financial crisis, but have yet to reach the peak of 40.8 million m³ seen in 1995. 98% of forests are not specifically reserved by law and are potentially available for timber production, more than any other US state.

Figure 1.1 Average annual net growth and harvest level in Georgia, 2003-2015



Source: USDA¹

Some 54% of softwood roundwood removals is pulpwood, which also includes logs destined for composite panels and a small volume of other industrial roundwood. Saw logs, including veneer and poles, account for 37% of softwood removals, with bioenergy accounting for 9% of the roundwood requirement. See Table 1.1 for a detailed breakdown of number of mills and roundwood requirement by sector.

¹ USDA data were in cubic feet, conversion used: 1m³=35.3147 cubic feet



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Table 1.1 Number of Mills and Roundwood Requirement by Sector (2015)

Sector	Number of Mills	Roundwood Requirement (million cubic meters)	%
Saw mills	98	10.2	31%
Veneer mills	5	1.2	4%
Composite panels mills	4	2.4	7%
Pole, posts & pilings mills	18	0.8	2%
Pulp mills	12	14.9	46%
Bioenergy facilities	24	2.8	9%
Other industrial products e.g. firewood, mulch	37	0.4	1%
TOTAL	198	32.7	100%

Source: USDA

Current harvesting of industrial roundwood indicates a tight wood supply in Georgia. Across all assortments, 86% of roundwood harvested was processed within the state. 5.2 million m³ of roundwood was exported to other states and 5.6 million m³ was imported, making Georgia a net importer of roundwood.

The net annual growth of forests in Georgia is some 56.9 million m³. With harvesting of an average of 46.9 million m³ per annum. There appears to be little scope for significant expansion of wood production.

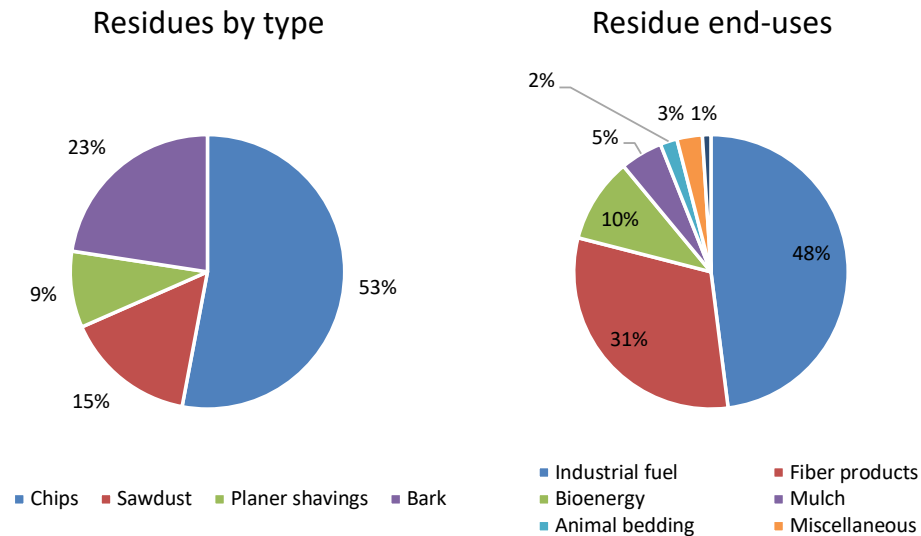
1.1.2 By-products

The processing industry in Georgia produced 12.5 million m³ of by-products in 2015, mostly consisting of bark and coarse residues. Around 78% of coarse residues are used to make fiber products such as particle board, 84% of bark is used for industrial fuel. The utilization of by-products is extremely efficient, only 1% of by-products are not used in any form. Without expansion of the primary processing industries, by-products are not a readily available source of raw material for the products being considered in this assignment, without recourse to price competition.



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Figure 1.2 Primary mill residue by type and end-uses of residues (2015)



Source: USDA

1.1.3 Forest ownership

The majority of Georgia's 10.0 million hectares (24.8 million acres) is owned by private non-industrial landowners. Georgia has the most commercial, privately owned timberland of all the US states. The rapidly ageing population of private landowners will likely see a transfer of ownership in the next 10 to 15 years. It might be speculated that corporate buyers will purchase timberland brought to market following the passing of many private owners.

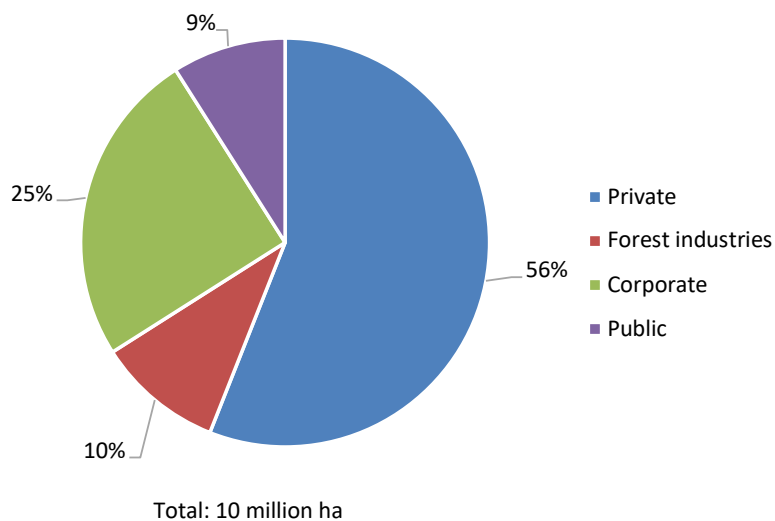
During the 1990s and 2000s, the forest industry divested significant areas of forestry land, such that they now own around a quarter of their previous area. Most was sold to corporate entities, including Real Estate Investment Trusts (REITs) and Timberland Investment Managers (TIMOs), who increased their forest ownership, from relatively low levels to become the second largest owner. Some sales of land from private individuals to corporate investors also occurred over this period. Public land ownership has been stable since the 1950s.

As the majority of timberland is owned by private individuals or corporate investors, timber price is the major determinant of harvest levels.



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Figure 1.3 Forest Ownership Structure



Source: Georgia Forestry Commission

1.1.4 Delivered wood cost

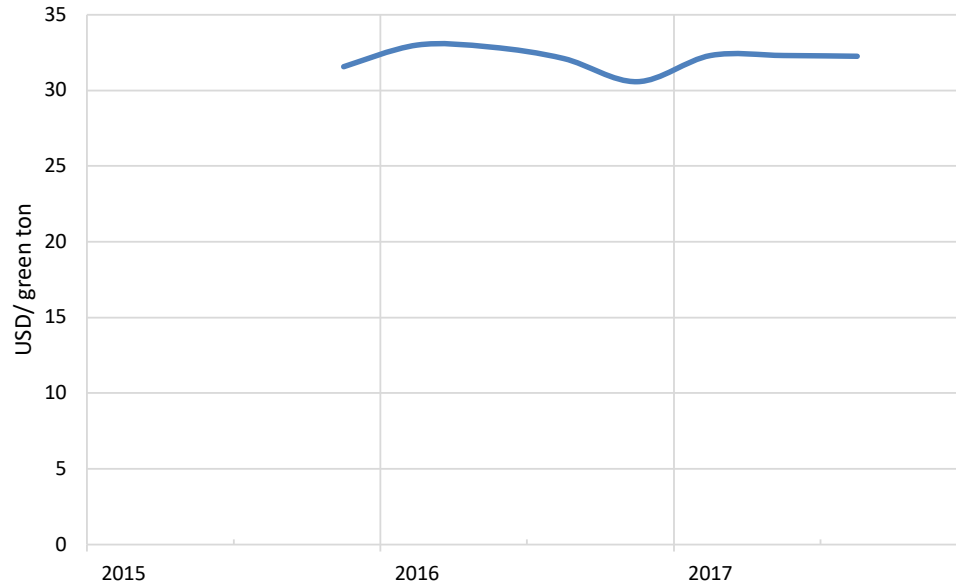
The pulpwood price information from Georgia is limited. Only recent prices for pine pulpwood are available. The limited data indicates that the current pine pulpwood price is about 32 to 33 USD/ per green ton (Figure 1.4), which is very low in comparison to many other regions in US and below the levels of US South.

Softwood roundwood prices in the US South recovered strongly in the period following the financial crises as demand picked up. Prices softened throughout 2016 before flattening out in early 2017 and remain flat ever since. The fall occurred due to plentiful supplies of softwood fiber as lumber production increased in the southern states causing a rise in small roundwood not directed to sawmills and higher volumes of sawmill residues. The South now has some of the lowest fiber costs in the US, which are competitive globally (Figure 1.5).



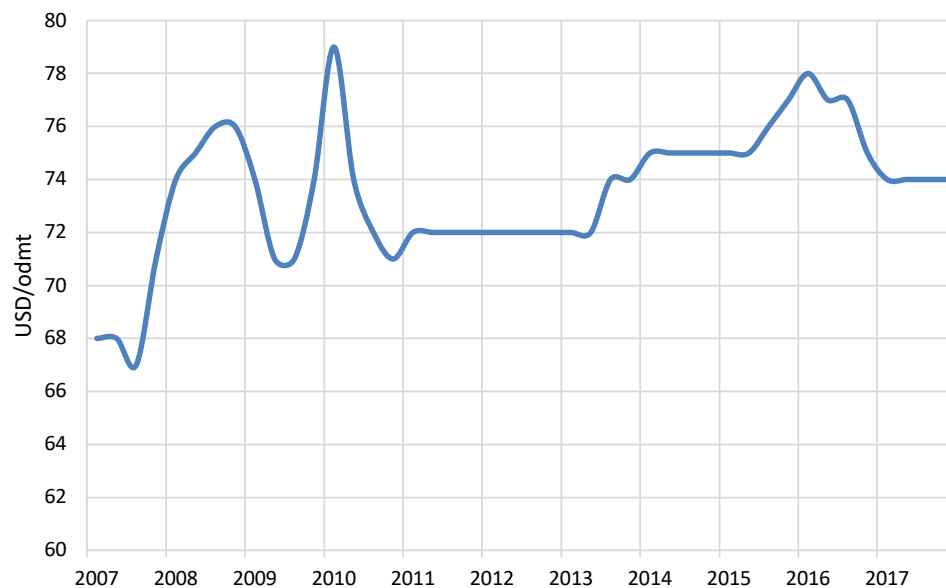
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Figure 1.4 Georgia quarterly pine pulpwood cost, 2015-Q4 to 2017-Q3



Source: Georgia Forestry Statistics.

Figure 1.5 US South conifer wood chip cost, 2007 to 2017



Source: Wood Resources Quarterly

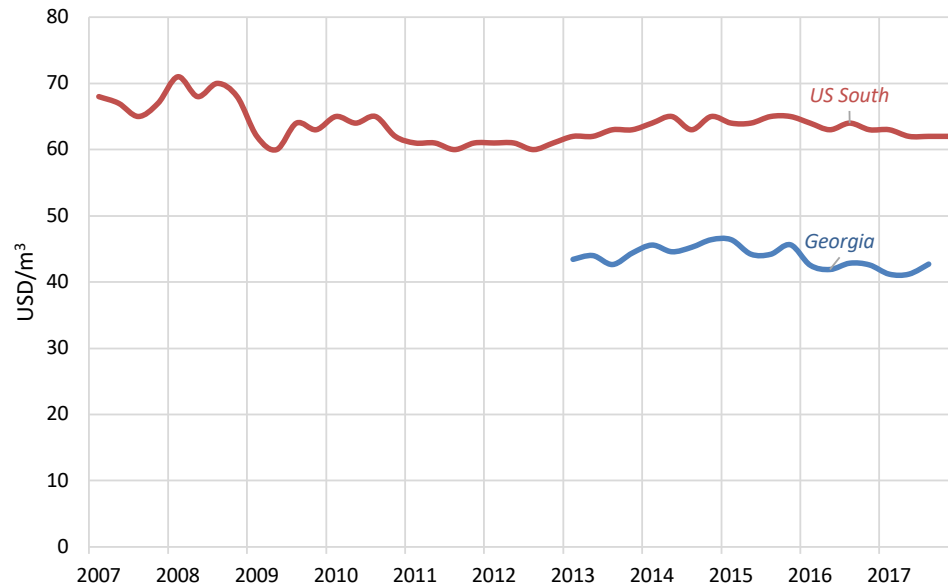
Softwood saw log prices fell dramatically in the US South in the aftermath of the financial crisis as housing starts, the main driver of lumber demand, reached historic lows. From 2012 to 2016 prices started to recover as housing start figures began to rise (Figure 1.6). The pine sawlog



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price has been lower in Georgia in comparison to other states in US South. The export of sawlogs in recent years, predominantly to China at strong price levels, also caused heat in the domestic market. As China's demand for logs slowed in 2015, export prices cooled correspondingly, and US South saw log prices decline between 2015 to 2017.

