Dissertationes Forestales 217

On the high road to future forest sector competitiveness

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Academic Dissertation

To be presented, with the permission of the Faculty of Agriculture and Forestry of the University of Helsinki, for public examination in Auditorium XII, The Main Building of the University of Helsinki on 6th of May 2016 at noon.

Title of dissertation: On the high road to future forest sector competitiveness

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Dissertationes Forestales 217

http://dx.doi.org/10.14214/df.217

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ISSN 1795-7389 (online)
ISBN 978-951-651-524-6 (pdf)

ISSN 2323-9220 (print)
ISBN 978-951-651-525-3 (paperback)

Publishers:
Finnish Society of Forest Science
Natural Resources Institute Finland
Faculty of Agriculture and Forestry of the University of Helsinki
School of Forest Sciences of the University of Eastern Finland

Editorial Office:
Finnish Society of Forest Science
P.O. Box 18 FI-01301 Vantaa, Finland
http://www.metla.fi/dissertations

Korhonen, J. 2016. On the high road to future forest sector competitiveness. Dissertationes Forestales 217. 58 p. Available at: http://dx.doi.org/10.14214/df.217

ABSTRACT

International industrial competitiveness depends on many aspects. It can be based on cost advantages over international competitors, which are realized as higher market shares and increased trade flows in global markets. Competitiveness can also be improved by creating higher value through increased product quality and by means of sustainability. This places increasing strategic importance on scarcening natural resources and on how proactively environmental responsibility is perceived in the international forest sector in the future; as an additional cost or more as an opportunity of a *high road to competitiveness*?

The goal of this dissertation is to analyze international competitiveness and its drivers from five different perspectives at the regional, country, and firm levels, with an emphasis on the pulp and paper industry. The empirical research problems of five individual research articles are approached by combining quantitative and qualitative data analyses. The time period from 1990 to 2030 was covered in the analyses.

The results highlight the importance of forests, markets, and regulation in creating competitive advantages at different levels in the sector. The traditional forest sector factors such as resource availability and traditional economic factors such price competitiveness are going to play an important role also in the future. However, sustainability will become increasingly important for the value creation opportunities of industries. It is an opportunity for companies in their global value chains if the global environmental awareness and societal demand for sustainability continue to increase. Therefore, more responsible use of global forest resources can offer solutions to global sustainability challenges, and in the transition to a bioeconomy in which the forest industry plays a key role.

Keywords: Competitiveness, pulp and paper industry, environmental sustainability, international trade, panel regression, logistic regression, Delphi-method.

ACKNOWLEDGEMENTS

I would like to express my greatest gratitude for my supervisors. Firstly, Anne Toppinen, the science superwoman, for being the much needed positive encouragement and continuous support during the studies. Secondly, Jari Kuuluvainen for being such a great and patient teacher whose professionalism I have been looking up to since the beginning of my studies. Thirdly, Frederick Cubbage for being a great teacher and person who truly cares about his students.

Sincere thanks to all my co-authors of the articles Jeffrey Prestemon, Yijing Zhang, Satu Pätäri, Anni Tuppura. Warm thanks to my pre-examiners Birger Solberg and Armi Temmes for taking the duty and providing constructive criticism and guidance to increase the quality of my thesis. Thank you Iikka Ilonen for collecting some data.

Thanks to the steering group of KILPO-project Teemu Harrinkari, Heikki Pajuoja, Pia Katila and Heimo Karppinen for accepting me for this project and sharing your knowledge during the project meeting. Thank you for advisory board of KILPO.

Thanks to my coworkers at the department of Forestry in Viikki for great discussions. Special thanks to Arttu Malkamäki, Brent Matthies, Dalia D'amato, Jani Holopainen, Janne Rämö, Katja Lähtinen, Liina Häyrinen, Osmo Mattila and Sampo Pihlainen for providing joy, tears and laughter in various context. Thanks to Elias Hurmekoski from the European Forest Institute for sharing your thoughts and company.

For the funding I received my greatest gratitude goes for Metsämiestensäätiö. Thanks to the Department of Forest Sciences and Academy of Finland for providing me possibilities to visit conferences and courses in abroad.

Thanks to my parents, brothers, and rest of the family for always believing me. Thanks to #Juukamuikit, Inga, Tiina, and all dearest friends in Finland and outside of Finland for your heartwarming friendship. Last, but not least, thank you Steve for being there for me every day.

LIST OF ORIGINAL ARTICLES

This thesis consists of an introductory review followed by four research papers. The papers in the review are referred to by their Roman numerals. Articles I, IV, and V are reprinted with permission from the publishers, while articles and II and III are the author's version of the manuscript.

I Korhonen J., Toppinen A., Cubbage F., Kuuluvainen J. (2014). Factors driving investment in planted forests: a comparison between OECD and non-OECD countries. International Forestry Review 16 (1): 67–77. http://www.bioone.org/doi/full/10.1505/146554814811031314

II Korhonen J., Zhang Y., Toppinen A. (2015). Examining timberland ownership and control strategies in the global forest sector. Manuscript.

III Korhonen J., Toppinen A., Kuuluvainen J., Prestemon J., Cubbage F. (2015). An empirical evaluation of paper and paperboard demand in the 21st century. Manuscript.

IV Korhonen J., Pätäri S., Toppinen A., Tuppura, A. (2015). The role of environmental regulation in the future competitiveness of the pulp and paper industry: the case of the sulfur emissions directive in Northern Europe. Journal of Cleaner Production 108: 864–872 http://dx.doi.org/10.1016/j.jclepro.2015.06.003

V Pätäri S., Tuppura A., Toppinen A., Korhonen J. (2015). Global sustainability megaforces in shaping the future of the European pulp and paper industry towards the bioeconomy. Forest Policy and Economics 66: 38–46. http://dx.doi.org/10.1016/j.forpol.2015.10.009

DIVISION OF LABOUR IN CO-AUTHORED ARTICLES

	I	II	III	IV	V
Conception & design	JKo, FC	JKo	JKo	SP, ATo, ATu	SP, ATo, ATu
Planning & implementation	JKo	JKo	JKo	ATo, ATu, SP, JKo	SP, ATo, ATu, JKo
Data collection	JKo	JKo, YZ	JKo	SP, ATu	SP, ATu
Analysis & interpretation	JKo, JKu	JKo, YZ	JKo, JP	ATo, ATu, SP, JKo	SP, ATo, ATu, JKo
Writing the article	JKo, ATo, FC, JKu	JKo, YZ, ATo	JKo, ATO, JP, JKu, FC	SP, ATo, ATu, JKo	SP, ATo, ATu, JKo
Overall responsibility	JKo	JKo	JKo	JKo	JKo

JKo = Jaana Korhonen, ATo = Anne Toppinen, JKu = Jari Kuuluvainen, FC = Frederick Cubbage, JP = Jeffrey P. Prestemon, YZ = Yijing Zhang, SP = Satu Pätäri, ATu = Anni Tuppura

TABLE OF CONTENTS

1 INTRODUCTION

1.1 Toward a competitive forest-based bioeconomy

The transition into equitable and sustainable production and consumption is high on the political agenda throughout the World. For example, the European Union (EU) and national-level bioeconomy[1] strategies in Europe highlight the role of innovative biomass-based products in the emergence of low-carbon economies, which increases new income and provides employment opportunities (Hetemäki 2014). Similarly, e.g. the U.S. National Bioeconomy Blueprint from 2012 emphasized the role of research and innovation in the biological sciences in creating economic activity and public benefit. In the context of forest-based sectors, the European commission blueprint (EC 2013) underlines the importance of stimulating sectoral transition with radical innovation, structural adaptation, production efficiency, and product and service quality, to allow for market growth both within and outside the EU. The role of the private sector is likely grow, and environmental health and safety originating from the viewpoint of sustainability of the international business viewpoint receive increasing attention as highlighted also in the recently published sustainable development goals (SDGs) issued by the United Nations (UN 2014).

Forests contribute toward economic, ecological and social sustainability and their role in sustainable development will be further emphasized in the future. The area of planted forests has increased concurrently with an increase in global demand for fiber, fuel, and energy (Barua et al. 2014). The area of these forests currently accounts for 7% of the total 3.9-Mha global forest area (FRA 2015). However, it is estimated that ca. one third of the total global industrial wood demand is fulfilled by wood originating from plantation forests, although large geographical differences exist (Barua et al. 2014).

Given the rapid growth in the trade of the market pulp over the past 20 years, particularly into Asia (FAOSTAT 2015), it is becoming clear that access to sustainably managed wood fiber has become an increasingly important strategic economic issue in the forest sector. Furthermore, scarcening resources, the emergence of the bioeconomy, and reorganization of

[1] The European Union (EU) defines Bioeconomy as "Encompassing the sustainable production of renewable resources from land, fisheries and aquaculture environments and their conversion into food, feed, fiber bio-based products and bioenergy as well as the related public goods. It includes agriculture, forestry, fisheries, food and pulp and paper production, as well as parts of chemical, biotechnological and energy industries

global industrial forest ownership can increase the competition of forestland both between firms and industries in the sector and outside the sectors. The reorganization of forest ownership at the global level has profoundly impacted the supply of forest products, but these impacts have received little scholarly attention (Hansen et al. 2013). Direct forest ownership or control strategies may allow companies for companies to use their resources to succeed in volatile international markets (Yin et al. 2000; Kaufmann & Carter 2006), especially if a shift toward higher value-added products due to bioeconomy policies results in rising market prices of wood, as speculated by some authors (Ollikainen 2014; Weimar et al. 2014).

The structural changes in the pulp and paper sector have also been driven by globalization with increasing numbers of multinational companies (Hetemäki et al. 2013). The international expansion of the forest sector has been fast and especially the share of international trade has increased rapidly. For example, the value of exports increased 72% between 2000 and 2014 (FAO 2015). Simultaneously, the value of global exports of industrial roundwood has more than doubled between 2000 and 2014, exceeding 18.6 billion $US in 2014 (FAOSTAT 2015). Furthermore, traditional forest sector areas have lost their competitiveness compared to the emerging regions in terms of investment attractiveness. The share of foreign direct investment (FDI) flows in the wood product industry allocated to developing and transition economies was 18.8% in 1990–1992, but had already increased to 73% in 2009–2011 (WIR 2013; Zhang 2014).

