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The European pulp and paper industry in transition to a bio-economy: A Delphi study

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ABSTRACT

The current challenge facing the European pulp and paper industry is how to materialize the transformation to a bio-economy, as well as to realize the necessary new green innovations. The risks, costs and constraints of doing business will increase, thereby further intensifying competition, but at the same time new business opportunities will open up. This study adopts a three-round dissensus-based Delphi approach in order to explore our key research question of how the pulp and paper industry may change strategically, and what is the potential for value creation in the year 2030. According to our expert panel, the main drivers of competitiveness in 2030 will include energy and material efficiency, sustainability, as well as new innovations in products to serve customer needs better. According to the projected 2030 scenario, the pulp and paper industry will produce more diversified products, focus on higher value-added, and aim at consumer segments with higher environmental awareness. On average, 40 percent of the turnover will according to the panel come from genuinely new products. Strategic cross-sectorial partnerships will have a key role in making this big leap, while simultaneously acknowledging the changing needs of sustainability-conscious customers and other stakeholders.

1. Introduction

The pulp and paper industry (PPI) has traditionally been one of the most environmentally sensitive sectors due to its heavy dependence on water, its use of energy, and the vitality of forest ecosystems as a source of wood fiber. Taking a historical perspective, Ojala, Lamberg, Ahola, and Melander (2007) concluded that only a moderate degree of competition existed in the global forest industry up until the end of the 1990s on account of constantly growing markets, a low degree of internationalization in the leading firms, and an emphasis on business-to-business products associated with long-term buyer-supplier contracts. However, things have changed dramatically since then. The strategic orientation of the forest industry in general has evolved in the course of time through four distinct stages: forestry orientation, production orientation, market orientation, and sustainability orientation (Toppinen, Wan, & Lähtinen, 2013, Chap 17). In a recent work, Kozak (2013, Chap 18) describes the global landscape of the forest industrial sector as eclipsed by large, multinational

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corporations producing commodity products and struggling in a phase of ongoing transformation towards a conservation-based economy.

The PPI has been seeking renewal under the emerging concept of bio-economy, particularly in Europe (Kivimaa & Kautto, 2010; McCormick & Kautto, 2013). Bio-economy is a concept that has attracted increasing attention in the last decade (Staffas, Gustavsson, & McCormick, 2013), and has developed to include great challenges and opportunities for the forest sector to the extent that might blur its traditional boarders (Kleinschmit et al., 2014; Pätäri, Tuppura, Toppinen, & Korhonen, 2016). The EU and some of its member states focus on an economy that is based on the use of biomass resources (Pätäri et al., 2016), comprising "[. . .]biological resources from the land and sea, as well as waste, as inputs to food and feed, industrial and energy production [. . .]" (European Commission, 2012). According to Sisto, van Vliet, & Prosperi (2016:45) "for its cross-cutting nature, bio-economy represents a great challenge to comprehensively address inter-connected rural development issues such as sustainable economic growth, natural resource scarcity, food security, fossil resource dependence and climate change."

The diffusion of biorefinery technology is the key concept with regard to the bio-economy in the forest sector (Hetemäki & Hänninen, 2013), but the PPI's low willingness to take investment risks has been perceived as a barrier to the diffusion of biorefineries (Näyhä & Pesonen, 2012). Although there has been research on the future outlook of the European forest sector (e.g. Hurmekoski & Hetemäki, 2013; Olsmats & Kaivo-oja, 2014; see also the review in Näyhä, Pelli, & Hetemäki, 2015), no scientific studies have considered the future of the pulp and paper industry from a strategic viewpoint, covering the full spectrum of aspects ranging from industry structure, technology and innovations to competition in product and raw-material markets, and combining industry-specific factors with the emerging societal transition towards sustainability (Loorbach & Wijsman, 2013).

Instead, published reports on factors of strategic change in PPI have predominantly been industry-led, or developed by policy makers. For example, the roadmap for the Finnish forest sector drawn up in 2010 developed four scenarios for an operating environment leading up to 2030: the global bio-economy (with consumers and industry recognizing climate change and working towards a carbon-neutral society), the forest as a source of bioenergy (substituting fossil fuel keeps value capture low), business as usual (in which the dominant logic prevails), and a self-sufficient society (characterized by extensive biomass food production due to repercussions from climate change) (The world's leading forest cluster, 2010). In accordance with these alternative futures for the business environment, the key necessary strategic actions identified in the report were specialization in the most value-adding products and solutions, aiming for global leadership in standardization and norms, and taking a global role as a resource integrator. The European Commission (2013) has also recently drawn up a blueprint for the forest-based industries, identifying altogether 12 challenges, which collectively underline the importance of stimulating sectorial transition with a radical change in the industry's mind-set, and the need to improve innovation, structural adaptation, production efficiency and the quality of products and services in order to grow in markets both within and outside the EU.

In order to fill the research gap, we aim to produce a methodologically sound study on industry transformation and change in business logic in the European PPI, and to map the expectations of high-level industry experts concerning the future business and business environment. Our first research question is *how the pulp and paper industry may change strategically in the development towards bio-economy, and what kind of business opportunities the industry transformation will offer to the existing and new companies in the field*? A more practical secondary question is also addressed, based on the results, concerning *what are the pathways open to the European PPI in order to maintain its competitiveness in the changing business environment?*

We adopt a Delphi approach aimed at PPI experts in several European countries to explore the current situation in terms of industry structure and the potential for transformation and value creation in the year 2030. According to Hurmekoski and Hetemäki (2013:17), "there are potential advantages in complementing the current modeling approach dominant in the forest sector with other methods from the field of foresight", which also warrants the use of the Delphi method. With regard to the future, we aim to assess the expected change and its significance in terms of seven key factors (i.e. technology, raw materials, products, markets, strategic partnerships, specialization and sustainability investments) that are assumed to shape future business in the European pulp and paper sector over a time span extending to 2030. On this basis we further construct an industry scenario and discuss the changes this would require to current business logics.