Figure 1.6 Georgia pine saw log and US South softwood sawlog prices 2007 to 2017



Source: Georgia Forestry Statistics and Wood Resources Quarterly.

1.1.5 Wood procurement practice

With the majority of timberland owned by the private sector, the typical method of sale is stumpage i.e. trees are sold standing at an agreed price and the purchaser is then responsible for harvesting and marketing the timber. The agreed price can be either on a lump sum or price per ton basis. Harvesting and merchanting contractors will purchase standing timber and sell the harvested log assortments to a variety of industrial clients. Small roundwood will be sold to pulp and wood-based panels mills. Large roundwood will be sold to sawmills and plywood/veneer mills.

The depth and scale of the forest industry in Georgia means that there is demand for all log assortments.

1.2 Workforce

1.2.1 Demographic comparisons

The total population of Georgia is 10.4 million, with 1.8 million (17%) living in rural communities and 8.6 million (83%) in urban environments (Table 1.2). The unemployment rate in May 2018 was 13.9%, indicating that there is an available pool of labor for industries seeking to establish manufacturing facilities in the state. Unemployment has shown a declining trend since the high in 2009 of 18.3% (National Statistics Office of Georgia). The distribution by age is shown in Figure 1.7.



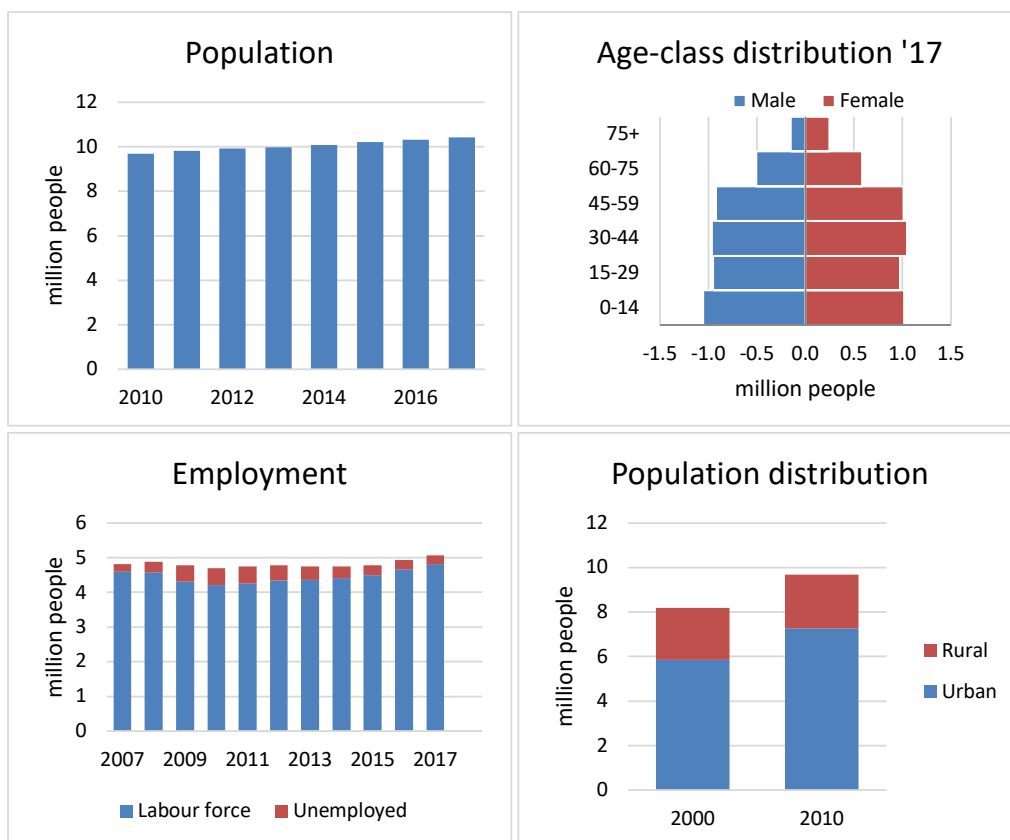
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Table 1.2 Key demographic indicators

Indicator	Current situation
Total population (Jan. 2018)	10 545 140
Population growth rate (2017)	1.1%
Population urbanization, rural vs urban (2010)	24.9% vs 76.1%
Unemployment rate (2017)	4.7%
Level of education ^(a) (2016)	55.90%

^a Share of college or equivalent degree in all population aged 25 and above

Figure 1.7 Historical demographic development



Source: World Population Review, Suburban Stats, Bureau of Labor Statistics, US Census Bureau

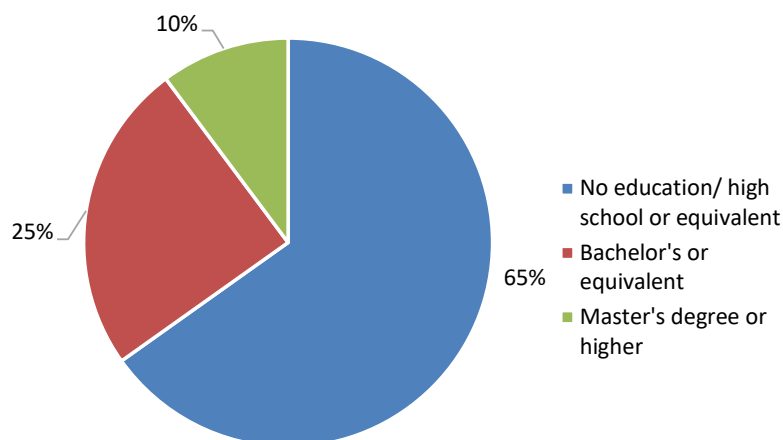
1.2.2 Level of education in each competitor country and the skill levels required

Some 86% of the population is a high school graduate or higher, with 29% having a bachelor's degree or higher. These rates are comparable to the US as a whole, suggesting there will be sufficiently qualified persons available for both blue and white-collar jobs, including the higher levels of education required for higher value-added manufacturing products.



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Figure 1.8 Educational attainment in Georgia, 2017



Source: Statistical Atlas

1.2.3 Typical labor costs

Forestry in the state of Georgia supports 159 538 jobs, with a combined payroll of USD 6.8 billion, making the annual average salary in the forestry sector USD 42 400. The pulp and paper industry pay the highest salaries. Representative salaries for forestry and pulp and paper sector workers are shown in Table 1.3 and average annual salaries for the whole pulp and paper and wood products industries along with social costs of labor are shown in Figure 1.9.

Table 1.3 Representative labor costs in Georgia (2017)

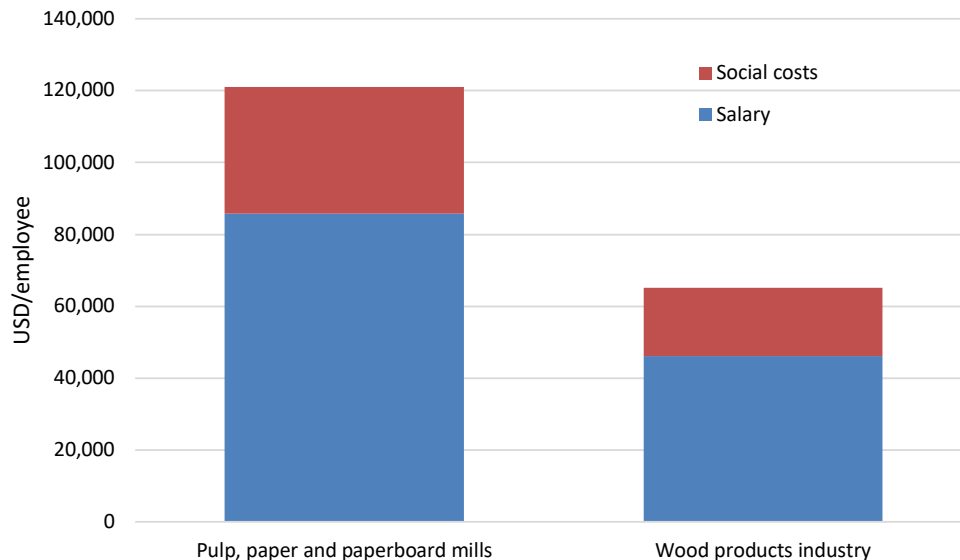
Job description	Mean Annual Salary (USD)
Pulp and Paper Sector:	
Operations Manager at Georgia-Pacific	81 500
Project Engineer at Georgia-Pacific	74 000
Process Engineer at Georgia-Pacific	72 500
Forestry Workers:	
First-Line Supervisor of Forestry Workers	48 000
Tree Fallers	42 500
Logging Equipment Operators	36 500
Log Graders and Scalers	36 000
Logging Workers, All Other	38 000

Source: US Dept. of Labor- Bureau of Labor Statistics, Georgia-Pacific Corporation



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Figure 1.9 Labor costs in P&P and wood product manufacturing industry, 2017



Source: Bureau of Labor Statistics

1.3 Regulatory climate

Raw material supply

There are relatively few regulations on timber harvesting in Georgia. Most notably, the state Best Management Practices (BMP) manual provides guidance to reduce the impact from harvesting activities on water quality and other issues such as erosion.

Environmental regulations for manufacturing

Georgia's Environmental Protection Department (EPD) has the authority to administer the NPDES permitting under the Clean Water Act. Recent controversy over the permitting of the Rayonier pulp mill called into question the stringency of a recent revision to Georgia's water quality standards, which some argue allow more water pollution from pulp mills. Specific to pulp mills, the EPD regulates air pollution from new and existing kraft pulp mills in line with the Clean Air Act.

Market access

Relevant to the production of LVL and MDF, the Georgia General Assembly passed House Bill 255 in 2015, which changed the standards regarding publicly funded buildings. The new law allows for the use of wood products from all forest certification programs and not just FSC, which are required by LEED green building standards.

Georgia adheres to the following codes:

- International Building Code (IBC), 2012 Edition
- International Residential Code (IRC), 2012 Edition
- International Energy Conservation Code (IECC), 2009 Edition

1.4 Taxation

Georgia has one of the highest corporate tax rates in North America, at 27%, comprising of the Federal Corporate Tax Rate (21%) and the State Corporate Tax Rate (6%). The State tax only



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applies to the portion of income that is earned in Georgia, but the state is currently transitioning to a sales-only tax rate. Georgia offers programs and incentives to reduce or eliminate both the income tax rate as well as the sales tax for up to 10 years. These programs include for example R&D Credits, Mega Project Tax Credits, Investment Tax Credits, Job Tax Credit and Quality Job Tax Credit and The Georgia Conservation Tax Credit. Georgia companies that increase imports or exports through a Georgia port by at least 10% may qualify for either a USD 1 250 bonus added to the job tax credit or an adjustment to the investment tax credit. Manufacturers can also be exempt from paying sales tax on electricity, and biomass materials used for energy production are exempt from the sales tax. The sales tax in Georgia is 4%.

The state offers a Work Opportunity Tax Credit, which reduces an employer's federal income tax liability when a company hires individuals who have consistently faced significant barriers to employment, such as veterans. The most frequently paid credit is USD 2 400 for each adult new hire, but the amount varies between USD 1 200 and USD 9 600.

Georgia has a fuel tax of 0.549 cents per gallon for diesel and 0.457 for gas, including both state and federal level taxes. There is no Carbon tax in the USA on a federal level and no state level tax in Georgia.

Taxation of Timber Sales

Georgia has a State tax in addition to the Federal tax on timber sales (both standing and cut timber). In the USA, sales from cut timber are taxed as ordinary income, while the sale of standing timber is taxed as capital gain. Georgia taxes timber sales at 100% of the fair market value and prices vary by county. Timber is taxed only once during the period of its growth, and this is at the time of harvest or sale. The tax rate for the sales of standing timber ranges between 0-20%. The standing timber sales by a woodland business may be taxed as long-term capital gains; if the timber is owned for over a year before sale, the sale is eligible for long-term capital gain, which is taxed at lower tax rates than ordinary income. This includes both lump-sum and pay-as-cut standing timber sales. The sales of cut timber are taxed at a rate varying between 10-39.6%.

Costs may be deducted from wood land held as an investment. However, they are only deductible to the extent that such costs exceed 2% of the adjusted gross income. Property taxes are fully deductible and interests on loans are deductible up to the net investment income in a year, with excess carried forward indefinitely. Depreciation on assets used for timber held to produce income, such as logging equipment, tractors, computers, cars, bridges, fences, etc., are eligible for deductions. It is possible to deduct casualty losses for timber held for business or investment purposes, as well as qualified restoration costs.