According to Kozak (2013, p. 432) "*there is no force – be it climate change, pests, disease, fire, poverty, and so on – that has as big an impact on the current and future states of our forests as business has*". Environmental (and social) concerns are concurrently increased along with forest sector globalization. The Earth's Planetary Boundaries have been pushed close to severe threat especially in terms of climate change, biodiversity loss, and nitrogen input (Rockström et al. 2009). Land-system change, including deforestation, was identified being heavily modified by human activities (Steffen et al. 2015). KPMG (2012) identified altogether ten interlinked sustainability megaforces including water and resource scarcity, urbanization, demand for energy and fuel, which are going to influence every business in the future. However, the understanding of strategic issues and the interplay between corporate sustainability and competitiveness from the future perspective is yet limited (Hetemäki et al. 2014).

These factors provide an impetus for studying drivers of future competitiveness in the global forest sector, acknowledging multiple perspectives and different operational scales, and combining historical development and future-oriented approaches.

1.2 Research objectives

The goal of this dissertation is to analyze competitiveness from five different perspectives at four different levels with a scope on the pulp and paper industry (PPI) while integrating economic and sustainability views. More specifically, the objectives of this thesis are to assess the effects of economic and policy factors on the markets and industry investments, and to evaluate the impacts of regulation and megatrends such as sustainability and raw material scarcity related to forestry sector competitiveness. The empirical research problems are approached using both quantitative and qualitative data and analyses (i.e. regression analysis and Delphi future's research). Sector competitiveness is assessed in five different articles, the independent but related research questions of which are:

Article I: *What regional- and national-level factor's influence the development of planted forest areas from the investment viewpoint?*

Article II: *What is the global state of industrial timberland ownership and control among the top 100 pulp and paper companies?*

Article III: *What is the importance of economic and raw material sustainability -driven factors influencing import demand of PPI products in the U.S. and German markets?*

Article IV: *How does environmental regulation influence the future development and success of the PPI?*

Article V: *What is the role of global sustainability megaforces in shaping the future of the European PPI towards a bioeconomy?*

2 THEORETICAL PREMISES FOR FORCES DRIVING COMPETITIVENESS

2.1 What is competitiveness at the national level and how to measure it?

When the concept of competitiveness was introduced in the broader political discussion in the 1980s, it was used to explain why some countries (or some businesses within a country) perform better than others. Competitiveness was closely associated with a high market share and low costs that provided competitive advantage against competitors (Lee & Wilhelm 2010). Consequently, competitiveness was seen as a zero-sum game: a country was able to advance its competitiveness only at the expense of another country.

Today, the World Economic Forum (WEF) defines competitiveness at the national level more holistically as "the set of institutions, policies, and factors that determine the level of productivity of an economy" (WEF 2015 p.4). The IMD World competitiveness yearbook (2015) ranks countries according to their shorter term competitiveness, defining competitiveness as ability to manage all their resources and competencies to facilitate long-term value creation. Competitiveness has an undeniably complex character and it is constantly discussed and debated from different perspectives in industrial policy debate as well as within marketing, management, and policy research.

There is currently an agreement that the competitiveness of a referred subject should rather be measured in relative terms and also with a dynamic component evaluating its future prospects (Aiginger & Vogel 2015). The challenge to measuring competitiveness derives from the difficulty to fully understand the drivers that are the cause of long-term performance differences across countries, industries and firms (Costanza et al. 2015; WEF 2015). Many of the best known rating reports, such as the Global Competitiveness Report by the World Economic Forum, the IMD World competitiveness rankings, the World Bank's Doing business ranking, or the European commission's 2020 growth strategy are largely based on the productivity-focused approach originating from work by Michael Porter (1990) and Paul Krugman (1994).

The above-mentioned competitiveness reports can give a basic idea of structural competitiveness across different countries, referring to the circumstances for economic productivity growth and investment attractiveness in these, but they may not be sufficient to understanding the competitiveness across different sectors in a holistic manner. Developed

countries (such as Finland and Sweden) typically dominate the highest rankings in international competiveness reports despite their weakened position compared to actual investment growth in the pulp and paper sector, e.g. in comparison to Asian and Latin American countries (Zhang et al. 2014).

According to criticism, competitiveness as a concept does not provide sufficient information for practical decision-making and its use as a basis for industrial policy recommendations may lead to undesired decisions, especially if assessed at the national level (Krugman 1994). Hay (2012) stated that it is cost-competitiveness rather than general competitiveness itself that is "dangerous", and argues that the concept is often misunderstood in discourse and in the competitiveness process calling for a more holistic approach on the topic. While the economies in both developing and advanced regions are subscribing to the notion of inclusive growth in their competitiveness discourse, there is growing interest towards striking a balance between different aspects of competitiveness, including economic, social, and environmental sustainability (WEF 2015).

In academia, two — somewhat competing — schools of thought exist: Firstly, the economic school that discusses national competitiveness through success in international trade and competitive advantage emphasizing the sectorial composition of trade between countries (Smith 2010; Weimar et al. 2014). Articles I and III assess competitiveness through the lenses of economics, focusing on competitiveness in international trade and investment attractiveness. The articles consider individual countries as separate units of analysis, despite the impacts on relative competitiveness being measured in a more aggregated environment in article I and in individual markets in article III.

Secondly, the management school that focuses on international competition at the country level and emphasizes more country-specific advantages as a source of the international competitive advantage of firms (Porter 1990; Mehotra & Kant 2010; Kanter 2012). Furthermore, the newest stream on management literature emphasizes the role of environmental and social responsibility as an integral and essential part of successful economic performance in long-term competitiveness (see Herciu & Ogrean 2008). Article II derives its views from the management school, focusing on firm-level forest ownership strategies across different countries and regions as a driver of competitiveness. The articles IV and V incorporate from the perspective of management school, the effects which higher aspirations for sustainability have for the future competitiveness in northern Europe. Respectively, articles IV and V do not measure competitiveness quantitatively, but focus on the drivers of industrial competitiveness.

2.2 Strategies to competitiveness

Concurrent industrial policy literature identifies two alternative strategies – a low and high road to competitiveness – for adapting to the transitioning world (Aiginger et al. 2013) (Figure 1). The low road to competitiveness -strategy focuses on price competitiveness and identifies social programs and environmental regulation as costs hampering competitiveness. The high road to competitiveness is based on innovations, the production of higher value-added products and services by enhancing product quality and related services, and based also upon higher environmental sustainability by adopting standards beyond current laws and even supporting the emergence of new standards.

Each of the research questions of the individual articles included in this thesis relate to the adaptation of the high-road strategy in the forest sector from the perspective of environmental sustainability. The principal motivation for understanding the global trends in planted and industrial forests in articles I and II is that they link with economic, environmental, and social sustainability, despite that sustainability aspects were not the core focus of these studies. Furthermore, the adaptation of the increasing environmental regulation and different sustainability challenges in the global competitive sphere of the forest sector is identified in articles IV and V as a key issue for achieving sustainable competitiveness in the industry. The influence of increased price competition and role of economic activity on international trade flows in global markets is assessed in article III. There, the analysis was expanded to include the effect of regulatory and voluntary-based sustainability policy implementation in the producer countries.

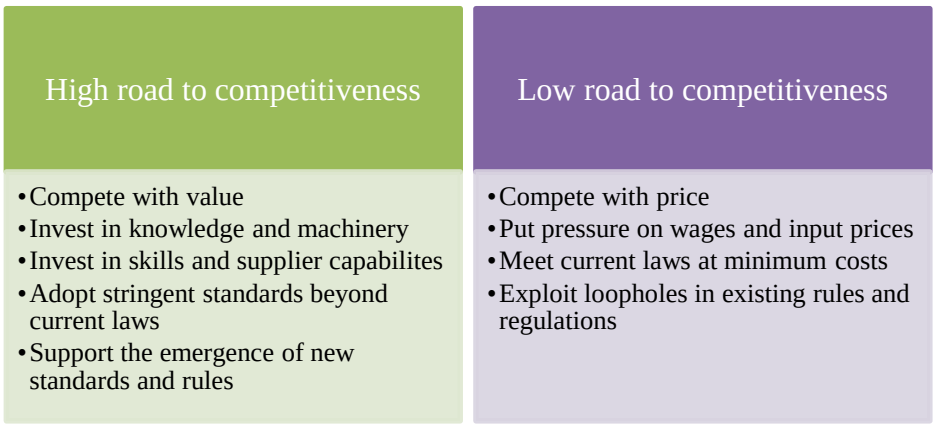

Figure 1. The emphasis areas of the high and low road to competitiveness strategies (Adapted from Ketels & Protsiy 2013).

2.3 Industrial-level competitiveness

At the industry or firm level, competitiveness is often discussed as the ability to perform better in terms of value creation than competitors over time. For example, D'Cruz (1992) defined competitiveness as the ability of a firm to design, produce, and/or market products superior to those offered by competitors, considering price and non-price qualities.

The competitiveness of a nation in a particular industry can be seen as a "bottom-up" process, where industry-level competitiveness in a specific country context builds grounds for firm-level competitiveness. According to Porter's diamond model, the competitive advantage in international markets depends on four interlinked determinants (Figure 2): (1) *Factor conditions*, which provide country-specific advantage (CSA) such as raw material availability, skilled labor, and infrastructure. The factor conditions form the backbone of success of a particular industry. (2) The sophistication of the *demand condition* is the ultimate driver for firms to innovate and gain the first mover advantage in international markets (Porter & Kramer 2006). (3) *Firm strategy and rivalry* builds on firm-specific advantage (FSA)[2] that determines how companies are created, organized, and managed. (4) *Related and supporting industries* provide e.g. the most cost-efficient inputs, and provide innovation and upgrading.