2. Theoretical foundations

2.1. The dominant logic of an industry

Prahalad and Bettis (1986) introduced the construct of dominant logic, or dominant general management logic, in order to better understand relationship between industry diversification and performance. One of the key motivations behind this stream of strategy literature is the question of why is it so hard for organizations to change. First the approach focused on diversification-driven organizational change and then moved on revolving around environmental-driven organizational change (Bettis & Prahalad, 1995; Prahalad & Bettis, 1986). Prahalad and Bettis (1986:491) defined the concept of dominant logic as "a mind set or a world view or conceptualization of the business and the administrative tools to accomplish goals and make decisions in that business". It relates to how business is conducted to make profits in the markets and how firms interact with customers and competitors, and it also gives some indication of its perceived key success factors (Prahalad &

Bettis, 1986). Dominant logic can be manifested through e.g. organization's business model, processes and approaches to competition (Prahalad, 2004). It is embedded in an organization and according to Prahalad (2004:172), "it becomes the lens through which managers see all emerging opportunities". Thus, it limits the incumbent organization's ability to rethink and question the traditional business logic and way of doing business – one is not agilely able to recognize changes in the competitive environment and drive innovation.

Due to its cognitive nature, "changing the dominant logic is extremely difficult" (Prahalad, 2004:172), although vital for future value creation requiring, for example, internal development of new products or markets, or external development through acquisitions or the building of strategic alliances. Prahalad (2004) had defined approaches how firms can better understand the emerging changes and opportunities in the competitive environment, including focusing on next practices (instead of benchmarking current best practices), learning from low-cost experimentation, and looking beyond the borders of industries and geographic borders. According to Kaplan (2011), in aim to understand strategic changes of organizations, the cognitive-based explanations have found to be very useful.

2.2. Industry dynamics and structural change within the forest industry

The PPI is an interesting example of an industry in which technology has for the most part developed only incrementally, with low-intensity research and development, and relatively high dependency on wood raw material (including pulp and recycled paper, 44% altogether), energy (16%), and chemicals (16%) in its total manufacturing costs (CEPI, 2013). Globally, the export value of forest industry products (pulp, paper and wood products) amounts to 250 billion USD annually.

Table 1 summarizes some of the most recent studies analyzing the future of the forest sector from a strategic perspective (excluding technologically focused studies). Based on it, quite a few of the studies in question focus on the forest-based bioenergy business. Earlier research has also analyzed potential developmental trends or proposed future scenarios for the industry, but the overall state of art seems very limited to address issues that have become eminent in industry renewal and strategic transformation in the future bio-economy. We will next discuss these issues in more depth.

Highly volatile forest product and input prices have traditionally had the most significant impact on the development of company performance, dictated by economies of scale and scope (e.g. Diesen, 2007). Investments in production facilities and plants are capital intensive, especially in the pulp and paper segment, and therefore the return on investments is relatively

Table 1
An overview of recent (2010–2015) strategically focused future-oriented studies in the forest sector.

Study	Main objective	Method	Main findings
Jonsson (2011)	Analyzes trends and possible future developments in global wood-product markets and discusses the implications for the Swedish forest sector	Qualitative scenario analysis	Provides four possible scenarios. The outlook for the Swedish solid wood-product industry is optimistic, but the prospects for the PPI in Sweden are more difficult to predict.
Koskela (2015)	Discusses the measurement of eco-efficiency in the Finnish forest industry	Delphi method and public data	The economic performance of eco-efficiency should be measured using the 'value added' indicator and environmental performance based on output by emission groups or environmental impact.
Lindahl and Westholm (2012)	Analyzes how the future is handled by actors in the present day	Twenty-four semi-structured interviews supplemented with written material	Actors' perceptions of the changes facing the forest sector diverge widely. However, most actors see its future as linked to the broader issues of climate mitigation and energy transition.
Näyhä and Pesonen (2012)	Outlines global and national drivers of forest biorefineries in Scandinavia and North America	An expert opinion survey combined with a Delphi approach	There seems to be potential for success in the biorefinery business, but support from the macro-scale environment is needed and the industries themselves need to be active.
Näyhä and Pesonen (2014)	Explores the current forest industry in terms of its change features, necessary resources, and management for the biorefining business	Data from the final round of a three-phase Delphi study	A conservative organizational culture and a lack of financial resources create barriers to change. New managerial and operational-level skills are needed, and a readiness for change should be embedded in the organizational culture.
Olsmats and Kaivo-oja (2014)	Maps and analyzes general trends and drivers among consumers and businesses within the packaging industry	Participatory foresight and focus-group methodology	Trends and changes in the environment will affect packaging and may bring both threats and opportunities.
Pätäri (2010)	Identifies the main industry- and company-level factors that are most likely to influence the bioenergy sector and its value-creation potential	Delphi study	The complementary resources held by forest and energy companies make collaboration in the bioenergy business favorable.
Pätäri et al. (2016)	Analyzes how the PPI experts and the industry understand and foresee the expected influences arising from sustainability megaforces	Delphi study	Global sustainability megaforces are perceived more as opportunities than as threats. Adaptation to climate change was identified as the greatest threat.

long-term compared to other industries. Furthermore, the industry has become more exposed to changes in its value chains, including media digitalization, growing customer awareness of sustainability issues, more intensive global competition, and the increasing complexity of industry regulation (of which recent examples include the EU chemical directive REACH and the EU Timber Regulation establishing legality verification needs for wood raw material).

The global demand for pulp and paper products has been relatively stable on the product level: although the rapidly growing digital media have reduced the demand for newsprint and other printing and writing paper, the consumption of paper and paperboard is continuously rising, being the material most commonly used in the global packaging sector. On the regional level, industry in Europe has been lacking large-scale investment in the 2000s (CEPI, 2013), and its competitiveness has dramatically changed in recent decades. The lower costs of production in Latin America (pulp) and Southeast Asia (paper, packaging) have intensified competition, the use of digital media has rapidly curtailed the use of printing paper, and European Union policies promoting the production of renewable bioenergy have increased the costs of wood raw material.