Property Tax

In the USA property tax for (forest) land is applied on a state level. In Georgia, an *ad valorem* tax is applied to property, which values the land as it is currently being used. The tax rate is 40% of Fair Market Value of the property. Forest property owners may also opt for Preferential Assessment, which calculates the tax in two steps: 1) 75% of the Fair Market Value 2) results of step one multiplied by 40%, similar to the regular calculation. Overall, landowners participating in the Preferential Assessment Program realize a benefit from the 25% savings. Forest owners can also reduce their property tax by up to 25% in Georgia by adopting a sustainable forest management plan. The Georgia Forest Land Protection Act (2008) provides an *ad valorem* tax exemption for property primarily used for the commercial production of trees, timber of other wood fibre products and excludes the entire value of any residence located on the property.



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2. TIER 2 – GENERAL ANALYSIS

2.1.1 Policies

Georgia does not have a Renewable Energy Standard, nor does it seem to have any GHG emissions targets. It requires biodiesel, produced or sold in the state, to be blended with petroleum diesel according to the ASTM specification. Businesses that manufacture alternative energy products for use in battery, biofuel, and electric vehicle enterprises may claim annual tax credit for five years.

In terms of forest programs, Georgia offers federal programs, such as the Forest Legacy Program, Environmental Quality Incentives Program, and the Working Forest Conservation Easement, which focus on protecting environmental areas and on removing land owners' rights for commercial development. As part of the Federal Forest Stewardship Program, Georgia Forestry Commission assists forest land owners by selling them tree seedlings that are adapted to Georgia's environment as well as assisting them in creating stewardship plans. Non-industry landowners may partake in a cost-sharing incentive program to control the southern pine beetle as well as can receive other services, such as financial assistance to reforest after a natural disaster damaged the forest.

The forest industry does not benefit directly from Georgia's forest programs, but may benefit indirectly from Georgia's programs aimed at businesses. For instance, Georgia offers the State Small Business Credit Initiative, which is funded with USD 1.5 billion to strengthen state lending programs that support small businesses and manufacturers. Moreover, manufacturers can receive advice on best business practices and technology-driven economic development through the Enterprise Innovation Institute, which had earmarked USD 66 million in 2018 budget. Other programs are The Georgia Small Business Credit Guaranty (SBCG) Program, which provides a 50% credit guaranty to the lender on loans up to USD 400 000, with a USD 200 000 maximum amount of the credit guaranty. The Georgia Loan Participation Program (GA LPP) shares the risks of lending money and enables lenders to provide more loans. A loan may range from USD 100 000 to USD 5 million, with a maximum of USD 20 million. In addition, forestry companies may profit from other program aimed winning over businesses, when competing with other states. For instance, under the Economic Development, Growth and Expansion (EDGE) Fund, businesses may receive financial assistance to move to or expand in Georgia.

Overall the forest industry may benefit from Georgia's incentives aimed at offering guaranteed loans, helping companies "consider" (re)locating to Georgia, and providing businesses with assistance programs. However, as none of these policies are focused on the forestry sector, and current forest policies do not go above and beyond federal policies or similar state policies on sustainable forest management, the policy environment, can therefore be considered low.

2.1.2 Access to financing

The state of Georgia's fiscal solvency is above average, ranked twenty-second by the Mercatus Center. While Georgia was hit hard by the recession, it has achieved substantial fiscal repair—as the state has between 1.86 and 2.96 times the cash needed to cover short-term obligations. Apart from long-run solvency and cash solvency, Georgia is under the national average in all standard metrics of fiscal health. Given these metrics, Georgia's credit rating is Aaa, which indicates a very low credit risk and low interest rate.

Georgia is ranked as the sixth best state for business, largely due to their improved economy and pro-business climate. Numerous multinational corporations are headquartered in Georgia, including 17 Fortune 500 companies that have their global headquarters in the state. Business opportunities are largely due to the state's robust infrastructure, low-cost workforce, and tax incentives. For instance, Georgia offers the State Small Business Credit Initiative, which is funded with USD 1.5 billion to strengthen state lending programs that support small businesses and manufacturers. In addition, Georgia offers favorable loan programs to attract businesses, such as the Georgia Small Business Credit Guaranty (SBCG) Program, which provides a 50%



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credit guaranty to the lender on loans up to USD 400 000, with a USD 200 000 maximum amount of the credit guaranty. Moreover, the Georgia Loan Participation Program (GA LPP) shares the risks of lending money and enables lenders to provide more loans. A loan may range from USD 100 000 to USD 5 million, with a maximum of USD 20 million. In sum, the tax environment in Georgia is designed to incentivize manufacturing, technology, and export-based businesses.

Fortune 500 companies and other corporations operating in the Atlanta metro and through Georgia's ports continue to draw outside investments and capital. Venture capital investments peaked in 2017 with nearly USD 1.7 billion raised, mainly in the emerging technology and startup markets. This placed Georgia as the sixth United States market for invested venture capital. From 2016 to 2017, Georgia's invested venture capital grew by 113 percent to reach USD 1.68 billion, which is significantly greater than the 7% total U.S. venture capital growth during this same period. While this wave of venture capital and angel investing has not yet made significant contributions to the forestry sector, there are funds opening operations in the region. Georgia's share of the U.S. venture capital market was 2.3%. The Internet and Software sectors led the venture capital investment in Georgia, accounting for 64 of the total 79 deals in 2017 and 89 percent of the dollars. Start-up VC financing is limited. Seed/Angel/Round A funding only represented 6.5% of total Georgia venture capital investment in 2017. In 2017, the bulk of seed/early stage investment occurred within the financial services, Internet, and mobile sectors.

Traditional capital investments for the forest products sector have also risen in recent years, Georgia-Pacific announced a USD 135 million dimensional-lumber mill in Warrenton near Augusta set for 2019, and Canfor announced it will begin construction on a USD 120 million sawmill in Washington near Athens. These investments are consistent with the growth of the sector since 2000—Georgia-Pacific has invested USD 1.9 billion in capital and acquisitions in Georgia since 2006; Interfor acquired seven mills since 2013, investing nearly USD 500 million; West Fraser bought softwood lumber mills across the state for USD 430 million; and DS Smith purchased an 80% stake of Interstate Resources (including its assets in Georgia) for USD 920 million. Given Georgia's numerous incentives, stable state economy, and high level of venture/traditional capital investments, the environment can be considered favorable to the forestry sector.

2.1.3 Logistic infrastructure and transportation costs

As a South-eastern coastal state, Georgia is uniquely positioned to take advantage of international forest products markets. With over eighty percent of forests as privately owned, commercial logging has remained a reliable source of economic activity for the state. 75% of goods are shipped within Georgia by trucks, 24% by rail, and the remaining less than one percent by in-state water and air transport. Georgia is nationally eighteenth in overall highway performance and in seventh for ROPA in poor condition (0.40%). Although the overall quality and reach of the road system in Georgia is significantly higher, urban congestion impedes the flow of goods through the urban "inland port" of Atlanta. Due to growing commercial and population stresses to the roads, 49% of pavement is considered poor or fair condition. Furthermore, 25% of total freight tons in Georgia are considered through trips—taxing the road system with marginal economic benefits. Georgia law has an exception for the forestry industry on hauling total gross weight (36 000 to 41 000 kg or 79 366 to 90 390 lb).

Due to the high private ownership of forest lands in Georgia, there are demands for forest road construction to access timber sites. Georgia's extensive road network and interstate system (9th largest in the United States) partially offsets construction and maintenance demands as forest tracks are generally within miles of federally or state funded roads. Using Annual Highway Construction costs, Georgia ranks as the twenty-seventh most expensive state for road construction (USD 25 538 per lane mile). Ecosystem conditions, however, can complicate harvesting older hardwood stands due to floodplains and swamps that may limit seasonal access. Railway transit plays a much larger role than most states, Atlanta is the hub of Southeast rail operations for class I railroads in the Eastern half of the United States (CSX and Norfolk Southern). While the rail system is among the most equipped and well connected, most short



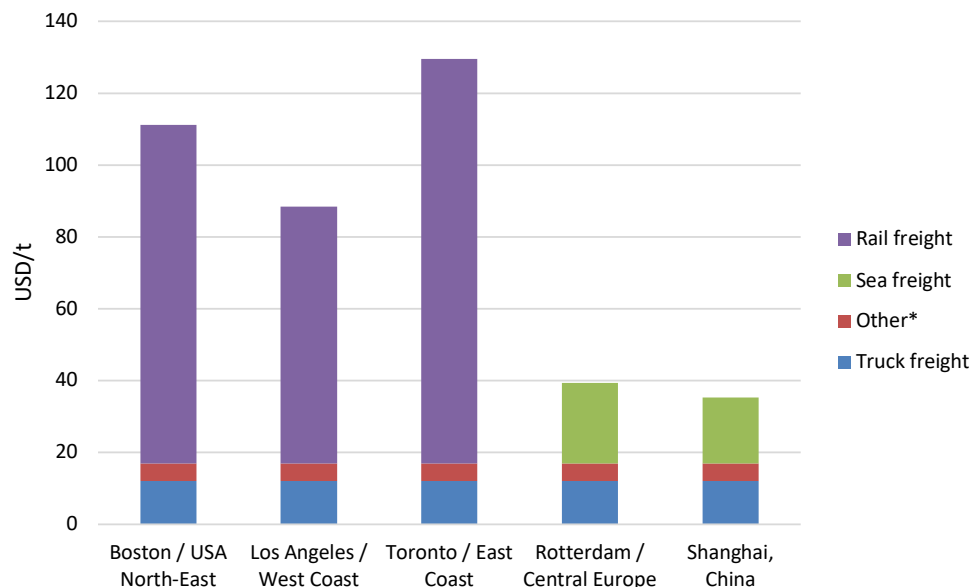
line rails are not able to handle the interline standard rail cars (286 000 lb) or use double stacked configurations due to height constraints. It is estimated that USD 4-6 billion is required to fully upgrade the railways in Georgia to meet increasing demands over the next thirty years. The first step in improving rail connectivity is the Crescent Corridor, slated for completion in 2020, which connects Memphis and New Orleans through Atlanta to New York City. It is estimated that this will remove USD 575 million in traffic congestion annually, remove more than 1.3 million long-haul trucks annually, and vastly improve the intermodal connections to ports in along the East coast including Georgia.

Georgia's coast is a critical center of international trade with two major ports: Savannah and Brunswick. Savannah is home to the Garden City Terminal, the fourth-largest container port in the United States and largest single-terminal in North America. Wood pulp (178,654 TEUS) and paper/paperboard (144 710 TEUS) are respectively the top and third highest exported commodity from Savannah. Over 75% of Georgia's international bound freight moves through ports in Georgia, with the remaining 25% split evenly between Charleston, South Carolina and a series of other port facilities. While Georgia's ports are among the fastest growing in the United States, they have not yet been modified to the Post-Panamax ship size—which would require dredging the Savannah River from 42 to 48 feet. Without this modification, Georgia's ports could lose their comparative advantage to other deep-water ports in North America.

Pulp, paper or allied products have a Southeast freight carload average rate of USD 3 750 below 180% RVC and an average of USD 5 596 above 180% RVC. Chemical or allied products have a Southeast freight carload average rate of USD 2 476 below 180% RVC and an average of USD 5 249 above 180% RVC.

The rail freight rates in U.S. are high from Georgia to the selected target markets in North America. On the other hand, the transportation costs to China and Europe are competitive (Figure 2.1).

Figure 2.1 Transportation costs



(*) Port costs, unloading and loading.



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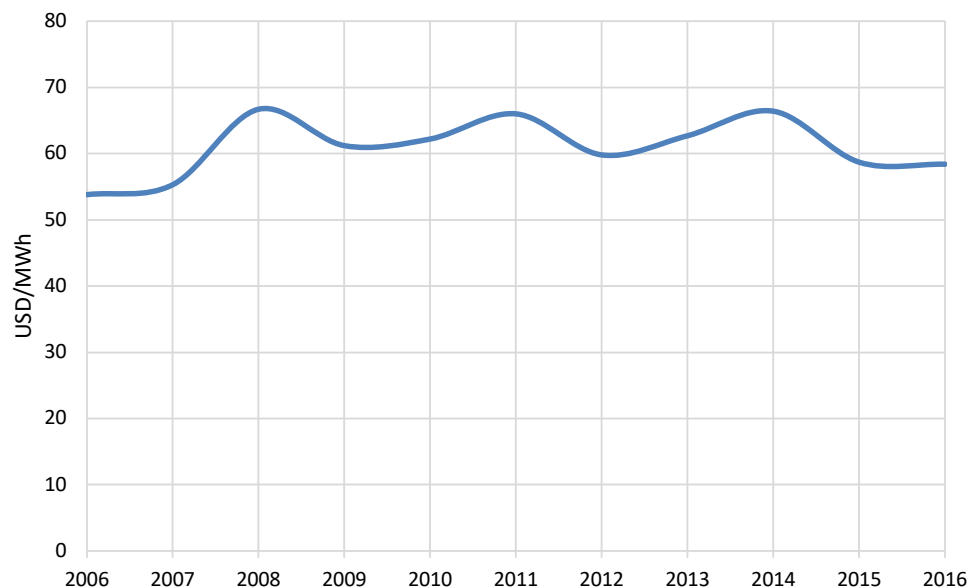
3. TIER 3 – HIGH LEVEL ANALYSIS

3.1.1 Energy

The State of Georgia is heavily reliant on domestic and foreign natural gas, coal and motor gasoline imported from other states and countries, as Georgia itself has no notable fossil fuel resources. The transport industry consumes nearly all the motor gasoline, with less than 5% of householders relying on some form of petroleum for heating (U.S. Energy information administration).