The Porter model has been criticized for being inadequate especially for small export-driven economies. International competition on one hand forces companies to adapt to the pressures originating from the international markets and on the other hand provides the opportunity to benefit from a cluster at a supranational level (Rugman & D'Cruz 1991; Davis & Ellis 2000; Rugman & Verbeke 2004). Additionally, the model is argued to be useable only for developed countries as it was developed based on examples taken from them (Rugman 2011). In alterations of the model, the capability of firms engaged in value-adding activities over long periods of time despite international competition in a specific industry or a particular country, are analyzed beyond competitiveness in the home country (See e.g. Dunning 1988; Rugman & D'Cruz 1991).

[2] FSA includes e.g. production knowledge, networks, financial resources, and other managerial or marketing capabilities (Johansson & Vahlne 2009; Buckley & Casson 2011; Rugman et al. 2012). These are not assessed in this thesis.

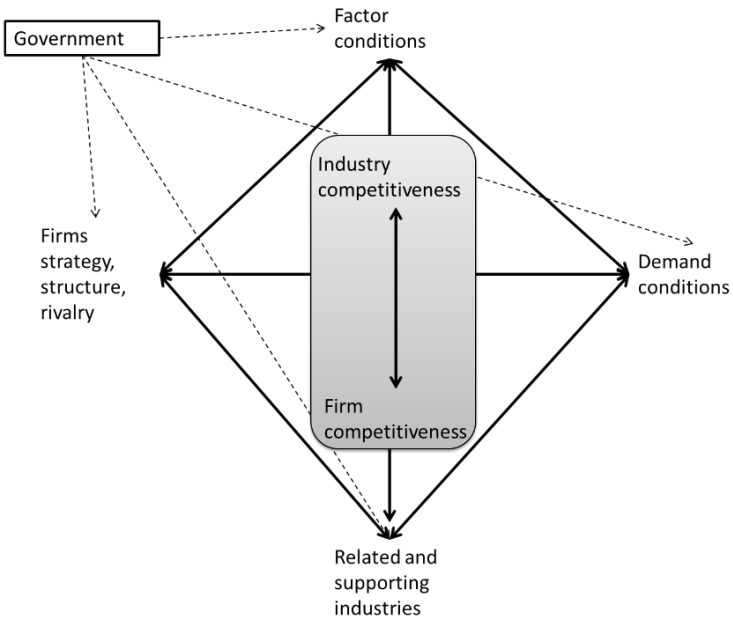

Figure 2. Porter's diamond, and a bottom-up view on competitiveness (Based on Porter 1990).

In the original diamond model or its applications, the government cannot create competitiveness, but plays a role in building favorable underlying conditions in the diamond where firms are able to renew and succeed over time. The models do not recognize how and through which channels government actions or other regulation pressures influences the national environment and they could be developed to integrate determinants such as legal and institutional framework (Weimar et al. 2014). Furthermore, theories are probably incapable of explaining the structure and competitiveness linkages of more complicated and diverse global networks beyond the bilateral trade flow relationships (Midttun 2008; Smith 2010). Lastly, the models deriving from Porter's diamond are also criticized for their removal of the comparative advantage flowing from natural resource endowment (Mehrotra & Kant 2010).

It has been argued that the diamond model can be used as a broader *framework*[3] for analysis that enhances our understanding of the international competitiveness of industries (see examples from the forest sector: Sasatani 2009; Brown 2010; Mehrotra & Kant 2010).

[3] Framework referring to a basic structure underlying a system or concept.

In this thesis industrial competitiveness is also analyzed in an international sphere beyond the home-based cluster, and the individual research questions derive from the different components defining the competitive environment of the forest sector.

2.4 Environmental regulation enhancing industrial competitiveness

At the national level, the industrial policies targeting competitiveness and environmental policies share complementary objectives. They aim to increase social welfare and to correct market failures. Whereas economic policies focus on improving economic productivity, environmental regulations seek to mandate industries to internalize their negative environmental effects.

The anticipated effect of national environmental regulation on industrial and firm level competitiveness varies between neoclassical and more dynamic traditions of economic thought. Thus, the impact of national environmental regulation continues to be controversially debated reflecting the political concerns related to the topic (Peuckert 2014; Taylor et al. 2015). Under neoclassical assumptions the international competitiveness of industries is deterred by strengthening environmental regulation because the regulation imposes new constrains and costs for firms. However, most of the studies concluding this are based on contemporaneous evaluation which may hamper understanding of the long-term potential in adopting through technological change and innovation due to stricter environmental regulation (Lanoie et al. 2008; Peuckert 2014).

Porter (1990) and Porter and van der Linde (1995) proposed that well-designed and well-implemented regulation creates win-win situation for the environment and firms. According to the Porter hypothesis, environmental regulation may improve firm level competitiveness and offset compliance costs by driving resource efficiency and new innovations by achieving first-mover advantages (Porter & Van der Linde 1995; Porter & Kramer 2006). Similarly, Haq et al. (2001) state that while environmental standards and regulations may impose burdens on industries, they may also result in the emergence of new, environmentally sounder technologies that alleviate the increased costs for those who "seize their opportunities". Vahlne & Ivarsson (2014) suggest that as global competition tightens, firm responsiveness toward local/host country regulatory standards is likely becoming more crucial for its success.

The impact of regulation on competitiveness varies between different sectors and geographical regions (Iraldo et al. 2011). Effectiveness of regulation in achieving anticipated outcomes and economic efficiency is connected also with its regulatory design (Taylor et al. 2015). Iraldo et al. (2011) concludes that the relationship between environmental regulation and competitiveness depends not only regulatory source and form, but also from the environmental assets it is seeking to protect.

In general, different regulatory instruments aimed at reducing environmental impacts can be divided into legally binding obligations ("hard law" direct regulation), the use of economic instruments (taxes, subsidies), and the use of soft instruments ("soft law" or market-based governance), or the instrument can also be a mixture of these hard- and soft-law elements (Abbott & Snidal 2000). Typical problems of legally binding "one size fits all" -regulation are low cost-efficiency, long negotiation times and a lack of operator incentives to move beyond compliance, which has led to an increasing interest in more flexible or proactive regulation that provides opportunities for interactive and broader stakeholder engagement in environmental policy-making (Howlett 2004; Ribeiro & Kruglianskas 2015).

Furthermore, according to European Union (2011), corporate environmental and social responsibility (CSR or CR) is referred to as corporate initiatives that evaluate and take responsibility beyond law-abiding regulation for the company impacts on society and environment (See also Boulouta & Pitelis 2014 for more detail). In the context of forest industry, corporate environmental and social responsibility (CSR or CR), and competitiveness in terms of financial performance have also been addressed (see Li & Toppinen 2011), but results from the empirical analyses concerning these relationships have shown only weak interlinkages (Li et al. 2014).

2.5 Forests as a sustainable strategic resource for industry

Sustainable forest management is defined by FAO as "the stewardship and use of forests and forest lands in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfill, now and in the future, relevant ecological, economic and social functions, at local, national and global level, and that does not cause damage to other ecosystems" (Paavilainen 1994). Sustainability on the general industrial level refers to maintaining the ability of natural systems to provide natural resources and ecosystem services upon which economies and societies depend. Furthermore,

it is nowadays not only seen as an integral part of the creation of competitive advantage among the industrial players but also as a means to solve societal problems (Hart & Dowell 2011) and consequently, incorporating sustainability aspects in the core business strategy is a way forward not only for promoting innovations and productivity growth, but also for creating shared value in society (Porter & Kramer 2011).

Fernholz et al. (2007) list the consolidation of forest products companies through mergers and acquisition, globalization of the forest sector and fiber supplies, and the past poor financial performance of the pulp and paper industry as reasons why forest product companies have been forced to reevaluate the role of timberland as a strategic asset. The industrial forest ownership strategies is argued as being purely economic-driven (Sun et al. 2013; Lönnstedt & Sedjo 2011; Li & Zhang 2014) and the literature has heavily focused on North America and Europe (see e.g. Lönnstedt & Sedjo 2011; Li & Zhang 2014). Despite the strategic asset-seeking investments from emerging economies have increased their importance in global investment (Gammeltoft et al. 2012).

Zhang (2001) claims that there is a relatively large magnitude of transaction costs to production costs in the case of forest industry, and these costs have a strong role in evaluating managerial and policy decisions. The transaction cost motivation for resource ownership is more likely to occur for more complex inputs, when the high frequency of transactions and when the environment within which the firms operate are more uncertain (Lönnstedt & Sedjo 2011; Li & Zhang 2014). Forest ownership can also form an entry barrier for potential competitors by forcing them to enter in both the input and production stages of the value chain, leaving the open market thin for their competitors (O'Laughlin & Ellefson 1982).

The rationale for acquiring resources beyond the short-term cost minimization strategy perspective can be also drawn from the resource-based view of the firm (RBV) (Penrose 1959). The RBV suggest that firms acquire resources which are valuable and rare, and difficult to replicate or replace to gain a competitive advantage in a product market (i.e., so called VRIN resources, see Barney 1991). The RBV also suggests that the acquisition, integration and deployment of resources explains the variance between company performance (Wernerfelt 1984; Barney 1991).

The natural resource -based view (NRBV, Hart 1995) discusses constraints for competitive advantage deriving particularly from the possession of natural resources and the firm's relationship to its natural environment. In NRBV model, the product stewardship proposition highlights the importance of knowing and controlling the entire value chain that can create competitive advantage by providing exclusive access to renewable raw materials.

The recent literature on NRBV also considers the firm's relationship with external stakeholders and socioeconomic drivers (Prahalad & Hart 2002; Hart & Dowell 2011). Furthermore, a firm's decision to acquire certain resources may be reduced by external social pressure, such as regulation or stakeholder pressure, and socially responsible firms may be unwilling to acquire resources that lack legitimacy or fail to grant social license for operating among local stakeholders (Oliver 1997; Gunningham et al. 2004; Duran & Bajo 2014).