Being closer to end-user growth markets has been a key driving force behind the location of global paper investments, whereas pulp investments have been more inherently resource-driven (Zhang, Toppinen, & Uusivuori, 2014). The European paper industry has been suffering from low profitability and significant price erosion since 2009, especially in the market for graphic paper, leading to a wave of consolidation, divestments and capacity reduction. This financial hardship has led to the elimination of non-core activities and a constant need to reduce costs. According to Uronen (2010), most producers of paper and board are positioned in the middle of the value chain, where they can only generate about five percent of the total value creation.

Conversely, markets for pulp and recycled paper have developed more favorably on the raw materials side, with booming demand in China and other emerging countries. Longer rotations in wood fiber markets in the boreal zone (which is the major procurement area for producers in the European PPI), as compared to the fast-growing plantations of the Southern hemisphere, have put the companies under cost pressure. Currently there are plans for new investments in softwood pulp capacity in Finland, for example, but the focal areas for new investments are now Latin America and Asia, and in terms of paper and paperboard manufacturing in particular, China (Zhang et al., 2014).

The conditions of the forest industry, i.e. a mature industry in which the profitability is decreasing, are characteristics that challenge the existing business models and thus the industry dominant logic (Sabatier, Craig-Kennard, & Mangematin, 2012). However, this characteristic of a mature industry brings about also challenges specific to old and large firms (Peltoniemi, 2013). An industry's dominant logic could be described as reflecting its strategy across different businesses, and is also often connected with too strong lock-in and perceived inefficiency to diversify existing business models (Prahalad & Bettis, 1986; see also Abrahamson & Fombrun, 1994). Typically, the forest industry has been suffering from stagnation, not only in financial sense, but also in the way how it renews the business. According to Näyhä, Hetemäki, and Stern (2014), companies in the European forest sector are diversifying their business models and product portfolios by developing new products and services based on forest biomass, and the traditional sector will most likely fragment into several segments specialized in a variety of forest products. Consequently, regions such as Europe and Asia will also have to compete with each over where the companies will situate their activities in global value chains. Hence, the degree of specialization and diversification is expected to increase in the future. It is also evident in the strategies of some large forest industry companies (see, e.g., the recent shift in the business segments of UPM-Kymmene Ltd.) that in future the strategic orientation will increasingly diversify to include the production of renewable fuels, chemicals, bio-based fibrils and wood composite materials, for example. All this underlines the need for building strategic cross-sector partnerships. Such strategy may bring some benefits to the PPI in terms of corporate sustainability in that knowledge about the sourcing and production of raw materials could be used in ensuring forest-industry compliance with sustainability requirements, particularly at the beginning of the value chain (e.g. Pätäri, 2009).

The globalization of markets and a growing awareness of sustainability are making the PPI increasingly vulnerable to corporate sustainability images and more complex demands from a wide range of stakeholders for operational accountability. Issues related to corporate responsibility are no longer of marginal importance. Corporate investments in sustainability have been suggested to focus on improved energy and resource efficiency, more synergic value creation between various stages in forest-wood value chains, and the development of solutions to enhance customers' quality of life in the form of durable and safe products with integrated service components (Toppinen et al., 2013, Chap 17). Within the European PPI, despite an emphasis on sustainability leadership, the increasing environmental regulation is seen as a threat to maintaining current forest-industry production levels (CEPI, 2013). The sustainability-related risks, costs and constraints of doing business have clearly intensified competition between regions, but also provide significant new innovation opportunities.

To sum up, the future business environment of the European PPI is highly uncertain in light of the multitude of change factors outlined above. This uncertainty has an impact on the rivalry between current players and new entrants both in Europe and beyond, and merits empirical foresight studies as proposed in Hurmekoski and Hetemäki (2013) and Hetemäki and Hänninen (2013), for example.

3. Data and methods

The Delphi method is one of the best-known and most used forecasting mechanisms. Although the Delphi approach has faced quite a lot of criticism, it has an established position as an effective tool for gathering expert opinions on a variety of

topics in different domains. A Delphi study typically entails two or more paper- or web-based survey rounds with feedback given to respondents, or panelists, after each round. (Ribeiro & Quintanilla, 2015; Steinert, 2009) The number of panelists ranges from a few to 50, although the key criterion in selecting the panel is the members' expertise and contribution to the topic (Hatcher & Colton, 2007). Iteration, participant and response anonymity, controlled feedback, and statistical group response have been identified as the key characteristics of a Delphi study. (Blind, Cuhls, & Grupp, 2001; Förster, 2015; Kuusi, 1999; Landeta, 2006; Steinert, 2009; Tapio, 2002; Turoff, 1975). Nevertheless, there are many variants, of which the later ones in particular (e.g., Policy Delphi, Argument Delphi, and Disaggregative Policy Delphi) highlight the importance of finding reasons for dissensus rather than striving for consensus among the experts.

The key objective of our Delphi study was to elicit expert opinions on the current business conditions of the PPI and the emergent strategies that are likely to facilitate development towards a bio-economy and sustainable value creation. The overall Delphi process depicted in Fig. 1 was conducted in spring 2014 (from March to June). We used the dissensus-based approach, thus our aim was to bring up for discussion all relevant issues and reasons for differences of opinion among the panelists. The time scale we covered extended to 2030, and the questionnaires included closed questions and statements with response alternatives, as well as open-ended questions. The study comprised three rounds of online inquiry. The rounds were iterative so that the responses of the previous rounds formed the basis of the following rounds. In the second and third rounds, the focus was especially on the themes and issues that either provoked a lot of comments and discussion or differing opinions among the panelists in the previous round or needed further clarification. In addition, members of the panel were given feedback after each round informing them of their anonymous colleagues' opinions. The panelists, who were carefully selected on the basis their solid expertise, knowledge and experience of the subject matter, represented a total of six European countries and the following three expert groups: (1) representatives of industry associations and other experts, (2) representatives of academia, and (3) industry experts. Thus, our aim was to form a panel of top-experts in the field that would consider the PPI from different perspectives in order to give a comprehensive view of the topic under scrutiny. More than 70% of the experts had over 10 years of experience from the forest sector. Nineteen experts responded to the first-round questionnaire, and the panel size decreased by two in the second and third rounds. The titles of the 19 experts are presented in Appendix A. Among the first expert group (representatives of industry associations and other experts), the representatives hold mainly the titles of a consultant or director of forest/bioeconomy/environment. Representatives of academia (group 2) have degrees in forestry, forest management, corporate environmental management, environmental and innovation management, or in chemistry. The titles of the experts range from a professor to a researcher. The industry experts (group 3) are all involved in sustainability affairs, and their titles are similar to a sustainability or environmental manager.