Electricity generation is predominantly from natural gas, accounting for 40% of generation, nuclear generation accounts for approximately 25% of net generation and coal under 30%. Renewable sources provide the remaining portion of electricity generation, mainly from biomass and hydro (U.S. Energy Information Administration). Georgia is the first state in 30 years to receive approval for two new nuclear reactors, which are expected to begin generation in 2021 and 2022. Currently nearly all wood pellets produced in Georgia are exported to Europe to be used for electricity generation. Figure 3.1 presents the average cost of electricity for industrial consumers in Georgia. The general trend over the ten years to 2016 has been for marginal price rises only, however there have been cyclical peaks that occur every three to four years.

Figure 3.1 Average electricity price for industrial consumers



Source: U.S. Energy Information Administration

3.1.2 Key supplies

Georgia is the number one forestry state in the US, topping the league tables for harvest volumes, private commercial timberland and exports of pulp, paper, paperboard, fuelwood and wood pellets. The scale of the forest industry has led to a large network of supporting activities developing alongside it. Mill numbers and sectors were presented earlier in Table 1.1.

Numerous machinery producers for the of pulp and paper sector and other forest products have locations and branches in Georgia, or in neighbouring states, enabling easy acquisition and maintenance of crucial manufacturing equipment and components. These manufacturers



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include Valmet Inc., Dieffenbacher, Metso Automation and Siemens Process Industries and Drives amongst others.

Manufacturing of products such as LVL and MDF, which require binding agents in their manufacturing process, can also be easily supplied. Georgia-Pacific has its Chemicals division headquartered in Atlanta along with its corporate headquarters. In addition, the company has another Chemicals division facility located within the state.

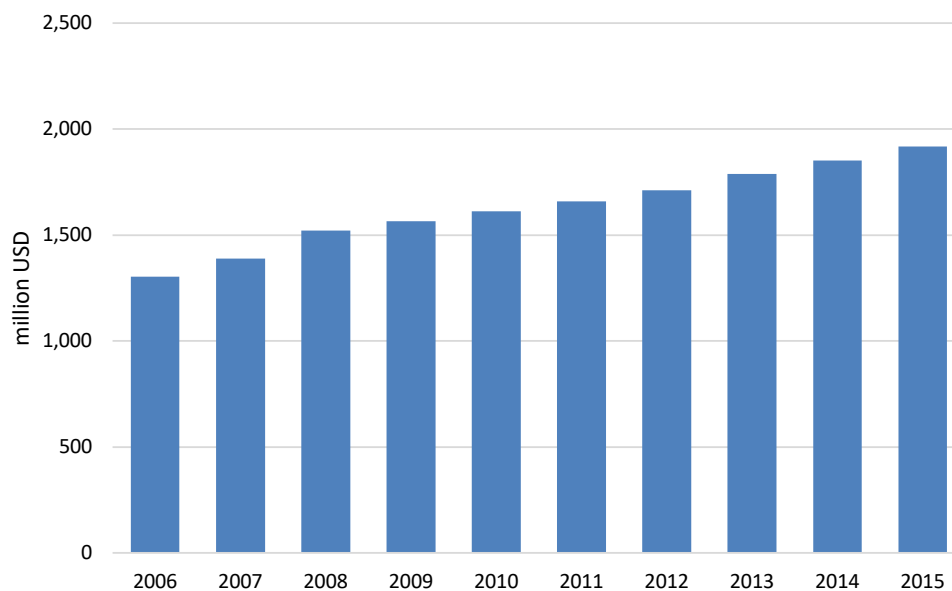
3.1.3 R&D

Compared to other US states, Georgia has a good position in forestry and forest products R&D. There are two major universities in the state with forestry and forest products related programmes; the Georgia Institute of Technology (Georgia Tech) and the University of Georgia. Georgia Tech's Renewable Bioproducts Institute (RIB) is focused on advancing the science and engineering solutions related to biorefining of forest and agricultural biomass and on creating new, resource and cost efficient bioproducts and biochemicals for the industry. The institute has a USD 44 million fund for researchers working with and creating new bioproducts. Georgia Tech also offers PhD programmes in e.g. bioengineering and paper science and engineering. Renewable bioproducts is regarded as one of its core research areas.

The University of Georgia Warnell School of Forestry and Natural Resources offers graduate degrees in forest biology and management, natural resources management and sustainability and forest business, as well as conducting research in these areas.

At 10.6%, Georgia had the second-highest share of industry funded university research, just behind North Carolina's 12.6% in 2016 (Information Technology & Innovation Foundation). The total higher education R&D expenditures in science and engineering fields have been steadily rising between 2006 and 2015 as seen from Figure 3.2.

Figure 3.2 Higher education R&D expenditures in science and engineering fields in Georgia



Source: National Science Foundation, National Center for Science and Engineering Statistics



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The United States Department of Agriculture (USDA) U.S. Forest Service Southern Research Station serves forest owners, policy-makers and the industry by conducting research and publishing results e.g. on sustainable forest management, ecosystem services, forest operations and forest economics and policy, among other subjects.

Georgia also encourages research and development in business by participating in a R&D Tax Credit system. Companies that have qualified research expenses exceeding a certain level can receive 10% of the exceeding portion as a tax credit. Georgia-Pacific also has its R&D functions located in Georgia in its Innovation Institute.

Annex 8

China



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FOR/Maine

Global Market Analysis and Benchmarking Study – China

Final Report

Helsinki, Finland
June 29, 2018

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ID 122625



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1. TIER 1- DETAILED ANALYSIS

1.1 Raw Material

1.1.1 Harvest Levels

China has a chronic shortage of wood and renewable fibre within profitable transportation distance. Almost half of the wood and wood fibre processed in the country is sourced through imports. Where forest industries are concentrated, wood demand continues to increase faster than supply due to demographic and economic drivers in China. Natural forests are scarce, and their timber production capacity has been lowered by prior over-logging. China exports timber products mainly to the United States (US), the European Union (EU) and Japan, as well as the countries in the Middle East and Africa. Based on the national forest inventory, China does have a significant forest growing stock of 15 billion m³, of which 2.5 billion m³ is in planted forests. However, majority of the volumes are located deep inland of China out of reach of forest industry.

Domestic Chinese timber mainly originates from plantations, so diameter is generally small, and quality is not very good. Locally sourced wood is usually processed in papermaking, wood-based panels or self-use in agricultural or forest areas, while large number of logs for architectural use, furniture, packaging and wood products are usually imported from abroad.

Currently over half of industrial roundwood in China is sourced from plantations, according to estimates. One of the reasons for that is the ban for commercial logging in natural forests – so-called “National Forest Protection Program” (NFPP) – which was fully adopted in 2000 and has been expanded first to the north-east of the country and since 2017 to the whole country. Some experts state that the ban will put even more pressure on flooring, furniture, plywood/veneer producers in sourcing raw materials, as these industries are highly dependent on naturally-grown hardwoods, especially oak and birch. Establishment of hardwood plantations in China has been quite active but some hardwoods, especially birch, will take more time to obtain due to longer rotation spans, therefore in the short-term the ban will most likely result in increased import of hardwood logs from abroad.

China has announced plans to plant new forests in 2018 that will cover at least 6.6 million hectares. China’s State Forestry Administration target is to increase the number of hectares of forest in the country to 23% of the total land by 2020, by 2035 the figure will be up to 26%, with the figure currently at 21.7%.

For 2018, the new forest areas will be built in the northeast Hebei province, Qinghai province in the Tibetan Plateau, and in the Hunshandake Desert in Inner Mongolia, an autonomous region in the north. State invested USD 85 million, for the past five years, raising the forests in China to 208 million hectares, with 78 million hectares of planted forests.

During the last five years, harvesting of industrial roundwood in China has been quite steady at the level of 160 to 170 million m³, therefore the growing demand for wood in China has been more and more relying on log imports (Figure 1.1).

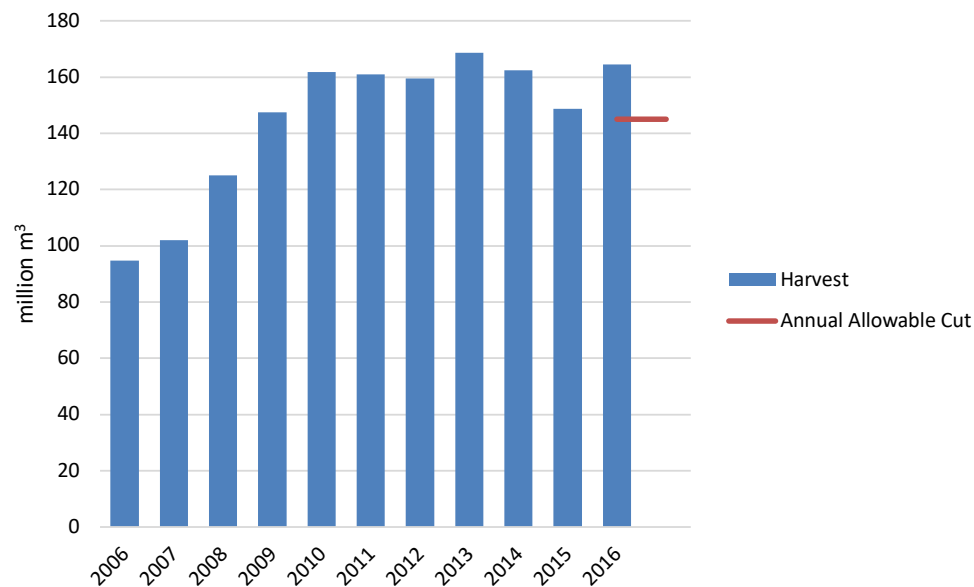
The annual allowable cut was estimated for all forests 223 million m³ annually in 2004.. However, the regional differences are significant in China and the country level AAC is poorly applicable to regions with forest industry clusters, such as regions in south of China close to the sea. In addition, it has been estimated that the AAC from plantations, which are the main supply for the forest industry, was around 100 million m³ in early 21st century. Since year 2000, China has reportedly increased its plantation area by 45%. Consequently, it is estimated that China’s AAC is 145 million m³. As evident from Figure 1.2 China is rapidly increasing share of imports in its roundwood consumption.

According to FAO, in 2015, China’s softwood log production reached 26 million m³, requiring softwood wood log imports of 54 million m³. Hardwood log production was likewise in deficit of 18 million m³, with a local production of 50 million m³.



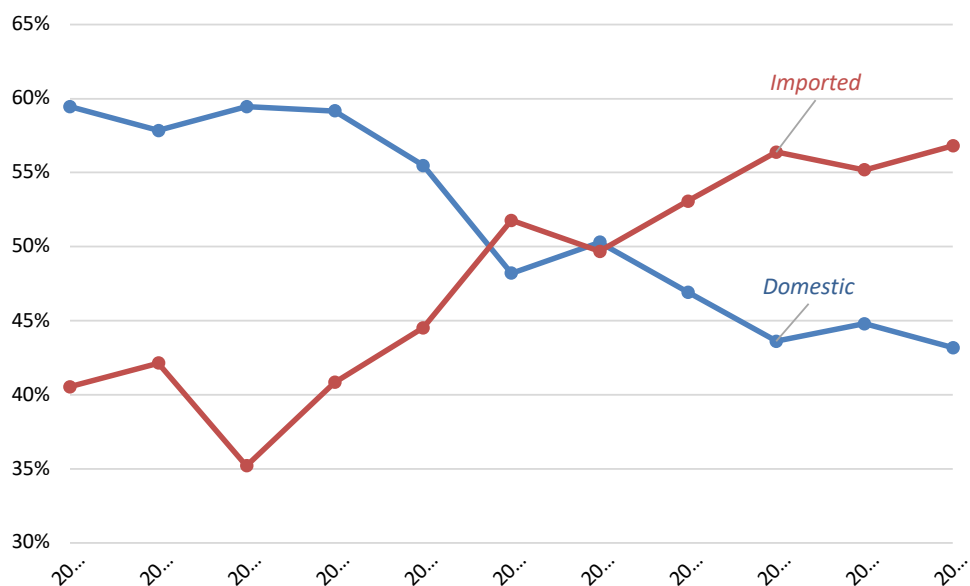
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Figure 1.1 Production of roundwood and AAC, 2006-2016



Source: FAO stat for harvest, CCAP and Butterworth 2003 for AAC estimate.

Figure 1.2 Share of domestic and imported of roundwood consumption, 2006-2016



Source: FAO stat, 2018.



