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Services and industrial development: analysis of industrial policy, trends and issues for the forest-based sector

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Increasing role of services in the economy has been recognized in the forest-based sector, yet the phenomenon and its possible impacts remain little studied. The forest-based sector companies operate in international markets and their products feed into a wide range of industrial activities. Increasing role of services as change in the operating environment of these companies can be expected to influence also on the upstream of the forest-based value chains, and better understanding of such developments is needed. This study analyses documents of the EU industrial policy and economic cooperation at international level from the year 2000 onwards, and asks: 1) how the increasing role of services is assessed as part of industrial development, 2) which trends and drivers are identified, and 3) whether and how the issues related to the natural resources base are addressed with regard to this phenomenon. The study concludes that instead of thinking of the increasing role of services as a trend in the external environment of the forest-based sector, it can also be assessed as a symptom of more profound changes underway in the industrial production. The recent industrial policy documents emphasize the new technology-enabled production modes that revolutionize how production, distribution and value capture can be organized. By assessing the developments only with accustomed metrics, such as number and volume of services, important opportunities and challenges may remain unrecognized for the forest-based sector. The paper concludes questions for future research to address this issue.

Keywords: industrial policy, manufacturing, services, forest-based sector, production revolution

JEL: L73, O14, O25
1. Introduction

The services sector contributes 70-80% of national value added and employment in developed countries, and its share is increasing also in the developing countries (Wölfl, 2005; De Backer et al., 2015). The traditional division of economic sectors, especially the borderline between manufacturing and services has become blurred: business services contribute an important input to the manufacturing operations, while manufacturing companies themselves also produce services along their value chains and offer services to their customers. In 2014 services trade represented 21% of the world trade in goods and services (WTO, 2017). The General Agreement on Trade in Services (GATS) entered into force in 1995, and in Europe measures have been taken to improve functioning of the internal market for services (EC, 2002a). Attention is not solely on the services industries on their own, but increasingly with regard to the role that services play in internationally distributed production, so called global value chains (Low, 2013). Services are a crucial part of the interactions in the primary and secondary production sectors, as well as on their own, contributing to the economic growth.

The increasing role of services has also been recognized in the forest-based sector. Services have been addressed from the perspective of new opportunities in services businesses, including activities related to non-wood goods and services, rural entrepreneurship and innovation in forestry (Niskanen et al., 2007; Weiss et al., 2011), changing modes in forest-owner services (Mattila and Roos, 2014); growing importance of business-to-business services in the forest industry (Toppinen et al., 2013; Viitamo, 2013); role of intangible aspects for the wood products industry (Toivonen et al., 2005, Wang et al., 2015; Räty et al., 2016), and; future prospects in innovations of new products and services (Näyhä et al., 2014). The analyses tend to focus on services within the forest-based sector, its processes and direct customers, whereas the further downstream developments and possible changes in the customer industries’ operations typically fall
outside the study scope. At the same time the traditional borderlines of a forest-based sector are blurring and the industry operations increasingly connect with energy, chemicals, pharmaceuticals and textiles sectors (Hetemäki, 2014; Hansen 2016). Biorefineries call for new types of partnerships and interaction across several levels of production (Pätäri et al., 2011; Näyhä and Pesonen, 2014; Bauer et al., 2016), and for example the European bioeconomy strategy emphasizes the need to cross the sector borderlines and establish new kinds of industrial ecosystems (EC, 2012d). Renewal of forest industry is connected with other industries, either supplying to it or using its products in their own processes. From this perspective the trend of increasing role of services in the economy raises the question how the changing industrial processes affect the upstream of the existing product value chains and the emerging new bio-based value chains.

The very concept of 'services' remains challenging to grasp for its impacts in the economy. Services are distributed across all socio-economic sectors, but they have gained little interest until the past thirty years (Bryson and Daniels, 2007). Recent analyses show that the average service content is nearly 40% of the total value of final manufacturing goods produced in the EU, that is, the input that service sectors contributes to the realization of the manufacturing output (Stehrer et al., 2014; De Backer et al., 2015). The role of especially knowledge-intensive business services for the industry is recognized, but statistical metrics to analyze these interconnections are lagging behind, not least due to the technological development (Toivonen, 2004; Miles, 2005). Furthermore, the input-output analyses do not count in services produced by the manufacturing companies themselves. The labor force surveys indicate that app. 40–50% of persons working in manufacturing are in fact employed in service-type occupations, for example in R&D, management, accounting, legal services, marketing, distribution or after-sales services (Pilat et al., 2006; Manyika et al., 2012). On the other hand, analyses on international company financial data demonstrate that app. 30% of manufacturers with over 100 employees offer services for their customers (Neely et al., 2011). Servitization in manufacturing, i.e., manufacturing companies
extending their tangible products with services and shifting their operations towards service, has gained an increasing attention in engineering and business research. Services, whether produced by the companies themselves or acquired from external service providers, are studied as sources of improved competitiveness and a means to gain higher and more stable revenue streams for the manufacturing companies (Vandermerwe and Rada, 1988; and summarily in Baines et al., 2009; Kowalkowski et al., 2017).