Fig. 2 summarizes the main elements covered in the Delphi study. The issues in Fig. 2 base on the previous literature on industry dynamics and structural change within the forest industry. Thus, our aim was to analyze the transformation of the

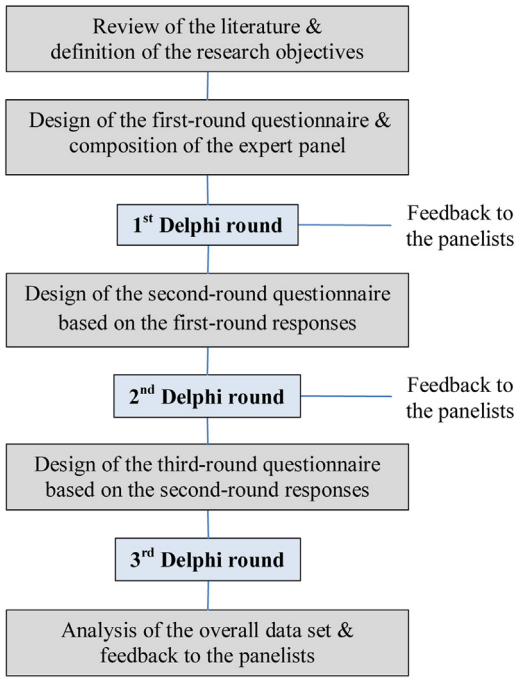

Fig. 1. The Delphi process.

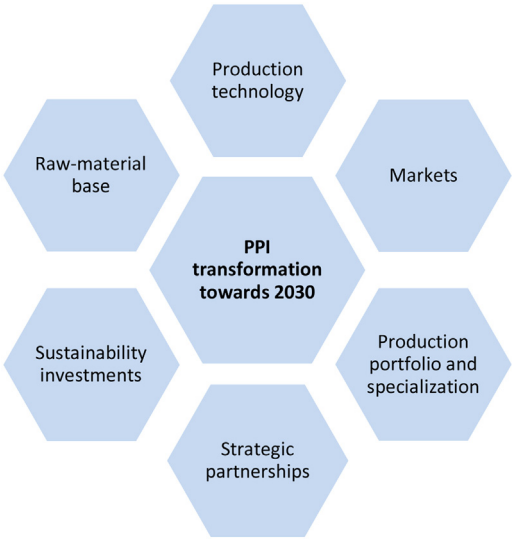

Fig. 2. The main change factors covered in the Delphi study.

industry by focusing on the main change factors that enables us to analyze the industry from many perspectives. The questions in the first round, which were also based on previous literature regarding industry change factors, related mainly to the current and future situation of the PPI in terms of competition, profitability, long-term survival, and industry structure. The panelists were also asked to evaluate future business opportunities and sources of long-term value creation. The second round focused on the issues that provoked the most discussion or dissenting opinions in the first round, with an emphasis on innovativeness and industry renewal. The key issues discussed in the previous rounds were brought together in the third and final round, and the panelists were asked to evaluate the expected change in factors and the significance of this change. They were also asked to describe a future scenario of the European PPI in 2030.

4. Results and discussion

4.1. The current industry structure in terms of profitability and innovativeness

In the first round we asked the panelists to assess the current situation of the European PPI, especially with regard to competition, profitability and long-term survival, and the vitality of the business. Referring to competition and profitability, they clearly communicated that the situation differed in different segments of the industry. The decline in demand for some paper grades was characteristic of European markets in particular, but the situation was better in some other segments such as northern softwood pulp. Packaging paper, hygiene products, specialty papers, and liner board were also mentioned as examples of product groups showing higher current profitability. Even though overall profitability was perceived as generally rather low, it had its strengths. As one respondent put it:

Table 2
Innovativeness and future orientation (mean values by respondent groups).

	Representatives of industry association and other experts [1]	Representatives of academia [2]	Industry experts [3]	Overall mean
Innovativeness in the industry is more widespread now than ten years ago.	3.83	3.71	4.00	3.82
R&D should be more strongly directed to developing new innovations.	3.83	4.57	4.25	4.24
The companies in the industry take climate change well into account in their R&D strategies.	3.50	2.57	3.50	3.12
The companies in the industry take end-customers' needs well into account in their long-term decision-making.	3.50	2.71	4.50	3.41

"*Europe has know-how, education and technological advantage in its side, which can be seen competitive advantage. Also, the sustainability in Europe is taken more seriously into account, which may give access to certain markets where less sustainable peers fail to succeed*."

The panelists expressed divergent opinions about long-term survival and vitality. Again, the perceived prospects of the different segments differed. Some respondents saw further cost-cutting as a necessity, whereas other experts highlighted opportunities related to replacing fossil-based with bio-based and renewable products. The following citation exemplifies the potential seen in the PPI, but also points out the need for change in this traditional mature industry:

"It seems to me like there are good opportunities for the pulp and paper industry. The logistics are there, the renewable material and the environmental benefits are there and a number of global trends and political initiatives are in line with the pulp and paper potential to grow. But to meet that potential I guess the industry has to be very innovative and ready to develop."

In the second round we asked the panelists to further assess the current situation in terms of innovation, R&D and end-customer orientation (Table 2). They graded the following statements on a scale ranging from one (completely disagree) to five (completely agree).