2.6 International trade competitiveness of producer countries

Much of the literature on national-level competitiveness in international trade in the forestry sector relies on the economic theory that explains international competitiveness basically as advantages in prices or exchange rate (e.g. Hänninen & Toppinen 1999; Daigneault et al. 2008; Saquet et al. 2011).

In reality, as many studies have shown, prices are not the only factors determining forest product trade competitiveness. For example, in the printing and writing paper trade models have been extended to include the effects of urbanization and the rapid increases in electronic media that are reducing the demand for printing and writing paper (e.g. McCarthy & Lei 2010; Hujala 2011), highlighting the importance of linking socioeconomic development and cultural factors with consumer trends.

From the perspective of supply, wood raw material availability has been identified as a key determinant in building comparative advantage between supplier countries in international markets (Bonnefoi & Buongiorno 1990; Prestemon & Buongiorno 1997). Contradictorily, a study by Uusivuori & Tervo (2002) observed that resource availability has become less important for OECD countries towards the new millennium. Earlier results seem to be sensitive to the selection of unit and context of analysis[4].

[4] Prestemon & Buongiorno (1997) tested the model both with aggregate data as well as with disaggregated data between lumber and wood products and paper and allied industries focusing on in interstate U.S. context. Uusivuori & Tervo (2002) respectively tested for roundwood exports and forest product exports, without dividing the forest products into subgroups.

Moreover, the increasing awareness of different sustainability-oriented stakeholder groups including consumers, financers, and environmental non-governmental organizations (ENGOs) working for the environment has become an important market and policy driver (Dauvergne & Lister 2011; Cashore & Stone 2014; Johansson 2014). Consumer attitudes and interest toward environmental sustainability policies targeted to ensure the legality and sustainability of raw material typically differ between countries within a region or across regions. In this case, the consumer preferences affect the market share of the supplier countries and reputation of the product or producer can become a burden to reach competitiveness (Rantala 2013). For example, Prestemon (2015) showed that the requirements for legality verification for hardwood lumber and hardwood plywood after implementing the Lacey Act 1900 amendment in 2008 interfered with the international trade competitiveness of different supplier countries as measured by import quantities in the U.S. markets. The effects of these policies undeniably affect international trade, but their actual market impacts have yet not been commonly incorporated into previous modelling studies (e.g., Johansson 2014).

Trade modeling studies applying time series or panel data methods to evaluate forest product markets mostly focus on aggregate global or regional demand for various forest products simultaneously or in several cross-sectional units (see review in Toppinen & Kuuluvainen 2010). However, drawing conclusions and policy recommendations based on region-specific or more aggregate-level analysis may result in undesired outcomes (McCarthy & Lei 2010).

The classical Armington model (Armington 1969) can be applied to examine the trade at the individual-market based on demand-side behavior. The approach is suitable when there is reason to assume that products from different countries are imperfect substitutes for each other. The model has been applied to analyzing the forestry sector at the aggregated level in studies focusing on e.g. plywood, sawnwood, and paper imports and exports (Chou & Buongiorno 1983; Laaksonen et al. 1997; Gan 2006; Saquet et al. 2011). However, the classical Armington model does have two major restrictions. Firstly, each country's market share at the exporting destination is assumed to be determined by the relative prices of the same product across supplier countries. This assumption further implies that market size does not affect each supplier country's market share and the expenditure elasticities are the same. Secondly, the classical Armington model assumes constant elasticities of substitution between imports from different source countries. The constant elasticity assumption implies

that the elasticity of substitution between the supplier countries is independent of the quantity demanded and is the same between any countries (Feenstra 2010).

3 RESEARCH DESIGN

3.1 General

The research design is described in this section to provide a foundation for Chapter 4, which presents the five research articles and summarizes their key findings. Figure 3 presents the theoretical framework and position of the individual articles in this thesis. As the significance of regional clusters has already diminished due to increased technological transfer, firms in the contemporary forest industrial setting can be seen increasingly as operating in "supranational clusters". The analysis is thus conducted in the international sphere based on the assumption that macro-level competitiveness builds on micro-level competitiveness and vice versa. The focus is on the competition between producer countries or regions, although firm-level competition is also studied in article II.

Furthermore, the globalization and emergence of a bioeconomy affects the entire sector, and these effects are assumed to be channeled especially through (law-abiding and voluntary) regulation. Articles I, II, and III assess trends related to forest resources, which can be seen as highly linked to the role of factor conditions in the creation of industrial-level competitive advantage. The role of demand conditions and consumer awareness emphasizing the demand for environmental sustainability in international trade and among industrial players is studied in articles III, IV, and V. Firm strategy and rivalry is examined in article II in terms of industrial forest ownership and control strategies. The role of related and supporting industries in the creation of competitive advantage is addressed in article IV from the sustainability of marine transportation viewpoint in the context of Europe. The articles I–III are based on assessment of statistical interference, whereas the articles IV and V focus on the collection and the assessment of the evidence collected by surveying experts in PPI.

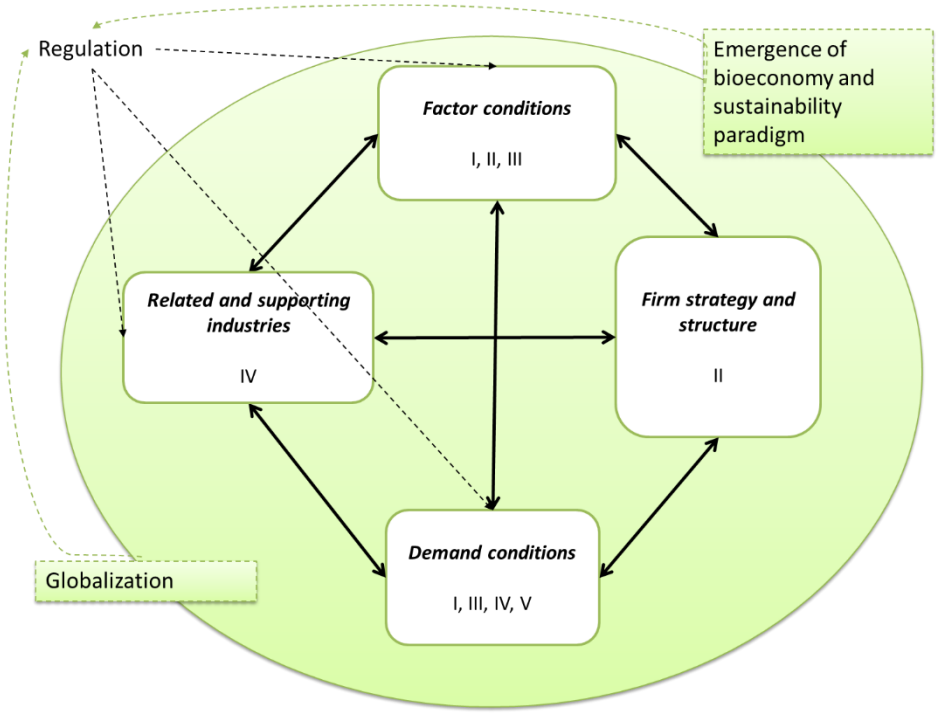

Figure 3. Theoretical framework and position of individual articles I–V.

The mixed-methods approach was chosen to examine the different dimensions of the research question on what drives forest sector competitiveness now and in the future. Competitiveness is a multi-perspective concept that makes it reasonable to combine quantitative and qualitative methods to assess the research question in the forest sector context. This is done by examining the topic from five different perspectives and at four different levels in the complementary research papers. The assessment is based on both quantitative data drawn from secondary data sources, and on qualitative primary data collected using the Delphi method. Especially in the first three quantitative articles, the different dimensions of competitiveness are assumed to be based upon the past and current market conditions. In comparison, articles IV and V based on the Delphi method evaluating future competitiveness from a slightly more normative perspective, where the interplay of evolving environmental regulation, global "sustainability megatrends", and industrial competitiveness is seen to derive from certain possible future events and assumptions on development (see Cheng et al. 2008). Figure 4 gives an overview of the sources of data collection and methods used in assessing the research questions in each article.

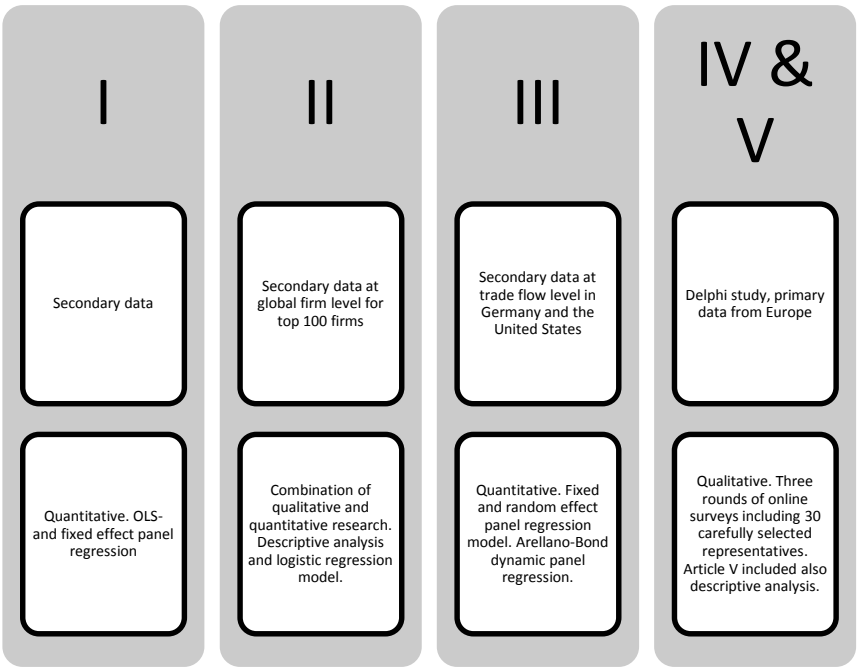

Figure 4. Summary of data collection and methods.