Although very few studies have been made on the forest industry specifically, its service-content or servitization, the developments are not unfamiliar in the forest-based sector. Servitization has been typical in machinery and engineering industry where, for example, companies have provided mill service and maintenance for the pulp and paper industry. But also paper and paperboard companies offer integrated solutions to their customers, for example packing materials and solutions that are developed together with the food and pharmaceuticals industries (Kuusisto, 2006; Viitamo, 2013). There are also examples of fairly simple products that are attached with a service component: For example, a producer of wooden electricity poles adds the product delivery with a GPS-tool that allows communication with the customer’s assembly teams and improves their efficiency; a company producing wooden frames for construction offers assembly services; a sawmill company offers pre-painted construction materials, thus, removing one step of the customer processes either at the construction site or in the pre-fabrication of wooden elements. The same pattern can be found in wood procurement: large forest companies in Finland provide the private forest owners with different types of service packages not only for harvesting and after-harvest forestry work, but also financial and legal services for managing the forest property.

In sum, services and services business are already within the forest-based sector, and they support the production processes in several ways. Yet, the potential of services for creating business or supporting innovations gains little attention in the forest-based sector programmes (Näyhä et al., 2015; Pelli et al., 2017). The programmes, such as the EU Forest Strategy (EC, 2013),
the forest product market reviews and forest sector outlooks (UNECE/FAO, 2011) and the green economy action plans (FOREST EUROPE, 2011; UNECE/FAO, 2014) focus on the part of the value chains which concerns the supply and demand of raw materials and forest products – including sustainable forest management, multiple use of forests, ecosystem services and contribution to rural livelihoods. Services related to trade, certification, labelling, sustainability and transparency are embedded in the processes, but how they contribute to the customer industries’ production processes is not further elaborated. From the point of view of the internationally distributed production, global value chains, and the increasing services trade, also these activities are a crucial part of the industrial processes. The forest products feed into several manufacturing processes both in the domestic European and global markets, and the developments related to the services affect also the forest-based sector: what are the changes ongoing and what kind of opportunities and challenges arise for the forest sector processes?

To gain an overview on this issue, this study analyses the EU industrial policy and economic cooperation at an international level, and asks:

(Q1) How the increasing role of services is described as part of industrial development, and which methods are used to assess the developments?

(Q2) Which trends and drivers are identified for the increasing role of services?

(Q3) Whether and how the issues related to the upstream, i.e. the natural resources base, are addressed with regard to the increasing role of services in industrial activities?

Contribution of this paper is to improve understanding on the increasing role of services from the perspective of industrial policy processes. The paper discusses means to research the role of services in the existing product value chains as well as for the emerging, new bio-based products value chains in the forest-based sector. Such work could contribute to the bioeconomy development
and respond to the concerns raised about renewal of the forest-based sector (Hetemäki, 2014; Kleinschmit et al., 2014; Hansen, 2016).

2. Methods

This study addresses a change recognized in the operation environment of the forest-based sector: the increasing role of services in industrial activities and the role of services for the economic growth in general. As described in the introduction, the phenomenon is multifaceted and can be assessed in the forest-based sector, for example, from the perspective of services functions or occupations that are embedded in the forest-based sector processes, the contribution of external services companies to the operation of the forest-based sector, and the services outputs that forest industries offer to their suppliers and customers. Statistics to analyze these aspects are lacking. This study takes a qualitative approach and analyses documents of industrial development and economic cooperation at international level to gain better understanding of the macro level developments which have led services to become increasingly intermingled with industrial activities. It also collects information about the methods and approaches how the challenges about data on services have been addressed.