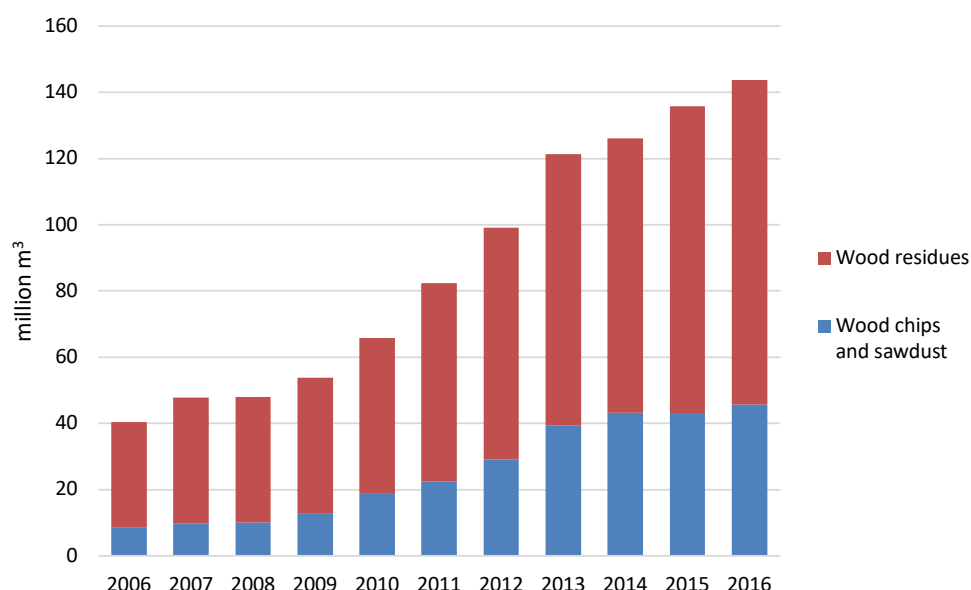
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1.1.2 By-products

China is a major wood chips importer, mainly for hardwood. Wood chip exports from Latin America reached a new record high in 2017, as the appetite for wood fiber by new Chinese pulp mills kept growing. Chile, which has been the major chip exporter from Latin America for many years, was the third largest supplier of hardwood chips to both China and Japan in 2017. The country exported a record 3.4 million odmt (oven dry metric ton) to Asia last year, up from 2.3 million odmt in 2015. While volumes for Japan have been fairly stable at just over two million odmt the past five years, shipments to China have gone from zero tons in 2013 to almost 1.2 million odmt in 2017.

From 2010 to 2016, the wood chip and wood residue consumption increased 120%, reaching 144 million m³ per year, with an average consumption increase of 14% per year (Figure 1.3). Wood chips and wood residues are used in pulp and wood-based panel industries.

Figure 1.3 By-product production volumes, 2006-2016



Source: FAO stat, 2018.

Vietnam is consistently ranked as China's top supplier of wood chips. However, its share of China's total wood chip imports has decreased in recent years due to growth in imports from the Australian wood chip industry. In 2016, Vietnam supplied 36% of China's total wood chip imports by volume and value, while Australia supplied 35% by volume and 38% by value.

Both the Vietnamese and Australian wood chip sectors source largely from commercial acacia and eucalyptus plantations and are generally considered to have relatively low-risk in terms of legal sourcing.

The top wood chip exporters to China are Vietnam, Australia, Thailand, Chile and Indonesia, responsible for 90% of the total volume exported.

1.1.3 Forest ownership

In 2010, collective forest tenure reforms began nationally. Along with market liberalization and privatization of forest tenure came a new emphasis on decentralizing decision-making to local government units and increased involvement of local stakeholders in forest management.



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The Rural Land Contracting Law in 2003 and Property Law in 2007 have clarified the land tenure system. Tenure rights may be allocated to individual farmers and can be renewed. Farmers may also lease-out the tenure right to third parties, based on private contracts. The aim is to encourage individual responsibility and stimulate greater involvement in forest management.

Now, private individuals may 'own' the collective forests by signing legal contracts. They then receive authorized forest certificates giving the right to utilize the forest lands for 30 to 70 years. With this long-term view, there are more trees being planted and sustainably managed, replacing the high harvesting levels that prevailed with collective-owned forests. The land remains in state or collective ownership and land 'use' rights (LURs) are granted to Chinese nationals or PRC body corporates. Foreign companies must incorporate in China to obtain LURs.

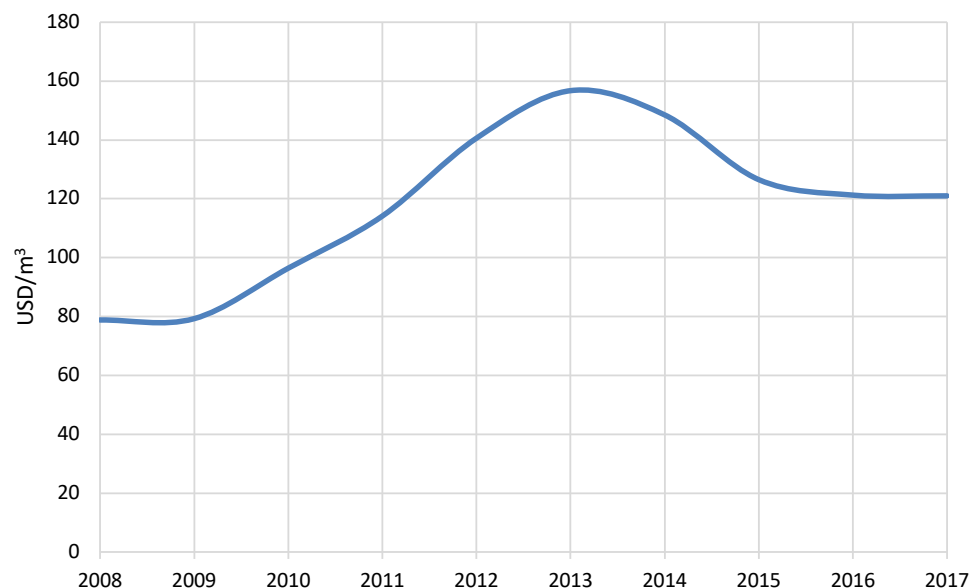
The forestland in China is divided by ownership into the state-owned forestland and the collectively-owned forestland, of which:

- State-owned forestland is 124 million ha, accounting for 40% of the total,
- Collectively-owned forestland is 186 million ha, accounting for 60% of the total.

1.1.4 Delivered wood cost

Eucalyptus is the main species used for pulp production in China. The eucalyptus roundwood prices increased rapidly after the financial crisis in 2008 and 2009 reaching record high level of nearly 160 USD/m³ in 2013. The price has since decreased and levelled to around 120 USD/m³ (Figure 1.4).

Figure 1.4 Delivered eucalyptus roundwood cost, 2008-2017 (USD/m³)



Source: Wood Resources Quarterly.

Since China entered the chip export market in Chile in 2014, export prices have declined, according to customs data. In 2014, the average export price was USD 173.00 / odmt as compared to 167 USD/odmt, in 2017 (Figure 1.5).

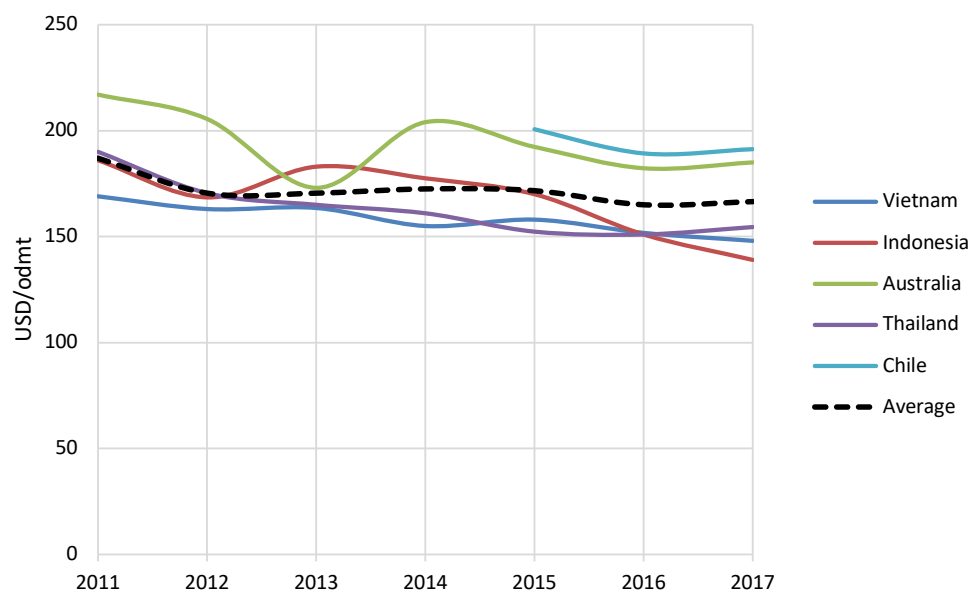


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Chip export prices for Japan have generally been higher than for China because Japanese pulp companies prefer to utilize higher density (and also higher cost) *Eucalyptus globulus* as a fiber source, while Chinese pulp mills are mostly buying lower-density *Eucalyptus nitens*.

It is not only hardwood chip prices from Chile that have fallen in the Pacific Rim region the past few years. The import price trend was down from most supplying countries for much of 2012 to 2016. A slight recovery in prices was seen in 2017.

Figure 1.5 Hardwood chip import prices, 2011-2017 (USD/odmt)



Source: Wood Resources Quarterly.

1.1.5 Wood procurement practice

Previously the state had a monopoly on the wood procurement in China, but after the liberalization of wood markets in the change of millennium, the wood sales were organized through wholesalers. There are hundreds of timber markets across the major roundwood producing and consuming regions. There are both private and state-owned timber companies which source the roundwood to be sold onwards in the timber markets. The timber traders can buy wood directly from farmers and collectives.

Forest industry players are increasingly sourcing their wood from overseas. Wood legality has become an ever more relevant factor in Chinese wood procurement via imports, because the largest end-user regions such as United States and European Union have implemented regulations to prohibit the sourcing of illegal wood or products derived from such wood.

Governments of the largest importer countries are increasingly excluding illegal products from their markets by: setting up border mechanisms to prohibit imports; by using public procurement policy to create protected markets for legal products; by using their own legal systems more aggressively to target companies involved in importing illegal goods; and by offering information and encouragement to importing, processing and retailing companies to control their supply chains.

The decline in the share of imports of potentially illegal timber and timber products into the EU from China ensured that the growth rate in the quantity of such imports was slower compared with that of overall imports earlier, particularly since 2004. This suggests that China exported



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an increasingly larger volume of legally verified timber to the EU as processed products. Nevertheless, the inflow of a large volume of potentially illegal timber and timber products into the EU from China continued even after the European Timber Regulation (EUTR) came into effect in 2013. Over 2.5 million RWE m³ of potentially illegal timber was estimated to have entered into EU markets in 2015 through timber and timber products imports from China. This suggests that the FLEGT Action Plan, and particularly the EUTR, augmented by the US LAA, was effective only in reducing the share of potentially illegal timber imports into the EU from China, not in eliminating the total import of such products. In other words, EU policies were only partially effective in cutting illegal timber flows into the EU from China.

Since 2007, China issued a number of policies (guidelines) for responsible forestry investment overseas. These policies essentially aim to direct the Chinese enterprises operating overseas in the forestry sector to comply with relevant laws and regulations of the host country, and thus to increase legally verified timber imports by cutting the flow of illegal timber into China. However, all these policies remained voluntary in nature.

1.2 Workforce

1.2.1 Demographics

Last January, China's population reached the 1.41 billion people mark, with 0.39% of population growth in 2017 (Table 1.1). China presents a relatively uniform age-class structure, having 46% of the population concentrated on ages 30 to 59 (Figure 1.6).

Unemployment rate has been low throughout the last decade, hitting its lowest point in 2017. From 2015 to 2020 every one percent increase in China's GDP is expected to equal roughly 1.8 million new jobs. China added 13 million new jobs in 2016 and 11 million new jobs in 2017, all in urban areas.

In 2016, over 790 million of people live in cities in China, representing 57%. Most have moved during two decades of boom in search of economic opportunities, and the historic mass migration from fields to office and apartment blocks ends the country's centuries-long agrarian status. For the next 20 years, 75% of Chinese people are expected to be living in cities, which will represent a huge demand for transport, energy, water and other vital infrastructure.