3.2 Quantitative methods

The panel or longitudinal data methods are under scrutiny and their use allows us to examine issues that could not be studied in either cross-sectional or time-series settings alone. Panel regression models are widely used in the social sciences and econometrics because the methods allow investigating economic processes while accounting for both heterogeneity across cross-sectional units and for the dynamic effects that are not visible in the cross section (Greene 2012, p. 343). The panel data methods are becoming more popular because they have proven to possess major advantages over conventional cross-sectional and time-series data (Hsiao 2007).

In this study, different panel regression specifications were used in articles I and III to examine causal relationships between different factors using cross-sectional time-series data. All data were in logarithmic form, to normalize the data and be able to interpret the coefficients directly as elasticities. The relationship between planted forest area development and several macroeconomic, institutional, and forest sector factors were assessed in article I to examine the trends of global planted forest area development in OECD and non-OECD

regions during 1990–2010. Panel regression methods were additionally also utilized in article III by applying the Armington approach, focusing on trade flows of paper products to Germany and the U.S. during the turbulent 21st century.

The key in controlling for confounding influences in applied quantitative research is to check the robustness of findings using alternative identifying assumptions (Angrist & Pischke 2008). The most common specifications based on different identifying assumptions in panel data modeling are:

1) *Pooled regression model,* which assumes that no differences exist between the cross-sectional units. The model estimates a common constant for all cross-sections.
2) *Fixed-effect model (FE)* assumes that the time-invariant characteristics of an entity or an individual are possibly correlated with regressors. It is also assumed that the time invariants are unique to the entity and should not be correlated with other characteristics. The FE model removes the effects of these time-invariant characteristics when assessing the net effect of predictors on the outcome variable. The model assumes that the unobserved heterogeneity is constant over time and is suitable whenever the focal interest is assessing the impacts of variables that vary over time.
3) *Random-effect model (RE)* assumes individual effects are not correlated with regressors and the variation across entities or individuals is assumed to be random and uncorrelated with the regressors. The advantage of the random-effect model is that you can include time-invariant regressors in the model.

Furthermore, the methods building on the assumption that unobserved panel-level effects are correlated with the lags of dependent variables are classified as dynamic panel methods. As the lags of dependent variables are correlated with idiosyncratic errors, the static methods such as fixed-effect or random-effect estimators become inconsistent. The Arellano-Bond (1991) (AB) method can be used for accounting for the dynamic nature of data to obtain consistent estimates if autocorrelation is present. The Arellano-Bond method was applied in article III. In publication I the dynamics were not taken into account because there were only four data points in the data set. Different model specifications can be compered by utilizing different statistical tests and examining their theoretical fit.

The standard *binary logistic regression* model was used in article II to study the influence of organizational characteristics of 100 large pulp and paper companies with the likelihood

of owning or controlling timberland. Descriptive analysis was used in article II as complementary to logistic regression to examine the global ownership and control strategies among pulp and paper companies. Due to the lack of scholarly literature on industrial forest ownership strategies, the descriptive statistics themselves were seen as sufficient for conducting an investigation on the nature of exploratory research concerning global industrial forest ownership and control strategies and used in addition to logistic regression modeling. In exploratory data analysis data can be utilized to gain information beyond the formal modeling and causal analysis, as was done in article II. Because we limit the study to 100 companies, bootstrap logistics regression (with a number of resampling grounds 500) was applied to see whether the asymptotic standard errors generalized from the maximum likelihood estimate are correctly estimated in the small sample to further validate the results of the study.

3.3 Quantitative data collection

The statistical data were collected from secondary public data sources for the articles I, II and III, which are briefly introduced here. The country-level indicators for macroeconomic and institutional factors used in article I were collected from the World Bank database (http://data.worldbank.org), and Transparency International database (www.transparency.org).

The cross-sectional forest sector data used in articles I and III were obtained through the Food and Agricultural Organization of the United Nations (FAO) inventory data (FAO 2011 and 2006) and the Global Forestry Statistic and Forestry trade flows databases available through (http://faostat.fao.org). The data on forest areas under the Forest Stewardship Council (FSC) and the Programme for the Endorsement forest certification (PEFC) were obtained from United Nation Environmental Program database (UNEP) (http://www.unep.org/), as well as the certifying organizations' webpages (https://ic.fsc.org, http://www.pefc.org). The level of average forest productivity was obtained either through FAO, from a summary report by Cubbage *et al*. (2010) for plantation investment analysis, or the estimated values were obtained from consultations with forestry experts.

The list of 100 largest pulp and paper companies in 2012 analyzed in article II was obtained from the Global Forests, Paper & Packaging Survey by PricewaterhouseCoopers (2013). Corporate operational information concerning company background, business orientation, location, and timberland ownership and control status in 2012 was collected from

reports by PricewaterhouseCoopers and the Pulp and Paper international magazine, as well as corporate financial reports and corporate sustainability reports.

3.4 Qualitative studies –Delphi method

Article IV examines the effect of environmental regulation on future competitiveness of the European PPI by eliciting expert opinions on the topic. Article V assess the role of sustainability megaforces in shaping the future of European PPI by similarly relying on expert opinions. The topics were examined with the Dephi method, which is a future studies technique used for the qualitative exploration of complex issues when expert opinions are often the only source of information due to a lack of historical, economic, or technological data (Blind et al. 2001; Wakefield & Watson 2014). The Delphi method consists of a minimum two survey rounds for a panel of experts, where their perceptions on the topic are examined (Landeta 2006; Rowe & Saffer 2014). Whereas traditionally the main objective of the Delphi studies was to find a consensus between the experts participating in the study process, the later applications of Delphi (e.g. Policy Delphi) have valued the variety of ideas that the process generates, and the increased understanding of the reasons behind dissensus (e.g. Landeta 2006; Pätäri 2011; Paré et al. 2013).

Controlled feedback, anonymity, iteration, and a group statistical response have been reported as the key features of a Delphi (Rowe & Wright 1999; Paré et al. 2013). Controlled feedback implies that feedback is given by panelists between each round and controlled by a group coordinator. The anonymity of the participants or their responses is secured in Delphi studies, which also ease the fear of losing face. An iteration means that the procedure, i.e. one survey round, is repeated multiple times and statistical group response means that the final answer is built on all the opinions (Landeta 2006; Von der Gracht 2012). The group size is usually small, and Delphi panelists are asked to participate in the research process, and the research topic typically sharpens from round to round (Kent & Saffer 2014).

One major advantage of the Delphi approach is that it enables the rapid and cost-efficient gathering of opinions from international experts because it utilizes modern information technology applications to reach the specialists (Okoli & Pawlowski 2004). On the other hand, the careless selection of experts, poorly formulated questions, the time required to carry out the study, and difficulty in checking for method accuracy have been identified as weaknesses of the Delphi approach (Landeta 2006). A comparison of the strengths and weaknesses of the Delphi study against traditional survey approaches has been made by e.g. Okoli and Pawlowski (2004), and Pätäri (2009, p.51) (Table 1).

Table 1. The key advantages and weaknesses of the Delphi method (Adapted from Pätäri 2009, p. 54).

Advantages	Weaknessess
Quick and simple, flexible methodology	Potential for poor implementation
Anonymity facilitates honest opinion and encourages taking up a personal viewpoint without group pressure	May lead to quick, hasty replies and the promotion of desired outcomes by the panelists
Selective feedback of relevant information	May lead to conformity
Adaptable and relatively inexpensive to organize and administer	Conceptual and methodological inadequacies
Brings geographically dispersed experts together	Lack of general guidelines for sample size or sampling techniques
Limited time required to complete surveys	Requires participant commitment due to the many survey rounds

3.5 Qualitative data collection

In this study for articles IV and V, we conducted a dissensus-based online Delphi study, with the time scale extended to 2030. The Delphi study consisted of three rounds of online inquiries. The previous rounds served as a basis for the following rounds, where the focus was on the themes and issues that either provoked a lot of opinions and discussion in the previous round or needed further clarification. The overall process was carried out in spring 2014 (from March to June). The research process is presented in Figure 5.

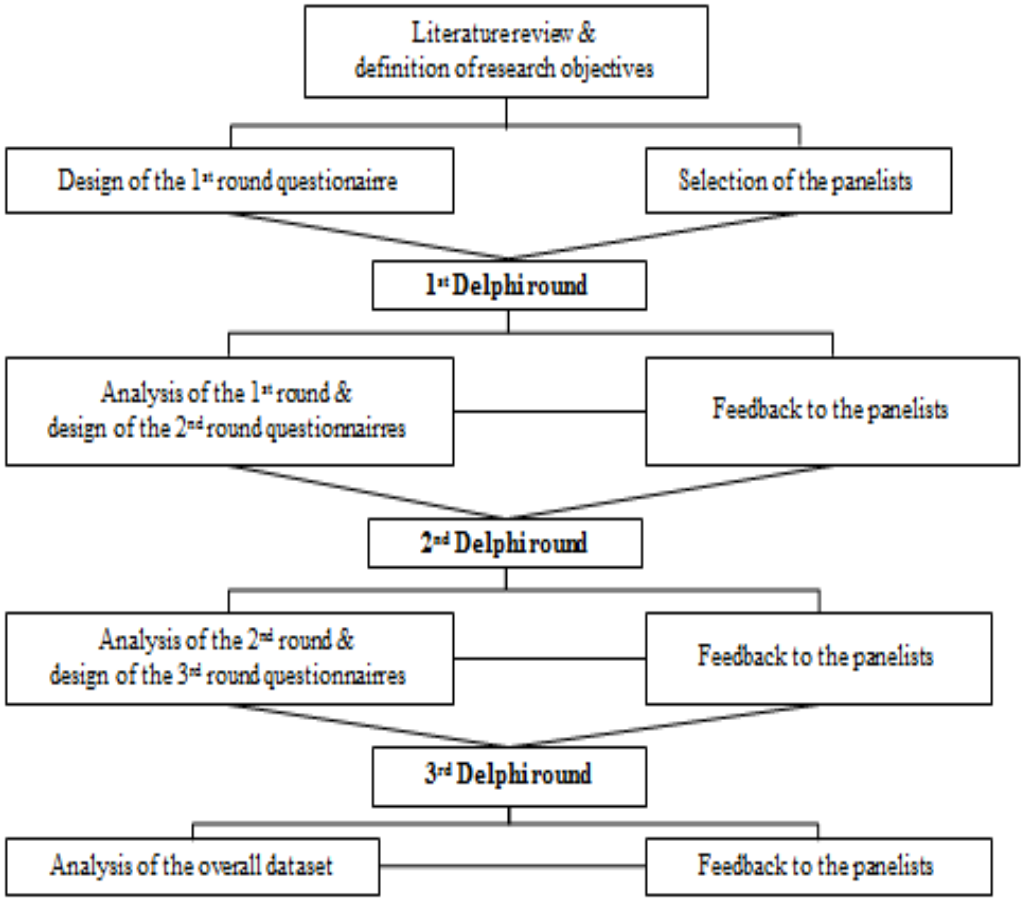

Figure 5. Research process in publication IV and V.