The scope of the study is the forest-based sector in Europe, and it focuses on the EU. In other words national or sub-national policies for industrial development are excluded from the analysis. The Community Industrial Policy is based on the legal bases set by the Maastricht Treaty (1992), and the cooperation pursues at issues of a European value added, such as the Single Market (EC, 2000). The EU member countries can pursue more sector-specific emphasis in their national level industrial policies; thus, for example, setting more – or less – emphasis for their forest-based sector and the industrial activities based on forests. The country-wise differences fall outside of the scope of the study. The period of time for analysis covers the Lisbon agenda in 2000 and the Europe
2020 strategy in 2010 as overall frameworks for the industrial policy development in Europe. The same time scope from the year 2000 onwards is used for analyzing other international processes.

The analysis started with a scoping study from the EU industrial policy and key international organizations, such as the World Trade Organization (WTO) and the General Agreement on Trade in Services (GATS), the Organization for Economic Co-operation and Development (OECD), the United Nations Economic Commission for Europe (UNECE) and other UN organizations, the World Bank (WB), as well as a number of economic research institutions whose studies were mentioned in these documents (e.g. Kommerskollegium in Sweden, wiw in Austria and ETLA in Finland). The purpose was to gain an overview of the topic area, what is discussed with respect to the increasing role of services, which issues and perspectives are addressed. Based on the scoping study, the research question was focused on the interrelationship between services and industrial production. More focused document search was made on: the EU industrial policy with regard to services, the OECD with regard to services and industrial development, and the UN processes related to industrial development and to trade and development. The document search from the UNECE sources produced one reference only: a seminar on innovation and competitiveness policies under the Committee on Economic Cooperation and Integration (UNECE, 2011). The two UN institutions that were included in the analyses (the United Nations Industrial Development Organization, UNIDO, and the United Nations Conference on Trade and Development, UNCTAD) address the increasing role of services for the developing countries and countries in transition, but cover also trade in services. Document searches were based on the organizations’ websites and adding the data with the materials which were cited in the already identified documents (see Table 1 for an overview of the data). Additional documents include the WTO GATS materials, studies of the World Bank Group, and for example the Asia-Pacific Economic Cooperation (APEC). The study aims not to be an exhaustive representation of all processes interlinking with services and industrial development, as for example, the EU
industrial policy and economic cooperation at international level connects with several other policy areas which are not included here. Key words for the document search were: “services”; “industrial development”; “industrial policy”; “manufacturing and services” and “servitization” / “servicisation” / “servicification”.

The content analysis of the documents was structured along the three research questions. Firstly the documents were analyzed from each data source separately in a chronological order. The findings were then grouped thematically from all studied documents, to highlight the similarities and differences across the data. Results are presented in the following with each research question in its own subchapter, including a separate subchapter about the methods and approaches for assessing the role of services. For the analysis about trends and drivers (Q2) the data was structured by using the categories of political/legislative, economic, social/values, technological and environmental aspects, and a summary table is included in the results chapter. The upstream natural resources base (Q3) was addressed relatively little in the analyzed documents, but the results are discussed in the end of the paper together with the proposals for future research.
Table 1. Summary of documents analyzed (bold: Communications on the EU industrial policy), for details see the list of references.

<table>
<thead>
<tr>
<th>EU</th>
<th>OECD</th>
<th>UN organizations, WB, WTO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe 2020 strategy (EC, 2010a) <strong>An Integrated Industrial Policy for the Globalisation Era Putting Competitiveness and Sustainability at Centre Stage</strong> (EC 2010b; EC, 2010c)</td>
<td>[Towards Green Growth (OECD, 2011)] Trade in services related to climate change (Steenblik and Geloso Grosso, 2011)</td>
<td>Services, trade and development (Mashayekhi et al. 2011; UNCTAD, 2014) Productive capabilities (Andreoni, 2011)</td>
</tr>
<tr>
<td><strong>For a European Industrial Renaissance</strong> (EC, 2014a; EC, 2014b) High-level group on business services (EC, 2014c)</td>
<td>Services and manufacturing (Nordås and Kim, 2013; De Backer et al., 2015)</td>
<td>Valuing Services in Trade (Sáez et al., 2014) Making global value chains work for development (Taglioni and Winkler, 2016)</td>
</tr>
</tbody>
</table>
3. Results

3.1 Increasing role of services: blurring of traditional sector borderlines and definitions

The analyzed documents illustrate an increasing interest on services and efforts made to gain a better understanding about the role of services in the economy. International conferences, expert groups, studies commissioned to support policy making, as well as for example, projects financed under the EU Framework programmes for research have brought together experts from policy-making, research and business fields. A wide range of issues have been raised; for example, analyses made specifically on the services sectors and services companies, or the services in and for other economic sectors. The major themes concluded from the document analysis can be grouped as three viewpoints to the role of services: a macroeconomic structural change and its implications; the relationship between services trade and (industrial) development, in particular issues related to global value chains, and; competitiveness, including services with respect to productivity and innovation.