As Table 2 shows, innovativeness was seen generally as more widespread than ten years previously, although the respondents thought that R&D activities should be more strongly directed towards new products, and that climate change should be taken into account more in R&D strategies. Perceptions on taking into account end-customer needs varied.

Representatives of academia perceived the industry situation less positively than the other two groups, suggesting that climate change and end-customer needs were not taken well enough into account, and that R&D should be more strongly directly towards new products. Members of the groups gave quite similar answers, except to the question concerning end-customer needs: the industry experts scored customer orientation most highly. When asked about current R&D investment, almost all the respondents responded that the level of investment was too low. Given their expectation that new products would generate about 40 percent of turnover in 2030, it is clear that further investments in R&D are needed to achieve this target.

4.2. Value creation potential in 2030

Next we asked the experts to describe the PPI in Europe in 2030 in terms of industry structure, competition, business profitability, long-term survival and business vitality. Many of them suggested that consolidation would continue, and hence the industry would be further concentrated, and the majority expected the PPI to be as large or smaller in terms of employees in Europe. Many of the respondents thought there would probably be larger mills and companies, but at the same time also opportunities for smaller-scale, specialized producers serving niche or geographically limited local markets. The question concerning competition divided opinions. Many of the respondents expected it to be tough in 2030, but some thought that there might be less competition due to increased differentiation, for example. Some of the experts thought that more competition would come from outside Europe, among other things because the European industry would no longer have technological advantage compared to Asia and other emerging markets. However, some also pointed out that European producers would focus on smaller-scale specialized production, whereas large-scale manufacturing would take place closer to the growing markets.

Overall, the profitability level of the industry in 2030 was expected to be quite positive. However, the profitability of companies depends on their ability to change their business logic, as the following citations clearly show:

"*Some segments might have better profitability than today, especially those succeeding in bringing high-value products to the market. The more traditional segments perform as today. Those clinging to traditional business models and cost structures perform worse than now, if they can survive until 2030*."

"*It uses different business models than today, in order to retain control over the material. Shifting from bulk material producer towards more involved in the supply chain to deliver solutions. The companies that succeed in this transition will be more profitable, and have better relations with customers and end-users*."

The responses concerning long-term business survival and vitality reflected the belief that the industry's future depended on its ability to utilize the raw-material base and pulp innovatively, and to create new businesses and value streams. Two experts described this well:

"*Long-term viability of pulp industry is likely to be secured, if innovation and research have been fruitful and several new applications for pulp are found. Pulp, as a renewable product, has secured its position as multipurpose raw material in several industries*."

"*I wouldn't talk about traditional pulp and paper industry. Instead there will be more specialized business with new products in Europe. Future for these businesses can look rather good*."

We further asked the respondents to estimate how big a proportion of turnover in 2030 would come from the current (2014) products. Fourteen of them gave their estimates in percentages, ranging from 30 to 75, the average being 61. Almost all representatives of the industry association and other experts, as well as the industry experts, mentioned a figure of at least 60 percent, whereas members of the third group (i.e. representatives of academia) gave the most diverse estimates, ranging from 30 to 75 percent. In the second round we asked how large a proportion of these new products would the existing

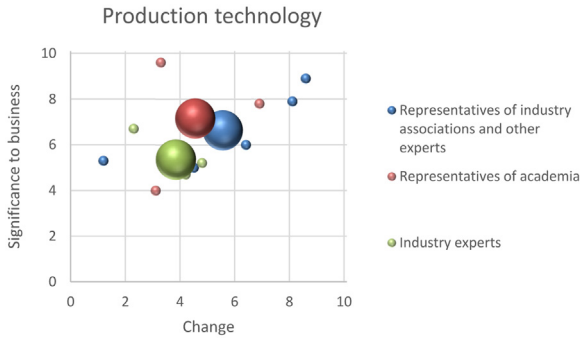

Fig. 3. The predicted change in production technology by 2030 and the significance of the change to the business.

technology and known technical solutions cope with. The responses ranged from 12 to 75 percent, the average being 50 percent. The ambivalence among the groups demonstrates high uncertainty regarding the future of the sector. According to the panelists, in addition to the traditional PPI products (pulp, paper, board, packaging, and tissue), the main sources of revenue in 2030 would include energy, biofuel, composites, bio-chemicals and bio-materials, paper and packaging products with intelligent properties, and fiber-based innovations. As main drivers of competitiveness they referred especially to energy and material efficiency, sustainability, and new innovations in processes and products that meet specific customer needs.

Next we asked about potential sources of value creation concerning raw material, technology, new markets, and new partners and industrial sectors. None of the areas was especially emphasized in the responses, indicating that the experts did not expect all the actors to follow similar paths in the search for future competitiveness. They varied widely in their perceptions of future business opportunities, reflecting expected further fragmentation within the industry. Examples of opportunities included finding new uses for re-modeled and non-wood fibers, advanced biorefineries, new process techniques, and collaboration with the chemical, food and textile industries.

4.3. Expected changes in the key factors by 2030, and the assessed significance of the changes to the business

In the third round we asked the respondents to assess from the overall industry's perspective how much the different factors – production technology, raw-material base, products, markets, sustainability investments, strategic partners, and specialization – would change by 2030, and how significant these changes would be for the business. For example, as regards the production technology, the respondents were asked to assess how much the production technology will change until 2030 on a scale from zero ("no change") to ten ("substantial change"). Second, they were also asked to assess the significance of the change *to business* on a scale from zero ("not significant") to ten ("very significant"). Thus, our aim was to study what kind of changes are expected within the industry until 2030. And with the second question (significance of the change to business) our objective was to discern whether these changes have small or significant impact to the business. Overall, the panelists predicted change in all of the listed factors, on average, ranging from four to seven on the scale, whereas the scores concerning the significance of these changes to the business ranged from six to eight. Next we describe these results in more detail.