The online questionnaires included both closed questions and statements with response alternatives, as well as open-ended questions. A sample of 30 panelists was carefully selected, nineteen of which responded to the first round questionnaire. The second and third rounds were answered by 17 and 15 panelists, respectively. The panelists were required to have in-depth knowledge of the European PPI, so they can be considered top-level experts in the field. Almost 80% of the experts had over 10 years of experience with the forest sector. All in all, they represented a total of six European countries (Finland, Sweden, Germany, France, the Netherlands and Belgium) and could be categorized into three groups: [1] representatives of the industry associations and other experts, [2] representatives of academia, and [3] industry experts.

4 SUMMARY OF ARTICLES

4.1 Introduction

In this section, the articles included in this dissertation are summarized and their main contributions are discussed one by one. Figure 6 illustrates the different layers and perspectives of competitiveness analysis and their interlinkages between the five articles. The time period from 1990 to 2030 is covered. Different aspect of competitiveness discussed throughout the study can be classified under three themes: resources, regulation, and markets, which all have some connection to the concept of sustainability either at the country/market, industry, or firm level. This thesis is primarily concerned with competitiveness at the firm and country level in the context global pulp and paper industry, where the competing units of analysis are identified as PPI producer countries (I and III), large PPI firms (II), or other sectors or other geographical regions (IV and V).

As competitiveness in global forest sector is characterized by its dependence on the existence of forest resources, the dynamics of the resource development in terms of ownership and availability of sustainable forest resources as drivers of competitiveness were selected as a focus of studies I and II. Article I applies the logic that investment provides the basis for future success (WEF 2015, Mehrotra & Kant 2010), and therefore the factors that drive investment in planted forests are studied.

Relying on the NRBV logic by Hart (1995), the strategic decision to control or own forest can be linked to the firm's ability to perform financially better than its competitors over time,

and therefore article II examines how firm financial success and other background characteristics affect the decision to integrate into the timberland among the largest PPI companies. In study II individual firms serve as a unit of analysis. The other objective of article II is to describe the situation of timberland control and ownership among the largest PPI firms, as there is very limited understanding regarding the industrial timberland ownership among private companies.

In article III country-level competitiveness is operationalized as larger market share compared to its competitors in case of German and the U.S. import markets 2000–2010. As a novelty, the analysis is expanded beyond traditional economic determinants, and the market share of the most important supplier countries in Germany and in the United States is assumed to be affected by the preferences in the demand side. Special focus is placed on the preferences for implementation of forest certification and the rate of recovered paper utilization in producer countries, which theoretically serve as a proxy for product differentiation in terms of sustainability driven policy implementation.

Articles IV and V, respectively, incorporate the effects of higher aspirations for sustainability for the future competitiveness in northern Europe from the perspective of strategic management. The focus is on understanding the perceptions of PPI experts on the ability of firms to adapt to the increasing environmental regulation especially in the context of maritime transportation in Europe in article IV. In article V, adaptability to pressures deriving from ten interlinked global sustainability megaforces, including demand for energy, volatility in fossil fuel markets, increasing material resource scarcity, and ecosystem decline are assessed (See KPMG 2012 for more detail). Adaptation strategies define how well the PPI firms can succeed in the global markets, and how well they are able to exploit the possibilities deriving from increased demand for bio-based products as a results of increased global environmental awareness and related policies. In these studies, the competitiveness is judged based on PPI expert perceptions on industry ability to perform better than its competitors in terms of long-term value creation in international markets.

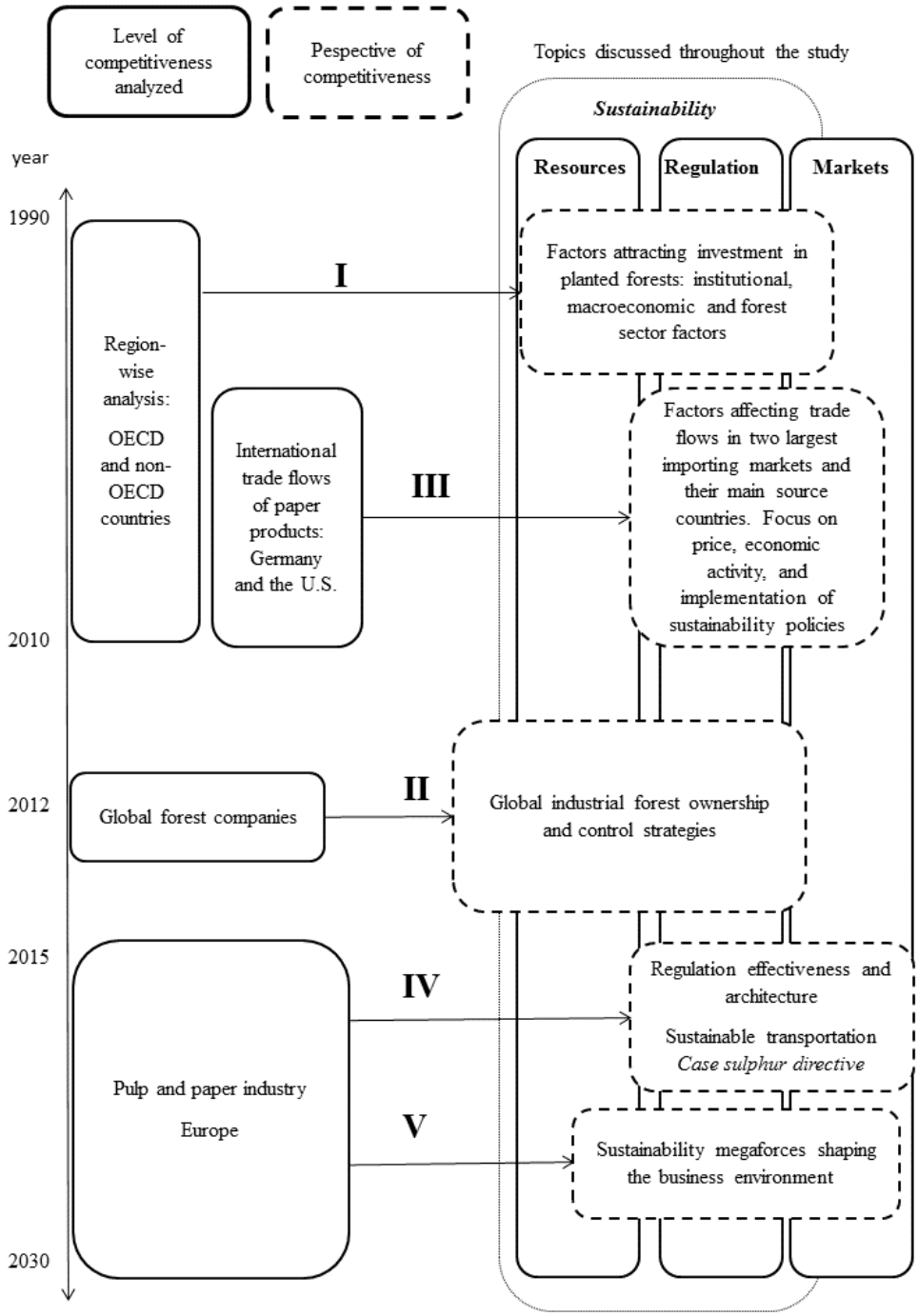

Figure 6. Levels of competitiveness, perspective, and topics discussed in the individual articles I – V.

4.2 Article I: Factors driving investment in planted forests: a comparison between OECD and non-OECD countries

Objective and methods: Article I examined the investment theories and investment location principles for evaluating factors affecting the area of planted forests between 1990 and 2010, relying on the premise that planted forest area expansion requires investment. The motivation for the research derives from the lack of literature on explaining the motives behind the global trends in the development of planted forest area. Panel data estimation methods, namely pooled ordinary least squares (OLS) and the fixed-effect model, were used to empirically estimate the relationship between the area of planted forest, and multiple macroeconomic, institutional, and forest sector factors in 19 OECD and 20 non-OECD countries. Based on the literature review and data availability, we selected four variables for describing the macroeconomic factors affecting the development of planted forests. GDP acted as an indicator for market size. The accessibility of banking credit and the total value of foreign direct investment indicate whether or not the general investment conditions affect the investment decision in planted forests. Furthermore, the presence/level of tariffs indicates the effects of trade barriers on planted forest area development. Corruption index and unemployment rate were selected to describe the institutional environment. Lastly, the forest sector indicators include forest productivity and volume of industrial roundwood production, also capturing industry path-dependency.

Main contribution: The results indicated that forestry sector factors are the key determinants of planted forest area development and that the existing production capacity in both areas is one of the most important determinants of planted forest area development. Another significant factor determining the development in both regions was the market size as measured by the GDP. Furthermore, the tariff level associated positively with investments in planted forests in OECD countries. In non-OECD countries the corruption level associated positively with the planted forest area development.