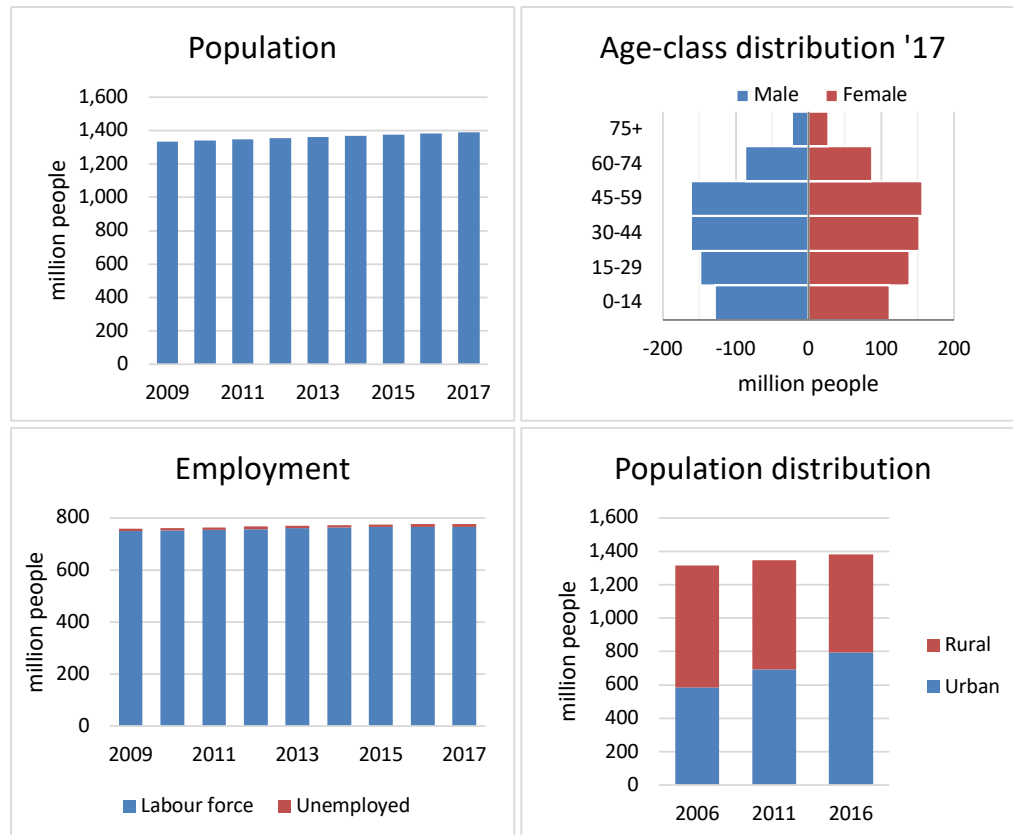
Table 1.1 Key demographic indicators

Indicator	Current situation
Total population (Jan. 2018)	1 414 563 656
Population growth rate (2017)	0.39%
Population density, rural vs urban (2016)	43% vs 57%
Unemployment rate (2017)	3.9%
Level of education ⁽¹⁾ (2016)	18%

⁽¹⁾ Ages 25 to 64, people with higher than secondary school diploma or equivalent.



Figure 1.6 Historical demographic development



Source: United Nations, Population Division.

1.2.2 Level of education in each competitor country and the skill levels required

China has the largest education system in the world, with almost 260 million students and over 15 million teachers in about 514 000 schools, excluding graduate education institutions.

Education is a responsibility of the State, with little involvement of private providers in the school sector, and increasingly decentralised. County-level governments have primary responsibility of the governing and delivery of school education. For the most part, provincial authorities administer higher education institutions. In recent years, the Ministry of Education has shifted from direct control to macro-level monitoring of the education system.

In China, students must complete nine years of compulsory education. Most students spend six years in primary school, though a few school systems use a five-year cycle for primary school. Primary education starts at age six for most children. This is followed by three to four years of junior secondary education. Before the 1990s, secondary schools recruited students on the basis of an entrance examination. To emphasise the compulsory nature of junior secondary schools, and as a part of the effort to orient education away from examination performance and towards a more holistic approach to learning, the government has replaced the entrance examination with a policy of mandatory enrolment based on area of residence.

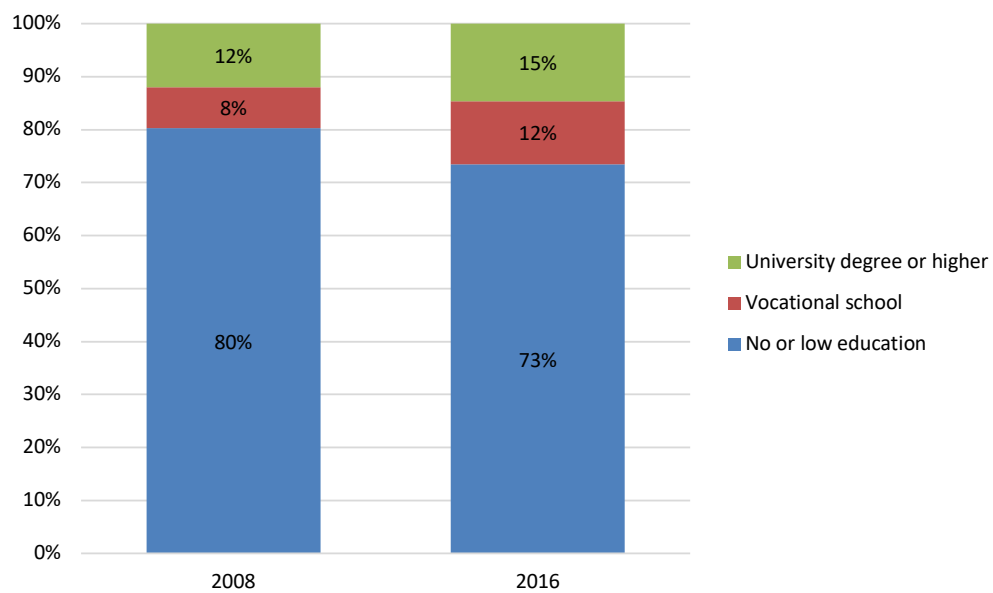
After finishing compulsory education, students can choose whether to continue with senior secondary education. Senior secondary education takes three years. There are five types of senior secondary schools in China: general senior secondary, technical or specialised secondary, adult secondary, vocational secondary and crafts schools. The last four are referred



to as secondary vocational schools. China has made significant efforts to expand participation in secondary vocational schools in recent years in order to meet the country's fast-evolving economic and manpower needs. In 2014, secondary vocational schools accounted for a little less than 22% of total senior secondary school enrolment in China.

In 2016, National Bureau of Statistics of China reported a significantly increase of students with university diploma or higher education, compared to prior years (Figure 1.7). This fact can be attributed to Ministry of Education's medium to long-term reform and development plan for education, aiming to support China's sustainable development.

Figure 1.7 **Level of education in China, 2008-2016**



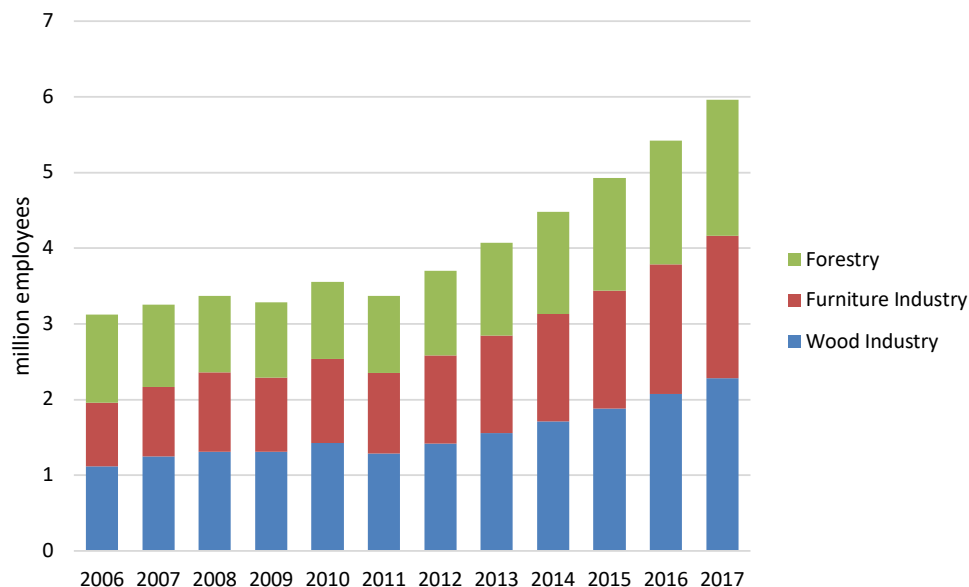
Source: OECD. KPMG Special Report: Education in China. National Bureau of Statistics of China.



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From 2010 to 2017, the number of workers in the forestry sector increased 77%, from 3.4 million to 5.9 million, representing an increase of 10% per year (**Figure 1.8**). These figures are compatible with the development of the forest sector, including the increase of planted forest and processed logs over the years.

Figure 1.8 Forest sector direct employment in China, 2007-2017



Source: FAO, SFA.

1.2.3 Typical labor costs

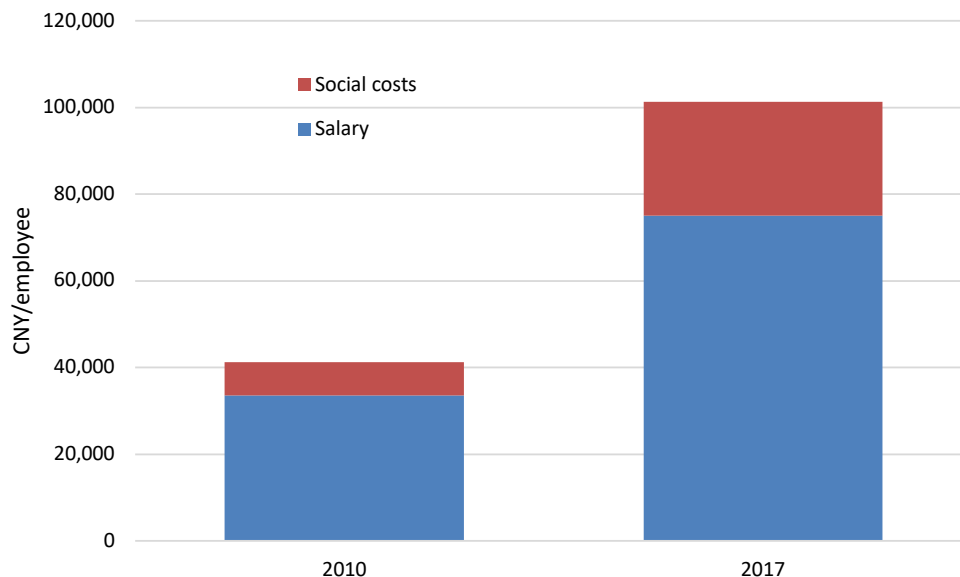
Cheap labor costs have long been considered the main factor behind the Chinese economic miracle, propelling the country to the status of the world's factory, shifting global supply chains, and igniting debates in other countries about companies moving their plants to China, the consequences of job outsourcing for domestic industries and workers, and unfair competitive advantages associated with the poor labor conditions of Chinese factory workers.

However, cheap labor had created the Chinese miracle, which in return can finally eliminate the cheap labor phenomenon. Economic growth during the past 20 years has led to a rapid increase in wages.

Since 2010, the annual wages for manufacturing, forestry and forest industry registered an increase of 120%, or 14% per year (Figure 1.9). Still, the annual wages for the forest sector remains quite competitive compared to any other country. The annual total labor cost of a worker in pulp and paper manufacturing was 101 000 CNY/employee in 2017 (i.e. 15 000 USD/employee).



Figure 1.9 Pulp and paper manufacturing annual labour cost, 2010 and 2017



Source: Trading Economics. FAO.

1.3 Regulatory climate

Overall Pressures for Protection

Historically, China has experienced environmental degradation. Economic outcomes rather than protection have been emphasized in land use planning. Frequent and severe natural disasters (floods and sandstorms) with long term consequences have prompted the government to protect existing forests and establish new forest areas. In 2014, the government began to increase enforcement of environmental regulations.

China has 22% forest cover, with 38% to be afforested or further improved. The most recent 8th National Forestry Inventory (NFI) (2009-2013) states China's total land area reserved for forest is 310 million hectares (ha) in total. Forested area is currently 191 million ha. According to FAO, over the last 25 years forest land cover has increased around 1.1% per annum, as a result of the Natural Forest Protection Program.

Of the total, 122 million ha is natural forests and 69 million ha plantations. The remainder of forest land (107 million ha) includes sparse forest land, shrubs, land with some trees and land suitable for plantations and other types of land for nursery and land with no standing timber.

Compared to the 6th and 7th NFIs, new plantation area has increased by 16% and 12% respectively. However, forest resources are inadequate, e.g. when benchmarked against international standards, the average standing volume is 73 m³/ha (only 61% of the global average) and per capita forest area is less than one-quarter of the world average.