In terms of *production technology* (Fig. 3) the perceptions of the experts are quite dispersed. The industry experts showed most consistency, whereas the opinions of the representatives of industry associations and other experts were the most divergent[1]. Overall, all of the respondent groups foresaw a moderate change in production technology (average 4.8). The industry experts were the most consistent in predicting moderate change, whereas the representatives of industry associations and other experts expected the biggest changes. All the groups were in agreement in assessing the significance of change in production technology as very high (average 6.4).

The respondents' opinions concerning the *raw-material base* (Fig. 4) diverged heavily. The industry experts predicted quite a minor change (average 2.6), whereas the opinions of the other groups were more diverse. One possible explanation for the divergence in opinions about both the change and its significance could be that the experts interpreted this question rather differently. The industry experts seemed to think that the raw material itself would not change very much, but that the changes that would be realized in terms of availability, usability, quality, and price would be important to the business (average 6.7). However, some experts from the other two groups rated the significance of the change quite low, which may reflect the belief that the value (what and how) created from the raw material matters more than what it consists of. However, more than half of these experts also thought that the raw-material base would change somewhat. The responses to

[1] In Figs. 3–9, the big bubbles represent the average mean values of each expert group whereas the small bubbles mark individual answers of the respondents.

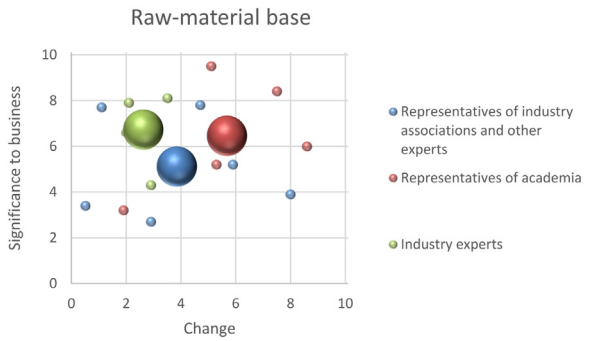

Fig. 4. The predicted change in the raw-material base by 2030 and the significance of the change to the business.

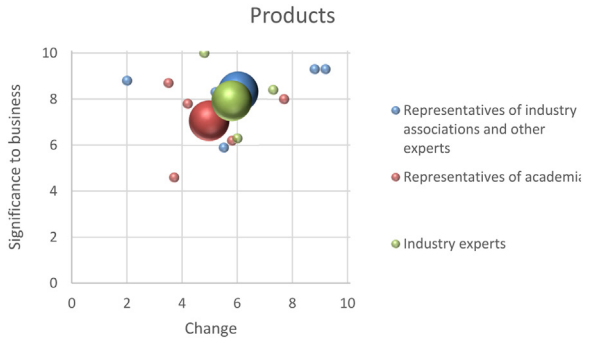

Fig. 5. The predicted change in products by 2030 and the significance of the change to the business.

the other questions in the three Delphi rounds gave the impression that this opinion could be related, in part, to the sourcing of alternative fibers or paper recycling.

With regard to *products* (Fig. 5) the respondents thought quite consistently that the change would be rather large (average 5.6), but that its significance would be even greater for the future business (average 7.8). This result is in line with the responses concerning the proportion of turnover coming from new products in 2030 (in the first round), which was expected to be around 40 percent.

Of particular note in the data on *markets* (Fig. 6) is that the industry experts appeared consistently to be of the view that the markets would have changed quite substantially by 2030. The average expectation is as high as 6.1 even though the other expert groups anticipated somewhat less radical change in this respect. It thus seems that the industry experts expected market change to be a key issue in the near future (average 7.8). The overall significance of the change was rated 7.5, on average. In general, the market issues that arose in the other Delphi rounds were related, among other things, to the role of Asia and the increasing environmental awareness of consumers.

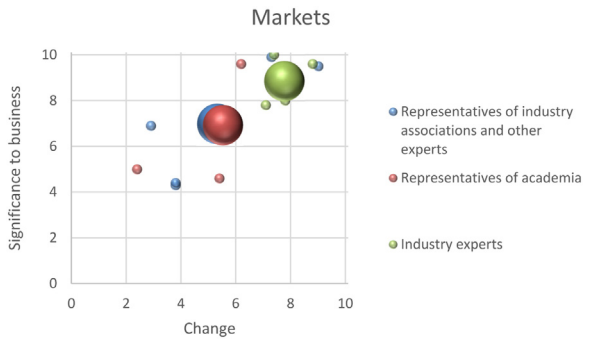

Fig. 6. The predicted change in markets by 2030 and the significance of the change to the business.

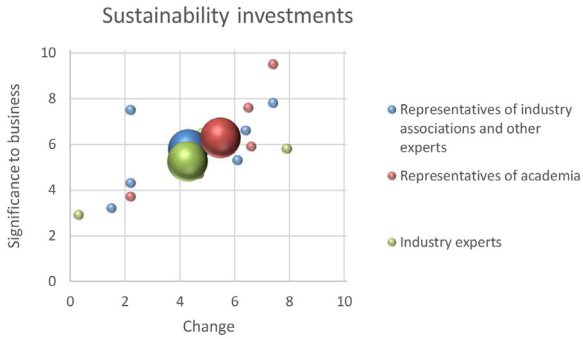

Fig. 7. The predicted change in sustainability investments by 2030 and the significance of the change to the business.

Fig. 8. The predicted change in strategic partnerships by 2030 and the significance of the change to the business.

The responses related to *sustainability investments* (Fig. 7) are interesting in terms of their range. The respondents differed strongly in their assessments of the degree of change (average 4.7), and their divergent opinions are also reflected in the expected significance of the changes for the business (average 5.8). This could indicate that some of the respondents see that the industry in Europe has already invested quite heavily in sustainability and may think that the current level of investment is good.

The industry experts expressed the most unanimity in assessing change in *strategic partnerships* (Fig. 8). On average, they thought that there would be quite substantial changes (average 5.6) in the role of these partnerships, and rated the significance of these changes to the business as even higher (average 7.7). The representatives of industry associations and other experts foresaw even greater change (average 6.8), which they also rated as significant for the business (average 6.7). The responses of the representatives of academia were the most divergent.