The impacts and statistical significance of institutional and macroeconomic factors in OECD and non-OECD countries were similar regardless of the estimation methods used, but the magnitude of these elasticities differed. Elasticity values were systematically inelastic (less than one) in the pooled effect model in non-OECD countries whereas the effects proved to be elastic (over one) in OECD countries. However, this difference leveled out and the effect became systematically lower when the fixed-effect model was used. Overall, the results

indicated that the pooled OLS model is able to capture long-run effects of independent variables on the dependent variable. The pooled OLS proved a better fit for the OECD countries. The fixed-effect model was more suitable in non-OECD countries. This may be due to the fact that the planted forestland area was adjusting over time in non-OECD countries, while the overtime variation in planted forestland area in OECD countries was relatively small during the study period.

4.3 Article II: Examining timberland ownership and control strategies in the global forest sector

Objective and methods: This is the first study attempting to explore the global state of industrial timberland ownership, choice of vertical integration strategy, and the effects of corporate background characteristics on this choice among the largest forest industry companies. The sample consisted of 100 of the largest forest product companies in 2012 listed by the Global Forests, Paper & Packaging Industry Survey (PricewaterhouseCoopers 2013). Our interest was in defining the state of industrial timberland ownership and control among the largest PPI companies, and whether or not firm background characteristics and orientation to different products affects the choice of timberland ownership and control. Furthermore, the potential differences in timberland ownership and control strategies between companies between Europe or North America and the rest of the world were assessed. The analysis was implemented as a combination of descriptive analysis and logistic regression analysis.

Main contribution: Our sample consisted of 40 companies that reported direct ownership and 51 companies that reported being integrated with timberland through ownership or leasing arrangements. At the global level, companies reportedly owned approximately 20.0 mha of timberland, 7.3 mha of which are located in South America, 3.6 mha in North America, 2.4 mha in Europe, 1.6 mha in Asia, 1.1 mha in Africa, and 0.2 mha in Oceania. The location of ca. 4 mha remained unspecified. The total forest area reported as owned, controlled, or managed by the companies was approximately 66.0 mha in 2012, 38.0 mha of which was located in Canada, where most of the land is owned by the government and only 7% of the total forest area is under private forest ownership. When compared to the situation in 2007, the total area of industrially owned and -controlled timberland among the

top 100 companies actually increased based on the available data, despite divestments in some locations (North America, Europe).

In practice, companies tended to acquire timberland ownership from the same continent where their headquarters are located, but international diversification was also found to be high, with 42 companies reporting forest ownership or control outside of their home continent. Based on the data, South American forests have attracted a lot of domestic and foreign companies and Asian companies have been particularly active in owning or controlling timberland in Africa and Oceania. According to the data, the timberland investment flows into Africa, Asia, and South America grew between 2007 and 2012, whereas investments in Oceania, Europe, and North America remained stable.

Results from the logistic regression analysis estimation indicate that larger company size and orientation to pulp-production increases the likelihood of being vertically integrated into timberland utilization. Company financial performance was also found to positively affect the choice of vertical integration when the entire sample was concerned, but when the focus was on companies in either emerging or traditional regions, the effect turned out to be insignificant. In Europe and North America, the greater focus on energy production increased the likelihood of a company being vertically integrated, but this effect was not statistically significant in the other parts of the world.

4.4 Article III: An empirical evaluation of paper and paperboard demand in the 21st century

Objective and methods: Article III analyzed the demand of paper and paperboard in the U.S. and German import markets in 2000–2010. Time-series cross-sectional panel data methods were applied to empirically measure the demand elasticities for relative price, economic activity, and two sustainability policies, namely forest certification diffusion rate and recycled paper utilization rate. In the analysis we modeled both countries separately by disaggregating imports from the 10 main countries of origin.

Main contribution: The results indicate that the elasticity of substitution with respect to the relative real price was practically the same in Germany and the U.S. Import demand prove inelastic with respect to relative price, centered around -0.8, for paper and paperboard at both German and U.S. markets, despite their different and diverse collection of supplier countries. It was also found that the import demand for paper and paperboard in the U.S. is slightly

more sensitive to fluctuations in economic activity (elasticities between 0.87 and 0.97) than it was for Germany (elasticities between 0.74 and 0.87), although the differences were marginal between these two countries. Additionally, the value of elasticities found in this study were lower for Germany and higher for the U.S. than the respective elasticities for Europe and North American Free Trade Agreement (NAFTA) countries found in previous study by McCarthy and Lei (2010).

The results indicate that while forest certification is very important for exports aimed at the German and U.S. markets, the preferred certification scheme differed between the two countries. The models for Germany actually demonstrated a dislike for imports of PEFC certified products, while the effect of FSC certification showed a weak positive effect in one of the models examined. In the U.S. market, the model on the other hand showed strong demand preferences for PEFC imports. The results of our study also indicated that importers in neither country prefer imports from countries whose paper and paperboard production is based dominantly on recycled fiber.

4.5 Article IV: The role of environmental regulation in the future competitiveness of the pulp and paper industry: the case of the sulfur emissions directive in Northern Europe

Objective and methods: This study brought insights to the scarce literature on the future competitiveness of the pulp and paper sector from the environmental regulation perspective. The study applied Delphi foresight methods to evaluate positive and negative aspects of regulation for the future success of the industry, using the regulation of sulfur emissions reductions in maritime transport as an example. The Delphi study can be classified as a dissensus-based Delphi design and our aim was to elicit expert opinions on the relative importance of sustainable transportation and other forces that influence the future development of the PPI towards 2030. The Delphi study consisted of three rounds of online surveys carried out during four months (from March to June 2014). The panel included 30 carefully selected representatives of academia, of industry associations, and other experts. The panelists represented six European countries (Finland, Sweden, Germany, France, the Netherlands, and Belgium), and over 70% of respondents had more than 10 years of experience in the forest sector. The questionnaire included both closed and open-ended questions, where the panelists could relatively freely comment and provide arguments for

their opinions. The previous rounds served as a basis for the following rounds, which focused on the themes and issues that either provoked a lot of opinions and discussion during the previous round or needed further clarification. The second and third Delphi rounds consisted of more tailored questions and statements with response alternatives.

Main contribution: Some panelists foresee the role of the government as important in developing the future viability of European PPI, but some did not believe in its capability to function as a catalyst for boosting the competitiveness of the industry. From the business perspective, the panelists saw tightening regulation as both a threat and an opportunity, depending on the time scale. These results accentuate the importance of recognizing the opportunity to gain market benefits from greening the entire supply chain, e.g. by building customer awareness and raising the global standards for environmental sustainability across all industries. In general, the increased interest in sustainability and growing environmental awareness among consumers and producers around the world was perceived likely to benefit countries and areas that have high standards for their environmental operations and management.

The tightening regulation on maritime transport was seen as a negative phenomenon, increasing costs and placing the Northern European PPI in an unequal position compared to the world's other production regions. However, the differences between expected (short-run) adjustment costs and possible business benefits over a longer time perspective, and foreseen benefits from building front-runner capabilities in environmental sustainability, were also clearly recognized by panelists. Furthermore, the results highlight the complementary role of law-abiding and voluntary regulation where the costs of implementation is shared equally between international competitors.

4.6 Article V: Global sustainability megaforces in shaping the future of the European pulp and paper industry towards a bioeconomy

Objective and methods: The objective of this study was to provide information on the current role of sustainability as megaforces in the European PPI, and explore what embedded potential threats and opportunities can be identified shaping the future of the European PPI in 2030. Furthermore, the study revealed the perceived relative importance of the ten sustainability megaforces now and in 2030 using the same Delphi methodology as in article IV. For the assessment we used the ten major sustainability megaforces identified by KPMG

(2012) that are going to influence business environments globally: climate change, deforestation, energy and fuel, wealth, urbanization, population growth, food security, ecosystem decline, material resource scarcity, and water scarcity.

Main contribution: The panelists identified a greater demand for energy, volatility of fossil fuels markets, and increasing resource scarcity as the most influential sustainability megaforces shaping the European PPI towards 2030. All other megaforces except global ecosystem decline and resource scarcity were perceived by panelists more as opportunities than threats to the European PPI business, indicating that designed energy and environmental policies have the potential to advance a paradigm change towards a bioeconomy rather than curbing the future of European PPI. The most significant threats were seen in the adaptation to climate change, energy and fuel, ecosystem decline, and food security, whereas energy and fuel, population growth, a growing global middle class, and urbanization were perceived as the greatest opportunities for PPI. The greatest opportunities were seen to be embedded in the increasing wealth and new consumption potential of the global middle class. Innovativeness, new products and new fiber applications, new raw materials, consumer needs, and customer orientation were repetitively brought up as the greatest opportunities for the European PPI.

The study highlighted the role of sustainability of as an integral part of the European business strategy towards a bioeconomy, and the panelists in the study saw a close interplay between corporate sustainability and competitiveness of PPI. However, sustainability was seen to be driven most keenly by efficiency gains, regulation, and striving for corporate image and customer demand, indicating that the key driver for advancing corporate sustainability is still more extrinsic than intrinsic. Furthermore, increasing competition from outside Europe was seen as a threat, and it was even suggested that the European PPI would lose to other, less renewable sectors, due to its lack of will, courage, and resources to create new products. To mitigate these uncertainties and to enhance the sustainable competitiveness of the PPI, new product development should, on the one hand, be based on mutually beneficial collaboration between suppliers and customers in value chains, and on the other, should reach over sectorial boundaries (such as the chemical industry, and the construction or transport sectors). Similarly, it was hypothesized that benefit-sharing from increased value added between those who offer and who compete for valuable and scrutinizing resources will probably be an essential aspect of a successful long-term PPI strategy.

5 DISCUSSION AND CONCLUSIONS

The study approaches international competitiveness from different, but complementary perspectives. To summarize, several different methods were combined in the assessment of forest sector competitiveness. The analysis was also based on multiple data sources and data were gathered for different time frames and based upon different methods of analysis. Competitiveness was examined from different sub-study objectives at the regional, market, industry, and firm levels (ranging from country-level investments and trade flows to firm-level decisions and expert opinions).