Land tenure

In 1999, SFA and the International Labour Organization (ILO) signed an agreement to jointly develop a forest harvest practice protocol for China. The Code of Forest Harvesting was completed in 2001 then piloted, with a revised version issued by SFA in 2005. Each province in turn was expected to establish local standards or detailed implementation guidance (Yin 2016).



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Despite the relative prescriptiveness of Annual Allowable Cuts (AAC) policies, overharvesting has continued in many forests. In addition, smallholder forest owners and managers have experienced encroachment on their forest rights and find it difficult to obtain harvest licenses (Yin 2016). Land tenure and related conflicts are one of the main challenges for investors/investments aiming to expand private forestry.

Forest Management and Harvesting

The Chinese government has passed 10 national laws, 17 forestry administrative regulations, 42 rules stipulated by the State Forestry Administration (SFA) as well as numerous local forestry related rules and regulations to handle the relationships between development, protection, industry and ecology, while tapping the various functions of forests. The aims are to protect biodiversity, increase carbon sequestration and to safeguard the overall ecological stability.

The devastating floods in Northeast and Central China in 1998 triggered SFA to consolidate and reorganize existing major forest programs started in the 1970s and launch new programs to form the Six Key Programs:

1. Sloping Land Conversion Program (the world's largest ecological construction program) in 2000
2. National Forest Protection Program (1998) which banned major commercial logging in some sensitive northern areas and transferred 740,000 workers to new afforestation and forest management positions
3. National Wildlife Conservation in 2001
4. Nature Reserve Construction Program in 2001
5. Desertification Combating Program around Beijing and Tianjin in 2002, and
6. The 4th phase of the Shelterbelt Network Development Program in 2001.

These programs cover over 97% of the counties across the country and have been accompanied by a major expansion of SFA budgets.

The State Council allocates a five-year quota on volume to be harvested in each province based on annual increment of growing stock. Its calculation allows for natural losses (fire, disease, etc.) and non-commercial wood-use by local communities (fuel, construction, mushroom farming, etc.). Timber harvesting in plantations or natural forests requires a license to harvest, which specifies the allowable cut and sets conditions for harvesting, transportation and marketing. Local forest management authorities (state forest enterprises and county forest bureaus) submit annual harvesting plans to relevant provincial authorities. The provincial authority recommends the share of the quota to be allocated to each local management authority. The recommendations are then submitted to the State Forest Administration, which ascertains their compliance with regulations before approving the recommended allocations and issuing annual harvesting licenses. The management authorities can then use these licenses to conduct their own harvesting or contract harvesting out to collectives and local community groups.

National Forest Protection Program (NFPP)

China is planning to ban commercial logging in all-natural forests in an extension of an ambitious program which was started in 1998 and whose purpose is to allow forests to recover from decades of over-logging and to help restore forest ecosystems and their resilience. The National Forest Protection Program (NFPP) is a 50-year program intended to protect forest resources and biodiversity, and to improve overall environmental quality in ecologically fragile areas. It has been developed in response to major flooding in the upper parts of the Yangtze and Yellow Rivers that was made worse by widespread deforestation and land degradation in the areas.

In 2000, the Chinese government fully implemented the National Forest Protection Program (NFPP), which instilled logging bans and harvesting reductions in 68.2 million ha of forest land – including 56.4 million ha of natural forest (approximately 53 percent of China's total natural forests). In 2014, the State Forestry Administration (SFA) expanded the NFPP with the launch of a trial ban on commercial logging in state-owned natural forests in Heilongjiang Province,



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which has historically produced over 30 percent of China's domestic log supply. Based on the results of the Heilongjiang trial, the SFA further expanded the trial ban to natural forest areas in other Northeast provinces starting from April 2015, and to the whole country by 2017. The Program was originally launched for 50 years (ending in 2050). However, no information on the expected duration of the total logging bans is currently available.

The newly released China's 13th Five-Year logging quota (2016-2020), which shows a logging quota of 254 million m³ for 2016-2020, reveals a 6.3% drop compared to 2010-2015 and shows that logging ban has been effectively enforced. Imported timber now accounts for more than half of China's total timber supply. With the new logging ban, timber imports are expected to further expand to fill the gap created by declines in domestic harvesting due to the expansion of the NFPP.

The new bans will undoubtedly bring many changes to China's forest sector, as it did when the NFPP was first introduced in 2000. China's vast and ambitious plantation programs are expected to continue to make up some of the gap that will arise after the ban. However, typically the species sourced from natural forests are not easy to substitute from plantation areas. Solid wood flooring, furniture, plywood veneer industries in particular have been dependent on hardwood natural forest timber species (e.g., oak and birch) which cannot be sourced from plantation forests at this time nor in the immediate future.

China will need to import more timber and timber products, particularly hardwood species and will need to procure enough legally verified and/or certified timber from international markets in order to avoid the reputational risk that China is disseminating manufactured timber products sourced from illegally harvested woods and contributing to the collapse of forests around the globe.

Natural Forest Protection and Management

Despite measures to protect natural forests, degradation and deforestation continues. Also, the classification of natural forests is not always explicit. Over 1.6 million ha of forest land is lost on an annual basis due to over logging or conversion to other land uses.

Natural forests are not managed according to proper silvicultural practices and their quality is poor.

In 2016, SFA rolled out a ban on all commercial logging in natural forests, suspending approval of commercial logging of natural forests within Annual Allowable Cuts (AACs).

Forest Plantation Development

China has the largest plantation area in the world, principally of fast-growing species and also has the highest afforestation rate, increasing its forest cover from 12% in 1981 (the 2nd NFI) to more than 21% in 2013. According to FAO, SFA optimistically expects domestic timber supply to reach 300 million m³/annum in 2020, whilst at the same time it also anticipates that industrial demand (not including private use or fuel wood) will increase to 467 million m³/annum (excluding recovered paper), leaving a deficit of 167 million m³/annum.

To fill the gap, China has vigorously encouraged all investors to establish forest resources and has several government run programs promoting and implementing forest establishment. After the full cessation of commercial logging of natural forests, China may have to expand the harvesting of plantation forests and import more timber products from the overseas markets.

However, afforestation is becoming more difficult. Of the 40 million ha of land suitable for forest, low quality land accounts for 54% and most is in the remote arid and semi-arid areas of Inner Mongolia and the Northwest China.

Environmental and Social Performance

Current forest policy emphasizes expansion of natural forests and increasing the productivity of forest plantations.



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China's National Climate Change Programme (CNCCP), updated in 2014, confirms the important role of China's forestry sector in climate change mitigation, adaptation and enhancement of environmental protection. The impressive afforestation targets increase the carbon dioxide sequestration in forest ecosystems. Land for new productive forests is most often available on abandoned farm land. Protection forests are often planted on low-productive barren or heavily degraded lands with no financial expectations.

Certification

The China Forest Certification Council administers the PEFC endorsed China Forest Certification Scheme (CFCS). Until now, China has not had a national FSC standard for certified forest management and all FSC certifications in the country are done with interim standards developed by certification bodies and approved by FSC. In 2016, China submitted a national standard to FSC for approval and the standard is likely to be in force already in 2017.

The overall certified forest area is close to 7 million ha (Table 1.2). Interest for certification is higher amongst internationally operating companies and lower amongst village cooperatives or smaller private or state-owned companies.

Table 1.2 Forest and Chain of Custody Certification in China

Scheme	Forest Certification	Chain of Custody Certification
	ha	pcs
CFCS/PEFC	6 006 017	265
FSC	988 500	5 200
Total	6 994 517	5 465

* The figures may include double certified areas under both schemes

Forests and Climate Change Mitigation

The China National Climate Change Programme (CNCCP) 2014-2020 sets objectives, principles, and policy measures for climate change mitigation and adaptation in China. It recognises the important role of forestry in improving the capacity to increase carbon sinks through afforestation and management, to raise the growing stock. Appropriate forest management also builds more resilient forest ecosystems that can buffer the adverse impacts of extreme weather conditions.

China's Intended Nationally Determined Contribution under the Paris Climate Agreement also pledges to increase carbon sinks through sustainable land use, including a long-term commitment to increase its forest stock volume by 4.5 billion m³ by 2030 compared to 2005 levels.

Five cities and three provinces in China have launched their own emissions trading schemes with the focus to cut industrial greenhouse gas emissions. All eight operating emissions trading pilot jurisdictions have made forest carbon offsets eligible for use by regulated emitters. Four land-based carbon accounting methodologies are available to generate Chinese Certified Emissions Reductions (CCERs) for use in the domestic carbon markets: afforestation-reforestation, bamboo-specific afforestation/reforestation, sustainable forest management, and grassland restoration.

A handful of carbon projects have obtained co-benefits certification under the Climate, Community, and Biodiversity Standards (CCB), which reward land-based projects based on multiple community and environmental benefits on top of a project's underlying climate benefits. Pursuit of co-benefits certification is primarily intended to appeal to voluntary buyers and is unlikely to be sought in projects seeking compliance buyers, given the lack of a price premium once the market matures.



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A nationwide emissions trading scheme is planned for launch in late 2017, though it may face further delays due to difficulties encountered during the pilots around data accuracy, transparency, and valuation of permit trading. NDRC temporarily stopped issuing CCERs in May 2017 due to administrative bottlenecks in reviewing applications and is considering excluding CCERs from the initial phase of the national ETS given concerns about oversupply.

Apart from those that pursue formal certification under carbon offset standards, some forest carbon projects developed or supported through CGCF have also received direct investment by Chinese companies motivated by corporate social responsibility, without the need to verify tonnes or quantify impacts via third-party certification. In general, until the carbon market matures, forest sector actors facing major financial constraints may need to draw income from alternative sources.

Environmental and Safety Regulations

China has recently increased enforcement of emissions standards in a major initiative to address the pollution problems. Since July 2016, the Chinese government's national environmental investigation is reshaping many of China's manufacturing sectors, including wood-based panels, furniture and building material.

In 2017, China announced a plan to cut the concentration of hazardous fine particulate matter (called PM_{2.5}) from 47 micrograms per cubic metre in 2016 to 35 micrograms by 2035. From January 2018, manufacturers will be required to pay environmental protection taxes on pollutant emissions for water, air, solid waste and noise. The new law introducing an environmental protection tax was approved in December 2016 for replacing former regulation which was not effective. Instead of charging a "fee" on pollutants, Chinese government will charge it as "tax". Specific emissions are subject to tax. Depending on the local government, additional emissions will also be taxable.

The tax-free structure will also be changed. Factories that emit less than 50% of the threshold will no longer be exempt from tax. From 2018, companies that emit less than half of the threshold pay 50% of the tax, companies that emit 30% less than the threshold will pay 75% of the tax. Tax of each emission unit will be also increased.

The full impact of the Chinese government's environmental policies is not yet clear but certainly this drive to improve standards will increase the overall production cost in China.

1.4 Taxation

The 2008 Enterprise Income Tax (EIT) Law applies to domestic and foreign-invested companies, generally at the same tax rate, with special rates applying in certain cases. In addition to the EIT, China levies a value added tax (VAT), consumption tax, customs duties, resource tax, land appreciation tax (LAT), social security contributions, stamp duty, etc. China does not impose a branch profits tax, excess profits tax or alternative minimum tax.



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Table 1.3 Taxation for Companies

Category	Tax Rate
Corporate income	25%
Branch	25%
Capital gains	25%
Social Security Contributions	Up to 40% of employee salary base
Real Estate Tax	1.2% of cost, or 12% on rental value
Land Appreciation Tax (LAT)	30% to 60% of gains on transfer
Value Added Tax (VAT)	0%; 6%; 11% and 17% (13% bracket is abolished as from 1 July 2017); a 3% and 5% rate apply under simplified VAT calculation method

Source: Deloitte Report: Taxation and Investments in China 2017.

Charges and taxes on private forest production may absorb 35% to 60% of the sale value of timber, depending on the locality. By comparison, agricultural charges and taxes only amount to 10% to 20% of revenues.

The forest sector taxes and fees consist of various agricultural taxes, forestry fees and the value added tax (VAT). Agricultural taxes apply to agriculture, forestry and animal husbandry, and vary by region.

Forestry fees include a range of items approved by the Ministry of Finance and the State Forest Administration. They include reforestation funds (royalties or stumpage fees), maintenance fees, and numerous other items specified by various departments and districts. The number of items subject to forestry fees varies among districts.

The current value added tax (VAT) in China is imposed under the Temporary Regulations on Value Added Tax of People's Republic of China. These regulations stipulate that raw forest products, such as logs and lumber, fall into the category of agricultural products with a VAT rate of 13% and processed wood products have a VAT of 17%.