In macroeconomic terms the increasing role of services, tertiariization of an economy, is described as an increasing share of the services sector in GDP and employment, while the role of the primary production and manufacturing-processing sectors is decreasing. Analyzed documents describe it as a natural economic progress from an agrarian to industrial economy, and further, to a service economy (OECD, 2000; EC, 2002a, 2002b, 2004; Wölfl, 2005). They however emphasize that the growing services sector needs to be assessed in the light of technological and economic transformations, including interlinked processes between manufacturing and services, as well as the developments in international trade and international distribution of production (EC 2002b; Wölfl, 2005; Memedovic and Iapadre, 2009; De Backer et al., 2015). Thus, the developments are not unambiguous.
The competitive pressure from the markets leads companies to seek for improved performance through technology development. Efficiency is targeted by outsourcing other than the company core activities to external suppliers, who in turn develop these into more efficient processes (OECD, 2000). Outsourcing from manufacturing has made visible the services that previously were embedded within the manufacturing processes. Business services, telecommunications, transport, wholesale and retail trade and finance explain the major part of increase in services employment, but these are also the services sectors that indicate fast productivity growth (Wölfl, 2003, 2005; EC, 2014c). The business services are developed and supplied to manufacturing, but also to other services companies, primary production companies and the public sector. Although manufacturing provides less employment, its still understood to run the economy with higher productivity growth, innovation and private sector R&D investments, demand for the above mentioned services, as well as its export trade performance (EC, 2002b, 2005a, 2010b; UNIDO, 2013a, 2013b). For example the EU industrial policy highlights the European world leadership in automotive, aeronautics, engineering, space, chemicals and pharmaceuticals industries which also illustrate high potential for technological innovation and productivity growth (EC,2012c, 2014a). Compared to this the forest-based sector gains little visibility in the European industrial policy field until the development of bioeconomy becomes highlighted (see e.g. EC, 2005b or EC,2014b).

The increase in services at general economic terms has been recognized since the late 1950’s, but the quality and character of this development remains debated. Also the analyzed documents raise the \textit{manufacturing vs. services} question, thus, either describing the contribution of services as input and demand for the ‘manufacturing proper’ (UNIDO, 2013a; EC, 2002b) or emphasizing services as drivers for ‘the new economy’ (EC, 2000; OECD, 2000). The developing countries’ rapid shift towards services – measured by their national economy figures, but also by international services trade – is provided as an evidence of the developing global service economy.
For example India has in a relatively short time succeeded to increase its services sector productivity and the whole economy has benefitted from the international trade of services (Majluf and Zarilli, 2007; UNCTAD, 2014a). This has raised the question whether the global value chains and internationally dispersed production now allow the developing countries to take different development paths than before (Taglioni and Winkler, 2016; UNCTAD, 2014a).

On the other hand the documents highlight that services as a category includes a very heterogeneous group of activities, and more detailed analyses are needed: tertiarization is not the same thing as de-industrialization, i.e., industrial decline with reducing employment, output and productivity growth, impaired with trade deficit (EC, 2004). Or alternatively, different types of de-industrialization should be highlighted: mature de-industrialization that enables development of high-tech services – such as the increase in producer services in the developed countries and some emerging economies – and premature de-industrialization where the services sector grows, but due to its limited capacity to apply new technologies, the economy is caught into a low-productivity trap (UNIDO, 2015; EC, 2003a). Also the name of the game is seen to change: the internationally distributed value chains and the de-and re-bundling of activities to the locations which provide best competitive advantage make it an ever more challenging task to assess the developments ongoing or their direction in the future (Baldwin, 2013). In the EU industrial policy documents, services are seen as a strength: the operating environment that supports manufacturing to combine its products with services can give a leading edge for the European industry (EC, 2004), and conditions need to be improved for the services exports, too (EC, 2011b).

New types of business models make it difficult to categorize activities as manufacturing or services. For example, into which group would fit the manufacturers without factories, such as Nike sports garments and Dell computers, or the service providers venturing manufacturers, such as Google tablets? It is the services part that is of most strategic importance for these companies, but value creation prerequisites the tangible products (Nordås and Kim, 2013).
Instead, ‘production’ is proposed as a term to describe the tangible and intangible elements that can no more be separated in the complex interactions; and instead of commanding either the manufacturing or services parts of the value chain it is important to be a part of the global value chains (EC, 2011a, 2011b, 2011c; Zysman et al., 2011; De Backer et al., 2015; OECD, 2016). Interaction between manufacturing and services is a mutual learning process where new technological and non-technological capabilities are coproduced, and the knowledge flows – intangible assets – are valuable part of production (Andreoni, 2011; EC, 2011b, 2011c; OECD, 2013b).