The rapid growth of fast growing plantations in tropical regions has been boosting the changes in market dynamics especially in PPI (Hetemäki et al. 2013). Articles I and II showed that planted forest area development and decisions to invest in forests (both at the country level and in the PPI industry) have concentrated into emerging regions during the past two decades. Simultaneously, the relative competitiveness in international markets and in terms of investment attractiveness of these areas has been enhanced compared to traditional production regions despite associated institutional challenges (Hetemäki et al. 2013, article I).

Several approaches exist for explaining foreign and domestic direct investment on the industry, country and firm levels, but general models explaining the most important determinants of geographical investment distribution are still missing (Chakrabarti 2001), and the literature has been characterized as "empirically driven" (Arauzo-Caurod et al. 2010). Article I contributes to the empirical literature on the drivers of planted forest area development over the past two decades at the country level. The results show that production capacity and market size are the most influential factors of the development of planted forest area development across studied countries in OECD and non-OECD regions based on the data from 1990–2010. This result aligns with previous arguments that international competitiveness is intrinsically related to the increased global demand for wood fibre, availability and dynamics of forest resources (Carle & Holmgren 2008; Toppinen et al. 2010; Hetemäki et al. 2013; Barua et al. 2014).

Article II contributes toward understanding the state of industrial timberland ownership and control strategies among large PPI companies at the global level. The results show that despite many North American and European forest product companies are divesting their timberlands (Lönnsted & Sedjo 2011; Sun et al. 2013; Li & Zhang 2014), there is still

significant interest toward forest ownership and control especially among the large pulp oriented PPI companies. Furthermore, there are differences between timberland integration strategies among companies from different regions and different production orientations. Asian companies are the most active in timberland integration outside of their own continent which is likely to be caused by resource-seeking motivations (Hobdari et al. 2007; Zhang et al. 2014). The strategic decisions on forest ownership and control have the potential to drive the industrial competitiveness of the forest sector in the future through controls on price and wood availability especially in more volatile market environments (Ollikainen 2014; Li & Zhang 2014; Flynn & Pahkasalo 2015).

The increase in environmental and social concerns due to globalization, and the inefficiency of current law-abiding regulations to avoid environmental deterioration have led to the emergence of market-driven regulatory systems and spurred discussion on the effectiveness of different forms of the regulation (Iraldo et al. 2011; Taylor et al. 2015). Furthermore, there is controversy in the empirical studies assessing the impact of regulation on industrial competitiveness, boosted by the lack of post-assessment on the actual regulatory impacts in different industrial contexts (Peuckert 2014).

Article III contributes towards understanding the relative importance of economic and regulatory factors in competitiveness of PPI by analyzing the effects of forest certification and recycled paper policies in current two largest import markets for these products. The results of article III indicate that the implementation of sustainability policies in the supplier country have less effect on success as compared to the economic determinants in German and the U.S import markets. The effect of recycled paper was negative, and effect of certifications positive or negative depending on the situation. This indicates their influence in international trade flows were still more driven by cost factors than by the consumer preferences toward sustainability (see also e.g. Gan 2005; Arminen et al. 2013). However, the differences between the preferences of the two dominant forest certification schemes varied between markets, reflecting that sustainability policy implementation can be used to differentiate the competitors, as suggested e.g. by Johansson (2014). Overall, the weak demand response on promoting waste paper recycling and certification in the international paper and paperboard markets might also indicate that there are concerns related to their short-term effect of production costs and long-term regulatory effectiveness (Peuckert 2014; Ribeiro & Kruglianskas 2015, see also article IV).

Articles IV and V contribute towards understanding of the effects on higher aspirations for sustainability for the future PPI competitiveness in northern Europe. Based on the finding

of these studies, the informative regulatory mechanisms to increase the global awareness on sustainability are not yet used to their full capacity in PPI. Increasing the consumer awareness related to the benefits of regulation might increase the preference towards sustainability-driven producers. This is supported by Tuppura et al. (2015), who recently pointed out that the lack of consumer demand, uncertain policies and indifference among regulators were claimed to hinder sustainability progress in the forest industry. Based on the results of articles IV and V, there is a high trust on the increasing importance of greening the entire supply chain, and the adaptation of environmental regulation is seen as a future opportunity rather than a cost.

Nonetheless, to really make a positive environmental impact, global commitment to more stringent regulatory measures that level the playing field between competitors from different regions is needed. Despite the shift toward private governance, government-based regulation will continue to have an important role in achieving environmental goals in PPI, as shown in article IV. The adoption of voluntary regulation is currently to a great extend a firm-level decision, but implementing regulation at the sectoral or at least industrial level could benefit the entire sector. Firstly, sectoral-level commitment would level the playing field among companies from different regions, and secondly, signal to environmentally conscious customers that companies operating in the industry are committed to sustainability. Based on the study V, faith in the emergence of new products is currently high among the experts in the European PPI, but simultaneously there are concerns related to leadership capabilities and resources that might cause the European PPI to lose opportunities to other sectors or non-European companies. Leadership challenge is emphasized especially in European PPI, as it is characterized by consolidated structure with maturing markets of a few core products, and a low innovation activity (see also Näyhä & Pesonen, 2012).

The strength of this thesis is that it incorporates a holistic view on the current phenomena driving competitiveness in the forest sector among different regions with respect to macro-level developments in resources, markets factors and regulation. However, many alternative aspects around the drivers of competitiveness of forest industry could only be considered to a limited extent. Article I assessed the planted forest area development with respect to certain macroeconomic, institutional and forest sector variables. While the motives behind public, private, productive, or protective planted forests may vary a great deal, the aggregate results of the article are not able to distinguish these. Article II evaluated the firms' background characteristics on the decision to own or control timberland, and the impacts of institutional factors such as capital taxation and country level legislation on tenure right had to be omitted

despite their acknowledged effect on the timberland integration decision (e.g. Li & Zhang 2014). The article II fails to answer the question of which circumstances the forest ownership and control associate positively with financial success. Article III had benefitted from higher disaggregation of data as the markets for different paper and paperboard product behave differently. Furthermore, it would be interesting to examine the similar impacts in other importing countries--for example, China and India--that are at different stages of market maturity compared to Germany and the United States.

In general, one of the biggest limitations of this study is the role of related and supporting industries was only assessed in one article (IV). The article assessed the sustainability of sea transportation in affecting future competitiveness, despite much of the future competitiveness potential lying in the strategic cross-sectorial partnerships and e.g. implementation of digitalization and servitization. Furthermore, the limitation of the article V is that the expert views on significance of the different sustainability megaforces for forest sector in the future can vary greatly. Furthermore, in articles IV and V all respondents were involved with the forest sector in one way or another, and thus the studied topic was viewed by the panelists from similar vantage points. Another mentionable limitation is that the study mainly focused on the "traditional" pulp and paper production regions, such as Europe and North America, whose relative power compared to the emerging world is weakening. The strategies and motivations of pulp and paper companies from emerging countries remain understudied despite their rapid population growth, fast growth in living standards, and despite the fact that the most vulnerable ecosystems are located in these regions.

One of the drivers of competitiveness of the forest sector that could not be considered here is the substitutability of non-renewable materials with renewable wood or wood-fibre based materials (Hurmekoski et al. 2015). Undeniably competitiveness of the industry is increasingly linked with the competition between various sectors (such as materials and energy), even though this study had a more traditional approach focusing on competition between different geographical locations. These aspects would call for future research on the strategic emphasis and more in-depth interest toward different aspects of sustainability and analysis of strategic orientation among different industries in various parts of the world.

When conducting quantitative applied statistical analysis and econometric modeling, the limitations related to investigation must be kept in mind. If controlling for the confounding factors fails, the coefficients from regression analysis do not necessarily have a causal interpretation. Consequently, the results provide a descriptive comparison of the relevant factors and conclusions based on the research and should be carefully considered.

Nevertheless, in the exploratory research of topics still lacking investigation, descriptive analysis is valuable in designing the best research design data collection methods and pointing out subject selection for future research, as in article II. In article I and III, the application of advanced panel regression methods was used to control for statistical biases. Furthermore, the challenges related to data gathering are an impediment to international-level competitiveness assessment when the research relies on publicly available data sets.

Qualitative methods, respectively, enable delving deeper into the topic and capturing phenomena for which statistical data do not exist, and the Delphi method has also faced criticism, which is not due to the method itself, but mainly due to the manner of executing Delphi. However, the generalization of results from qualitative studies is a challenge. Assessing the future of international competitiveness of the forest sector from various perspectives with different methods is justified to gain better understanding of this complex issue.

Based on this thesis, three prospective areas of study within the competitiveness and sustainability of the international forest sector can be identified. Firstly, more research on economic efficiency and environmental effectiveness of different forms of regulation and policy designs should be conducted from both geographical and product substitution perspectives. Secondly, even though the forest industry is foreseen to shift from resource driven toward higher-value added and innovation driven industry, the availability of resources and access to forests will continue to play a key role. Thus, studying the dynamics of industrial forests and ownership on the competitiveness in the future bioeconomy would be needed from different strategic orientations and behavioral patterns. Thirdly, providing systematic identification of better operationalization of competitiveness and its most relevant indicators within the forest-based bioeconomy would be a valuable contribution to the theory. This systematization would also provide tools for scenario-based analysis assessing the elements of future competitiveness in the forest bioeconomy.

As a conclusion of this study, the origin of change towards higher environmental and economical sustainability seems to be linked to both forces of globalization and competition between world regions, as well on the firm-level ability to realize the potential of innovations related to bioeoconomy. Current policy programs and frameworks (i.e. the EU Bioeconomy strategy 2012) are ambiguous in their aims to reach a bio-based economy, but they fail to address many uncertainties related to environmental effects (see e.g. Ollikainen 2014). Therefore, the key challenge in industry renewal is not just to create new technologies, products or services, based on meeting needs for material short-term benefits. Along with

this, the challenge is to assess the long-term impact our consumption and production decisions have on the Earth's limited resources, and to find competitive ways to promote the desired decisions. Eventually, this is the key to finding on *the high road to forest sector competitiveness*.

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