1.4.1 Tax Incentives

In 2008, China levelled the playing field for all enterprises—both foreign and domestic—by eliminating most of the preferential tax rates and holidays for foreign-invested enterprises (FIEs) through the Enterprise Income Tax Law (EITL). But the measure kept tax incentives for FIEs and domestic companies investing in the agriculture, forestry, animal husbandry and fishing industries. Specifically, the EITL Implementing Regulations exempt companies from paying enterprise income tax (EIT) on profits earned from the following activities:

- Growing vegetables, grains, potatoes, oil plants, beans, cotton, ramie, sugar crops, fruits and nuts;
- Breeding new varieties of agricultural products;
- Growing Chinese medicinal herbs;
- Cultivating and growing trees;
- Raising livestock and poultry;
- Harvesting forestry products;
- Providing services related to agriculture, forestry, animal husbandry, and fisheries, such as irrigation services, preliminary processing of agricultural products, veterinary services, agricultural technology promotion, agricultural machinery servicing, and repair; and
- High seas fishing.



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In addition to the EIT exemption, China offers various value-added tax (VAT) exemptions and reductions from its standard rate of 17% to FIEs and domestic companies investing in crop production, breeding, forestry, animal husbandry and aquaculture industries.

For example, the sale of self-produced, “qualified” agricultural products is exempt from VAT. “Qualified” products include “primary” vegetable and animal commodities from the crop production, breeding, forestry, animal husbandry, and aquaculture industries.

The sale of non-self-produced agricultural products is subject to a reduced VAT rate of 13%.



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2. TIER 2 – GENERAL ANALYSIS

2.1 Policies

2.1.1 Subsidies

Ecosystem Services

In 1999, China launched an initiative known as 'Grain for Green' — or the Conversion of Cropland to Forest Program (CCFP). Currently, more than 28 million hectares of land have been restored. To date, the country has spent more than USD 50 billion on the program, which includes cash incentives to 124 million farmers in 25 provinces.

Industry & Products

Government subsidies to produce technologically advanced products and undercut foreign manufacturers have strengthened China's trade capability. Since 2000, the value of Chinese exports more than quadrupled. Chinese companies benefit from China's central and provincial governments, including free or low-cost loans; artificially cheap raw materials, components,

From 2002 to 2009 helped China triple paper production and overtake the U.S. to become the world's largest paper producer by providing industry with USD 33 billion in subsidies. Despite the need to import pulp and recycled paper (mostly from the U.S.), Chinese paper sells at a substantial discount to U.S. and European paper.

2.2 Access to financing

Development Finance Institutions, such as IFC, World Bank, United Nations, among others, have several loan programs to foster sustainable economic growth in developing countries by supporting private sector development, mobilizing private capital, and providing advisory and risk mitigation services to businesses and governments, which includes to develop the forestry sector, establish sustainable practices, create jobs and protect the natural resources.

The European Investment Bank (EIB) is currently financing a total of 14 forestry projects in China, encompassing approximately 470 000 ha of a variety of different plantation types, and rehabilitation of existing forests. These are organised under two framework loans and one individual operation in Sichuan following the 2008 earthquake. The total committed EIB loan amount stands at EUR 580 million, with a total investment cost of approximately twice this amount.

China, through its government funds, would invest more than USD 350 billion in domestic renewable power generation by 2020.



2.3 Logistic infrastructure and transportation costs

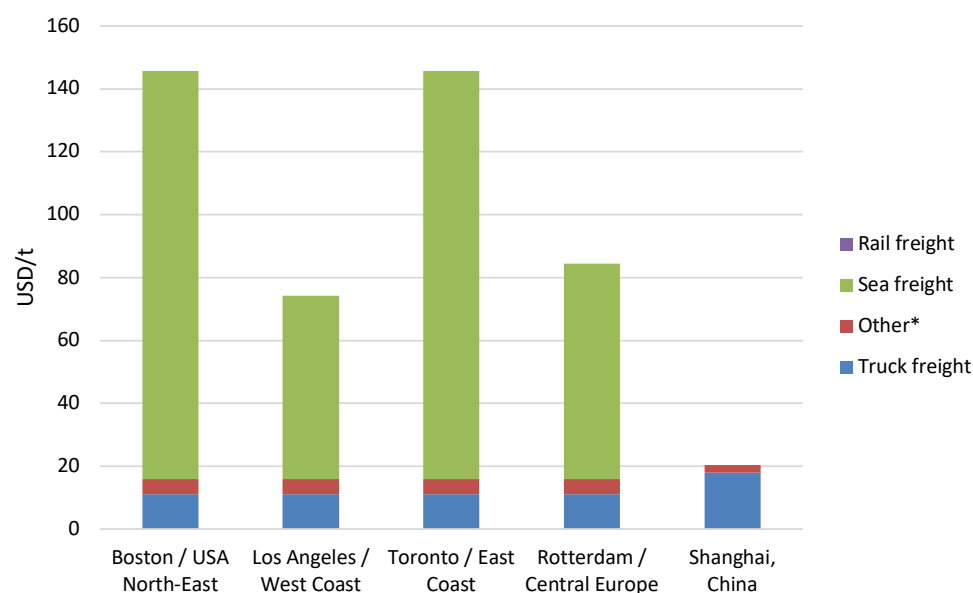
On March 2017, China announced that it plans to spend USD 2 trillion to expand and improve its railroads and highways between 2016 and 2020. The country plans to have 150 000 kilometres of railway lines, five million kilometres of roads, 260 airports and 2 527 berths for vessels over 10 000 tonnes by the year 2020. In addition, high speed railway network will be expanded to 30 000 kilometres during the same time, connecting more than 80% of Chinese cities with over one million in population.

According to both the Ministry of Transport and China Internet Network Information Center (CNNIC), at the end of 2016, there were close to four million kilometres of rural roads nationwide, meaning nearly all villages in the country had road access. As well as physical roads, extending the nation's broadband highway to rural areas is also important.

In general, China's transportation infrastructure including forest road network is not a limiting factor for the forest sector. China has a solid and comprehensive infrastructure investment plan that support its economic growth.

China has high transportation costs out of the country whereas it is relatively cheap to transport to China. However, China dominates globally in the value-added processing and has sufficient domestic markets for the wood products considered in this analysis. The inland truck transportation was estimated using the pulp mill concentration in Guangxi as proxy and assuming an average distance of a little less than 200 km to the nearest ports in the very south of mainland China. This resulted in inland transportation cost of 11 USD/t with (Figure 2.1).

Figure 2.1 Transportation costs



(*) Port costs, unloading and loading.



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3. TIER 3 – HIGH LEVEL ANALYSIS

3.1 Energy

In China companies have limited flexibility to manage their electricity costs. Companies that can operate at lower supply voltages may be able to manage their rates somewhat. Small industrial users who require a low voltage supply, can sometimes qualify for commercial rates, which, although higher than the average medium industrial rate, are fixed throughout the day.

While in principle consumers in China can purchase power in the wholesale market as a way to manage costs, in practice this has been limited to some very specific industry sectors, such as aluminium, and only on a trial basis.

The power authorities do not permit individual firms to generate their own electricity either for their own use or for sale back to the grid. While the grid may be theoretically reliable, companies located in economic development zones (industrial parks) close to large metropolitan areas like Shanghai and Guangzhou are sometimes required to shut down during peak demand days during the summer when electricity demand for air conditioning use spikes or when air pollution conditions in some areas reach critical levels affecting public health.

Similarly, requesting dual feed (and dual source) power in China to enhance reliability requires special permission and a cumbersome application process, which is particularly difficult for companies located on the border of two grid areas where connecting to the adjacent grid may offer cost advantages.

Electricity rates in China have risen 18.1% over the past six years, which equates to about 3% compound annual growth rate (Figure 3.1). But rates have already begun to fall in US dollar terms for several reasons. First, the U.S. dollar Chinese renminbi foreign exchange rate has softened by about 8.3% over the last six months, causing U.S. dollar denominated rates to fall a corresponding amount. Second, as coal prices and the Chinese economy have weakened over the last year, the State Council has reduced electric tariffs somewhat. In Jiangsu province, for example, electric rates for all classes of industrial users were reduced by USD 0.001/kWh as of April 2015 and further reduced by USD 0.005/kWh as of January 2016 for all but the largest industrial users.

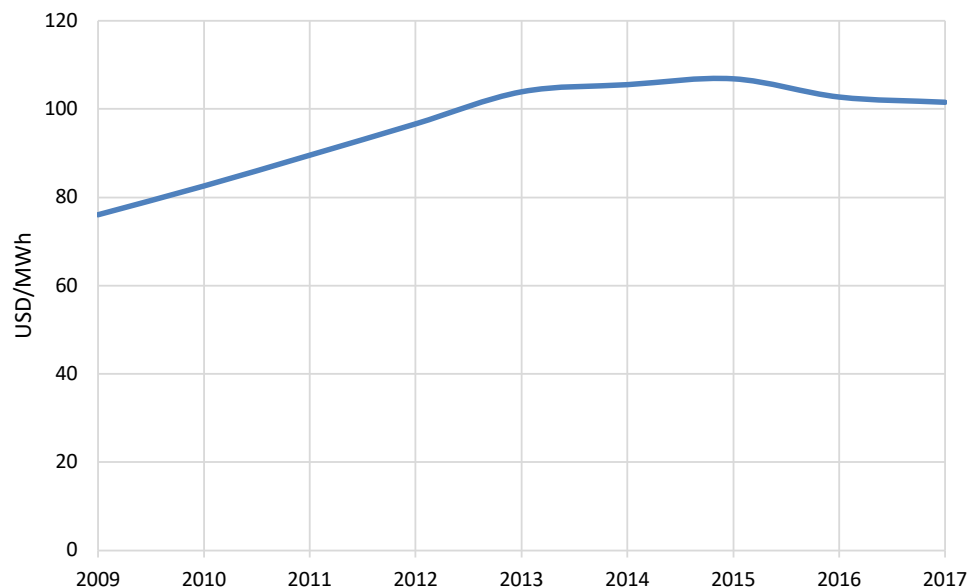
The higher Chinese rates reflect the costs of paying for an entire national generation, transmission and distribution grid built in the next 20 years during a period of rising capital and raw material costs.

At the same time, however, China has also been tightening controls on emissions, which could have an upward impact on the price of coal-generated electricity. In China, electric prices have also been used as leverage by the central government to make macroeconomic adjustments and use price signalling to incentivize efficient industry. Since June 2004, six energy-intensive industrial sectors (electrolytic aluminium, ferroalloy, calcium carbide, caustic soda, cement and iron and steel) were classified into four categories: Eliminated, Restricted, Permitted and Encouraged.

Punitive Surcharges are applied to standard tariffs for users categorized as Eliminated and Restricted. The categorization is applied to individual companies in each of these sectors based on a combination of factors including the products produced, manufacturing process used and the energy efficiency of the process. The punitive surcharges can vary from 0.0076 to 0.0615 USD/kWh for those companies



Figure 3.1 China's Average Wholesale Price of Electricity



Source: China Energy Group: Key China Energy Statistics.

Electric energy prices vary according to the size of industry (Table 3.1). China energy providers classify the industries as presented on the table below.

Table 3.1 Electricity consumption by industry client type

Indicator	Small Industry Client	Medium Industry Client	Large Industry Client
Energy Demand kW	250	2 500	20 000
Full Load Monthly Hours	350	400	600
Monthly kWh	87 500	1 000 000	12 000 000
Power Factor	85%	85%	90%
kVA	294	2 941	22 222
Annual kWh	1 050 000	12 000 000	144 000 000

Source: BLS&CO and Tractus's China Electricity Report, 2016.

3.2 Other supplies

China strong economic growth and important forest industry brought to the country a variety of supplies and engineering companies, providing services and inputs, such as technical support on several projects, chemicals, spare parts, among others. Valmet, Andritz, Kemira, Buchman are examples of companies operating in China.

3.3 R&D

China's spending on research and development (R&D) resumed double-digit growth rate in 2016, closing in on the level of developed countries. According to the National Bureau of Statistics, R&D spending rose 10.6% year on year to USD 234 billion in 2016, representing 2.11% of China's GDP, 1.7% points higher than the rate in 2015. Structure of R&D spending



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improved as more money was given to fundamental research, with high-tech firms and private research firms spending more. Spending on fundamental research remained low compared with developed countries.

According to the 13th five-year plan for national science and technology talent development (2016-2020), China had 5.35 million people working in R&D at the end of 2015, the world's largest pool of R&D talent.

Chinese government has given high priority to promote pulp and paper industry's modernization in recent years. In order to improve the production efficiency, Chinese government encourages technology transfer and developing joint ventures. For instance, China's State Forestry Administration and the Federation of Swedish Farmers (LRF) have some exchange visits over the past decade. According to their cooperation MOU (Memorandum of Understanding), Sweden offered technological guidance and introduce innovative products to China's forest industry. With this guidance and imported production lines, the quality of wood products has been improved in several sawmills. Plywood, particleboard and medium density fiberboard (MDF) are some of the main wood products in China, which have upgraded their production capacity over the years.

China is also making large investments abroad where they utilize the latest bioproduct technologies. For example, Chinese company Kaidi has announced a large scale investment in biorefinery mill in Finland with an aim to produce 225 000 tonnes of 2nd generation biofuels annually.

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