In other words, increasing role of services refers also to innovation in industrial activities. While the documents from the beginning of 2000s describe innovation in services mainly as service companies applying new technologies that lead to productivity growth (Pilat, 2001; EC, 2002b, 2004), more recent documents emphasize that services contribute to innovation in multiple ways (OECD, 2006; EC, 2007b, 2009). Services companies are carriers, facilitators and contributors of innovation; their processes involve the customer in using new technologies and they disseminate practices across their customer companies in different fields of operation and, through the international trade of services, to other countries. Services are seen to contribute towards more open approaches of innovation (OECD, 2007), but also to more profound transformations in the economy, for example, in finding solutions to societal challenges, environmental concerns or resource efficiency (EC, 2014c). The increasing role of services refers not only to services companies, but also the changing mode of operation they represent; business services and solutions are provided by various types of companies (EC, 2003b, 2014c). Knowledge-based economy is an economy where services play a crucial role; a role which is not possible to fully grasp based on the existing economic metrics. With new enabling technologies the supply chain that used to be manageable by a single actor becomes an open process with feedback loops across various stages of the networked operations. During the past few years attention of the industrial policy has shifted from
the manufacturing vs. services debate to the emerging new forms of production: whether it is called as future manufacturing, Industry 4.0 or next production revolution, the division between manufacturing and services is foreseen to become increasingly artificial (EC, 2016; OECD, 2016, 2017).

3.2 Need for new methods and tools for assessing the role of services

The analyzed documents highlight the challenges of analyzing services. The accustomed macroeconomic metrics include, for example, the services sector share of value added, employment, productivity, foreign direct investments and export trade. Trade of services is analyzed based on the Balance of Payments data (WTO, 2017), for example, when assessing the competitiveness and exports of services (see the analyses on communications, transports, finance and travel sectors in Sáez et al., 2014). Furthermore, the GATS related services sectoral classification list and modes of international trade of services are utilized in case studies: how to make visible the services embedded in the supply chains and the services offered to the customers by manufacturing companies (Kommerskollegium, 2010) or how to analyze the services in environmental/clean-tech trade (Steenblik and Geloso Grosso, 2011).

Overall the statistical categories for services have been lagging behind the detail level of manufacturing, and there has been need to develop more detailed measurement for these activities (EC, 2009). For example services such as computer activities or telecommunications were included in the Statistical classification of economic activities in the European Community (NACE) in the beginning of the 1990s, but categories for business services were detailed in the follow-up revisions. This work is still ongoing: the business services in particular are recognized as a dynamic and heterogeneous field where more precision for statistics would be needed (EC, 2014c). The NACE Revision 2 in 2006 has been in use since the beginning of 2008, but due to data availability for longer time series, more aggregate level data of previous revisions is often used (see EC,
or alternatively, the analyses are limited to those countries where longer time series are available (see OECD, 2007). Another example of changing metrics is the Oslo manual for innovation: the innovation surveys were expanded to include also services sectors in 1997, and marketing and organizational innovation categories were added in the 2005 edition of the manual (OECD and Eurostat, 2005; EC, 2009). Innovation in services is described as less technological, more incremental in nature, less formally organized, and more difficult to protect with IPR. The processual nature of innovations in and by services calls for new concepts for analysis, and the case studies also address the role of services within innovation systems, thus, a part of the knowledge structures (e.g. OECD, 2006).

The interlinkages between the manufacturing and services and their domestic and foreign content are presented in the analyzed documents based on input-output data (Wölf I, 2005; Wölf I and Pilat, 2005; Pilat et al., 2006; EC, 2010c; OECD, 2013a). The methods as well as data have been developed in several organizations, such as the OECD-WTO Trade in Value-Added (TiVA) initiative (OECD-WTO, 2012) and the World Input-Output Database (e.g. Stehrer et al., 2014). The sectoral input-output analyses are also combined with data from the Labor Force Surveys (LFS) and Community Innovation Surveys (CIS) by Eurostat, EU KLEMS Growth and Productivity Accounts, or the European Manufacturing Survey (EMS). The aim is to provide a wider view on the developments within manufacturing as well as the relationship between the manufacturing and services sectors. The latest release of the World Input-Output Database in 2016 includes 56 sectors mainly at the 2-digit statistical classification level (WIOD, 2017), but the input-output data is at too high aggregation level to describe, for example, the role of business services.