The groups differed in their views on *specialization* (Fig. 9), but were fairly unanimous internally. The representatives of industry associations and other experts anticipated less change (average 3.6), whereas the representatives of academia

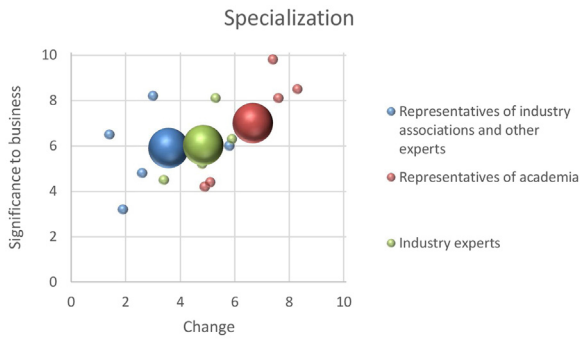

Fig. 9. The predicted change in specialization by 2030 and the significance of the change to the business.

Table 3
Future scenarios presented thematically.

Themes	Key points	Quotations
Resources, raw material and energy	- increasing competition for raw material - resource efficiency - energy efficiency	"The competition over a scarce yet renewable raw material will increase if all expectations loaded for raw material will materialize in relatively short period of time." [1]* "Increased demand for recycled fiber . . . " [2] "Energy efficiency is a key issue in Europe 2030, so the PPI should produce its own energy and not be dependent on the energy market. PPI will produce its energy at its plants, but also in co-owned wind, solar power, and waste power plants. The forests will not be used massively for energy, as they are too valuable for that either as fibre or as forest stands." [2]
RDI, technology, products	- more diversified product variety - emphasis on niche, high-value-added products - less volume, but more value	" . . . smaller production scales in part of the industry [. . .] open up opportunities for innovation, normally off-limits by the high capital lay-out of large mills." [2] " . . . the industry will further diversify into what is called 'bio-economy' and focus on very high added -value bio-based products." [1] " . . . integrated mills will play a more prominent role in the bio-based economy converting part of the now excess wood to valuable chemicals." [2]
Value chain and strategic partnerships	- significance of strategic partnerships with other sectors (e.g. chemical industry) will increase - the transition towards bio-economy	"The PPI and other forest-based industry will together [form] new strategic alliances with other industries which will develop new business models and value chains based on biomass from the forest and by-products from the forest-based industry." [1] " . . . sufficient level of R&D should take place because the bioeconomy discussion will be diverted from plain bioenergy." [1]
Consumers	- more consumers who are environmentally aware	"Consumers are becoming more and more environmentally aware, so consumer behavior will have a greater influence on the PPI environmental performance than we see today." [3] " . . . more consumers understand benefits of bio-based materials." [3]
Competition (geography)	- the role of Asia - resource and energy efficiency as competitiveness factors	"Competition from Asia will drastically diminish the production of pulp for paper as well as graphic paper, in addition to the reduction brought about by the competition from electronic ICT. Companies that prevail in Europe will to an increasing extent rely on the production of niche products." [2] "The Asian countries are already more important to us than they used to be, and I expect them to become even more important as there is a huge growth. Asian companies will of course also increase/start new capacity, but I think it will not fill the need of products in Asia." [3] "Asian competition is tough, but they have lost part of their cost competitiveness due to e.g. higher salaries." [3] "A more resource and energy-efficient European industry is able to capitalize on the increasing demand for sustainable products, while at the same time increasing its competitiveness with other regions." [2]
Policy and regulations	- the stabilization of environmental regulation - multiple policy targets create competition for raw material	"In the policy discussion it should be recognized [that] there are multiple targets set for developing forest based industry. This will result in challenges." [1] " . . . we may expect a slowdown in the regulatory approach toward environment protection/performance . . . " [1] "Environmental regulation has hopefully found more reasonable terms in Europe, or the other way round the other parts of the world have tightened their regulation too." [3]
Sustainability	- the expanding role of sustainability (mainly market-driven)	"While we may expect a slowdown in the regulatory approach toward environment protection/performance, the industry will keep improving its overall sustainability, possibly with a bit more focus on social sustainability." [1] "But the headline for the future scenario is probably about acting sustainably to ensure a strong position while meeting growing needs as well as competition from markets outside Europe." [3]

*) [1] = Representatives of the industry association and other experts, [2] = Representatives of academia, [3] = Industry experts.

expected the biggest change in this factor (average 6.7). However, on average all the groups rated the significance of the change rather similarly (average 6.3). With regard to future scenarios (which are discussed in the next section), the panelists pointed out the need to diversify the product portfolio, and put more emphasis on niche markets and high-value-added products. In our view this is in line with Fig. 9.

4.4. Future scenario

In the third round we asked the respondents to describe *a likely scenario of European PPI in 2030,* taking into account the aspects brought out in the previous Delphi rounds such as resource scarcity, competition, and increasing product variety. We analyzed the data in two phases. First, the members of the research team individually coded the scenarios defined by the

panelists. The responses were compressed and grouped under themes specified by each member. The classifications were compared in the second phase and then the final classification was created. Table 3 below describes the future scenario by themes, including the key points and representative quotations from the responses.

To summarize the scenario presented in Table 3: in 2030 the European PPI will be more resource and energy efficient, produce more diversified products, will also serve niche markets, and will focus on high added-value and environmental sustainability. The role of strategic partnerships as well as the environmental awareness of consumers will increase. Under the likely vision of the future of the industry, the importance of Asian companies and markets will continue to increase, and regulation will level off between Europe and Asia. We will discuss the implications for industry renewal strategies and future research needs in more detail below.

5. Conclusion

Contribution of this study is for the first time to consider the future of the European pulp and paper industry in bio-economy from a strategic viewpoint, covering the full spectrum of aspects ranging from industry structure, technology and innovations to competition in product and raw-material markets. Previous futures studies in the field have also more dominantly focused on bio-energy (Pätäri, 2009) or bio-refining (Näyhä & Pesonen, 2014), while bio-energy driven businesses have only limited potential in capturing value towards higher end products or services (Näyhä et al., 2015; Roos & Stendahl, 2016).