Overall, quantification of services faces several difficulties, not least because the internationally dispersed production and intra-firm trade of multinational companies obstruct direct analyses of trade flows (Low, 2013). A more detailed picture on the global supply chains has been targeted with case studies, either at the level of countries (Taglioni and Winkler, 2016), individual
companies (Kommerskollegium, 2010) or products (ETLA in EC, 2010c). Typical case studies are electronics, engineering and machinery industries, but also several other types of products have been investigated (summarily in: Kenney, 2012; Sturgeon et al., 2013; Ali-Yrkkö and Rouvinen, 2015). Although the case findings cannot be generalized to whole industries, they provide insights on the globally distributed value chains, including services and other intermediate inputs. The analyses aim at policy recommendations how governments could navigate in the dynamic international environment. In particular offshoring is discussed in this respect, that is, companies moving their activities to another country where these activities are produced either by the company’s own unit, by a joint venture or by acquiring the same activities from an external supplier (outsourcing). Services are needed to manage the distributed supply chains, but the analyses on trade in value added shed also light on the intangible value creation, including the services tasks of the manufacturing companies themselves.

3.3 Main drivers: technological development and globalization

The analyzed documents seek means to improve economic growth and industrial development. Technological development and globalization are recognized as major drives affecting the increasing role of services in industrial processes: both the tangible and intangible production can be de- and re-bundled in several ways, and available technologies make the re-location easy and also economically feasible (Baldwin, 2013). The recent developments for an industrial revolution or new production paradigm emphasize this connection further (Zysman et al., 2011; Nordås and Kim, 2013; OECD, 2016). Table 2 provides a general overview on the trends and drivers, including their direction and/or uncertainties identified in the analyzed documents.
Table 2. Summary of the document analysis: Trends and drivers of the increasing role of services.

<table>
<thead>
<tr>
<th>Trends / drivers</th>
<th>Direction / uncertainties</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Political</strong></td>
<td></td>
</tr>
<tr>
<td>GATS (1995); support for increasing international trade in services both at the EU</td>
<td>Open trade vs. increasing protectionism</td>
</tr>
<tr>
<td>and national levels</td>
<td></td>
</tr>
<tr>
<td>Integrated industrial policy, emphasis on technology and innovation (productivity</td>
<td>‘Pro-manufacture vs. Pro-services’ or the Next Production Revolution</td>
</tr>
<tr>
<td>growth)</td>
<td></td>
</tr>
<tr>
<td><strong>Economic</strong></td>
<td></td>
</tr>
<tr>
<td>Global value chains; increase in business services</td>
<td>Business services as source of competitiveness and economic growth; increasing</td>
</tr>
<tr>
<td></td>
<td>services trade, automatization/industrializations of services</td>
</tr>
<tr>
<td>Emerging and developing economies moving towards services in a quick pace</td>
<td>Changing world economy gravity points, changing international division of labor</td>
</tr>
<tr>
<td><strong>Social</strong></td>
<td></td>
</tr>
<tr>
<td>Demographic changes, increasing middle class in emerging economies; people</td>
<td>Increasing demand for services and new types of services (incl. big data analysis)</td>
</tr>
<tr>
<td>accustomed to be provided with solutions</td>
<td></td>
</tr>
<tr>
<td>Changes in labor markets; demand for new skills and structural adjustments</td>
<td>Question of ‘new work’ and its impact on the middle-class occupations; potential of services for tackling societal challenges</td>
</tr>
<tr>
<td><strong>Technological</strong></td>
<td></td>
</tr>
<tr>
<td>Algorithm revolution, advanced manufacturing, emerging technologies</td>
<td>Rapid spread of innovations, commoditization of products but also technologies vs. unrealistic expectations about the speed of technological changes in a short term</td>
</tr>
<tr>
<td>Innovation by adopting new technology in services (dissemination of technologies)</td>
<td>Service innovation of technology (development and spread of new applications through use)</td>
</tr>
<tr>
<td><strong>Environmental</strong></td>
<td></td>
</tr>
<tr>
<td>Green growth and environmental technologies; interrelated services, increase of</td>
<td>Potential of services for tackling environmental challenges vs. services making consumption easier and leading to an increased use of natural resources</td>
</tr>
<tr>
<td>services trade</td>
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</table>

The multilateral agreement on services trade, GATS in 1995, has led to an increase in services trade.

In the analyzed documents the development of efficient services markets, especially for trade of business services, transportation and logistics services, wholesale and retail trade, and financial services, are seen important for growth and competitiveness of manufacturing (EC, 2010b, 2014a,b,c; OECD, 2013a). In the recent documents, also the digital infrastructure necessary for new

In the EU industrial policy integrated approach means coherence across different policy fields, thus including trade, markets, technology, but also sustainability issues and competitiveness of the European industry (EC, 2005a). Emphasis is given to innovation, support of Key Enabling Technologies (KET) and their market uptake, including standards for emerging technologies and for example the bio-based products (EC, 2007a, 2010b). Setting high criteria and standards for the European markets, for example for low-carbon and resource efficient products and processes, is a means to support the European industry’s competitiveness by promoting the same standards also to trade agreements and international forums. The Services Directive (2006) for internal market for services is expected to strengthen the European economies, support reorganization of value chains across Europe, utilize competitive advantages of countries, and develop capacities to participate in the global value chains (EC, 2002b; EC, 2004). The goal for re-industrialization is set to increase the share of manufacturing of GDP from 16% in 2011 to 20% by the year 2020 (EC, 2012a,b,c,d) – thus, part of the industrial activities moved to low-cost countries is expected to be re-located back to Europe. At the same time growth in business services is expected to come from the emerging markets (EC, 2011b).

The analyzed documents tend to focus on the positive aspects of the international trade and its impact on economic development and, for example, disseminating new technologies across countries. The increasing economic interdependencies, however, make the operating environment highly dynamic. Although manufacturing is perceived to gain back its importance in the industrial policy in several countries and regions (Andreoni, 2011; Warwick, 2013; De Backer et al., 2015), policy making becomes increasingly challenging. Changes are more rapid and
unpredictable due to the multiplication effects accumulating from the internationally dispersed supply chains (Baldwin, 2013).

The analyzed documents recognize that the developed countries tend to host the services activities that provide most value added in the global supply chains, while assembly activities move to low-cost countries (Pilat et al., 2006; EC, 2007a; OECD 2013a). The services activities cover both upstream, such as R&D, planning, design and engineering, and downstream of the value chains, such as marketing, IPR and branding (OECD et al., 2014). The picture however has more dimensions, since companies have started to offshore an increasing number of their high value-added services, including R&D to the emerging economies. The international division of labor continues changing (De Backer et al., 2015). For the developed economies this raises concern whether offshoring of production activities to low-cost countries actually leads also the services with the highest productivity growth potential to follow the same path (Pilat and Wölfl, 2005). A recent study concludes that the increasing service trade in R&D functions of multinational enterprises in their global supply chains might actually support also developing these companies’ services activities in the high-cost countries (Belderbos et al., 2016). Both the high and low-technology industry companies’ value added and growth is increasingly linked to innovation and knowledge: there are opportunities for the large multinational companies to coordinate complex interactions in novel ways, but also for the small and medium-sized (SME) companies that are clever to find the niches available in any part of the globe (Baldwin, 2013; OECD, 2013a; De Backer et al., 2015; Taglioni and Winkler, 2016).

Parallel to these developments in industrial production, also other parts of the services sector are growing. In the developed economies ageing population creates demand for personal services, including new types of services. In emerging economies domestic demand supports increase of manufacturing and related services, and the growing middle class consumes more services. International trade in services, including tourism, is expected to increase. Although the EU
industrial policy documents analyzed here tend to place an equation mark between ‘manufacturing’ and ‘industry’, also healthcare industries (EC, 2010b), tourism industry (EC, 2014a), creative industries (EC, 2011b), and the opportunities for new industrial value chains in experience industries, such as cultural sectors (EC, 2012b) are mentioned in the industrial policy documents.

The structural changes in manufacturing will require new skills and adjustments. The developed countries have experienced employment loss due to offshoring of activities to low-cost countries (EC, 2002a, 2003a; OECD, 2007), but due to uptake of new technologies, bringing these tasks back to the developed countries will not increase employment in the same scale (Zysman et al., 2011; OECD, 2016). International trade and consequent increase in services creates hope for new sources of growth, notably in trade of business services (EC, 2012c; APEC, 2017). The developing countries, in turn, highlight sustainability and inclusive growth: balancing between the trade in services and protection of the home markets is a challenge, for example, for ensuring capacities in education and health care (Mashayekhi et al., 2011). Infrastructure services, such as telecommunications, environmental services, such as waste and water management, and other solutions for the increasing urban agglomerations are important for the functioning of the society as a whole (UNCTAD, 2004; Majluf and Zarilli, 2007; Mashayekhi et al., 2011). Overall increasing concern of consumers over the environment and sustainability is foreseen to affect the demand for both manufactured goods and services.