We studied the current situation of the PPI in terms of industry structure and the potential for value creation in 2030, using a three-round dissensus-Delphi approach. According to the panelists, the current level of profitability and competitive situation in the European PPI is largely product-segment-specific. Although profitability in some product segments was assessed as being better than in others, the overall profitability was generally perceived as rather low. Some of the panelists expected competition from other parts of the world to continue to have a strong influence on the European industry in the future, especially when producers in emerging markets have caught up with the European level of technology, whereas others referred to the major strengths of the European industry, such as the quality of education and know-how. The sustainability investments that have been made were seen as a further strength, and as a basis on which to contribute to a bio-based economy.

The solutions to ensure long-term industry survival and vitality divided the panelists in their opinions. Although some experts foresaw further cost cutting as a necessity, the higher-level opportunities of the industry were seen to lie especially in substituting fossil-based with bio-based products. The industry's future appeared to rely heavily on its capability to innovate and develop new bio-based products. Expectations in this respect were reflected, for example, in the prediction that an average 40 percent of the turnover in 2030 would come from new products, but either the need for or the expectation of RDI and new products also came up repeatedly in different forms in the answers to the various open questions. This finding is fairly well in line with the industry-driven roadmap for the Finnish forest cluster (2010), in which 50 percent of turnover is predicted to derive from products that were not on the market in 2006. However, the high level of diversity between the groups on the perceived industry capacity to realize the new products and services in their 2030 turnover demonstrates the high degree of uncertainty regarding the future of the sector.

More radically, some panelist expected that the businesses' chances of operating profitably in 2030 required changes not only in the products but also in business logic. Clearly, breaking free from the dominant industry logic (see Prahalad & Bettis, 1986) requires the reconfiguration of established norms and beliefs, and a shift in focus from incremental innovations and the maximum utilization of existing assets towards the search for more radical and novel solutions in order to capture value. In this particular industry context, and fueled by ambitious European climate and energy policies and the concept of bio-economy, there is a strong call for the establishment of cross-sectorial collaboration in R&D aimed at developing renewable bio-based materials to replace traditional paper products, chemicals and bio-fuels. Applying the new concepts in the process of developing new products, integrating into new value chains, and starting commercial-scale businesses will require a fundamentally better understanding of the new markets and customers, and of managing change, R&D and technical expertise: it will also require sufficient financial resources (see also Näyhä et al., 2014). The European paper industry has recently been actively developing a Public-Private Partnership on bio-based industry to boost innovations, perceiving itself as a solution provider in sustainability and a strategic actor in the EU economy. According to the assessments of the Delphi panel, there seems to be scope for further prioritizing actions and developing comprehensive research agendas that go beyond technological innovations and take into account markets, consumers, and the whole institutional context. Developing more diversified and competitive businesses in PPI also includes inevitably some switching costs. There is also a need for addressing sustainability challenges in the transformation to bio-economy and development of better quality standards. These all call for solid leadership and management capabilities in the industry, and a more proactive stance, as also emphasized by Roos and Stendal (2016).

With regard to the industry structure, many of the panelists expected the consolidation to continue. However, they also thought that there would be more room in the industry for smaller-scale, specialized businesses targeting niche markets, which would reflect the competitiveness of such companies. More generally, the respondents predicted that the main drivers of competitiveness in 2030 would include energy and material efficiency, sustainability, as well as the already mentioned new innovations in processes and products that would meet both regulatory requirements (such as carbon neutrality) and changing customer needs. The role of the regulatory environment and political uncertainty comprised a factor that was not

expected to appear as strongly as it did among the Delphi panelists as a major issue that will shape the future of the European PPI.

Overall, the findings of the Delphi study indicate that the actors in the industry are faced with several parallel changes in their business environment that are driven by goals arising from the need for sustainability and for maintaining the industry's competitiveness. The pulp and paper sector's potential to align itself with the changes largely depends on the ability of management to see the longer-term opportunities. No strategic renewal will take place if the industry continues on its path of incremental investment and short-termism, with a strategic focus on improving cost efficiency: such a strategy could also prolong its profitability problems.

It is also interesting to compare our results with those reported by Darkow and von der Gracht (2013), who used a Delphi approach in building scenarios for the European chemical industry. Their findings also emphasize sustainability and resource dependency as the two main factors shaping the industry up to 2030, and contributing to its competitive advantage. They also discussed the role of the regulatory framework in driving innovation, the strengthening competition from Asia and the need for diversification in business models. All these aspects were also identified as applying to the pulp and paper industry, which is understandable given the structural similarity between the two capital-intensive and mature process industries operating in global markets with high price volatility.

In terms of limitations, the number of respondents and their country of origin could have affected the results of this study: a different combination of panelists may have emphasized the change factors differently. However, given that Delphi has proved to be a suitable method for exploring complex phenomena lacking exact data, and that the panelists were high-level industry experts, it is feasible to assume that the results reflect the current and expected future situation fairly well. Further research could focus on what changes, in terms of strategic investments for example, are required in the industry for it to achieve and maintain global competitiveness in the future. From the sustainability perspective, an interesting future avenue would be to combine futures research with studies on business models, as recognized among transition theorists (e.g. Loorbach & Wijsman, 2013) and in the field of organizational management (Zollo, Cennamo, & Neuman, 2013).

Acknowledgements

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Appendix A. Titles of the expert panelists.

(1) Representatives of industry associations and other experts	Leading Consultant; Innovation and Bioeconomy Director; Environmental Director; Forest Director; Principal; International Development Expert
(2) Representatives of academia	Professors (2); Senior Researchers (2); Associate Professor; Researchers (3)
(3) Industry experts	Sustainability Manager; Environmental Manager; Senior Specialist, Environment and Responsibility; Manager, Quality and Environmental Information; Manager, Sustainability and Corporate Affairs

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