Technological development and digital markets have changed both tangible and intangible production. Zysman et al. (2011) name it as algorithm revolution that changes how value is created, distributed and captured throughout all economic sectors: activities can be coded, replicated, analyzed, modified and customized, and the feedback loops to customer processes enable creation of new services. The ways how people get accustomed to be provided with goods and services changes the requirements for the producers. Innovation and market cycles become rapid; not only products commoditize, but also technologies and their applications (Baldwin, 2013).
Digital markets together with new and emerging technologies, such as advanced manufacturing, 3d-printing, new industrial applications of internet, smart factories, robotics and photonics are expected to continue to change the production processes in a profound way (EC, 2014a; OECD, 2016). Thus the way how IT, ICT and digital technologies created totally new types of services, also the new bio-, nano- and other technologies are foreseen to lead into new service concepts; for example space-based monitoring contributing to creation of new type of climate change services (EC, 2007a, 2007b, 2010b, 2012c). The analyzed documents illustrate the speed of the technological change: in the beginning focus was on e-marketplaces, ICT and how marketing of goods (and services) changes (e.g. OECD, 2001); in 2016, only 15 years later, the documents elaborate a production revolution where the digital applications together with other enabling technologies change the way how production is organized (EC, 2014a, 2016; OECD, 2016). Although these developments are foreseen with caution about their realization in a short term, the impact of such changes is foreseen massive in a long term. The global value chains and their dynamic simply that innovations can take place internationally, not only in the most developed countries as a starting point.

As already described above (Chapter 3.1) the analyzed documents illustrate a changing understanding about the role of services in innovation. Technology has changed the nature of business services, but services contribute to the context where and how technology becomes used (EC, 2014c): instead of speaking of innovation in services, there is also service innovation, i.e., change in approaches and modes of operation how a system or for example a cluster of companies works. In the EU smart specialization is promoted as a way to allow countries or regions to concentrate on their comparative advantages and support platforms where also a wider transformative role of services could be achieved (EC, 2010b, 2011a, 2014a).

A service economy could have important environmental impacts and reduce greenhouse gas emissions, on one hand, by replacing tangible goods with use of intangible services, but more so, through more efficient processes (OECD, 2000; EC, 2010b).
dissemination of new resource-efficient technologies and environmental technologies require services (EC, 2010b; OECD, 2011; UNIDO 2015). These technologies have international markets, thus, their uptake creates demand for international trade of services. The related business services, telecommunications services, construction and engineering services can be provided by the technology producer or they can be sourced from local service providers, by a joint venture or as in-house activities established in the target country (Steenblik and Geloso Grosso, 2011). Such services are expected to result in increased capacities also in the developing countries (Majluf and Zarilli, 2007; UNIDO, 2013c; UNCTAD, 2014a) – although also the negative impact on the environment due to increase in services is recognized.

3.4 Services and the upstream natural resources base: ‘servitization’ of primary production?

Issues related to the upstream, i.e. the natural resources base, and services in industrial activities are addressed relatively little in the analyzed documents. Role of services, notably infrastructure services, transportation, energy and telecommunications, and business services have been assessed for the developing countries’ agricultural crops and trade (UNCTAD, 2014a), as well as the role of technology and services for the exports of higher-value processed agro-food products (Taglioni and Winkler, 2016). The documents provide several examples of new technologies and services in manufacturing, but much less for the primary production (e.g. Zysman et al., 2011).

However, the environmental concerns together with scarcities and consequent rising costs of raw materials are expected to force the manufacturing processes towards higher resource and energy efficiency as well as to re-use and re-manufacture materials in new ways. These are processes which would require the manufacturing companies to provide new types of services with their products along the whole supply chain (EC, 2010b; De Backer et al., 2015).

In the EU industrial policy documents focus is on access, secured supply, affordable price of raw materials and energy – thus, renewable and non-renewable as well as secondary raw
materials from recycling, and sourcing from domestic European markets and internationally (EC, 2004, 2010b, 2012c). Renewable biological resources are foreseen to provide an opportunity for increased domestic sourcing of materials and products in Europe. The focus is on technological solutions; for example, both green economy and bioeconomy become addressed as technological processes for industrial development, investment to R&D, ensuring competitiveness of industry, and market creation for new products and processes (EC, 2002b, 2010b, 2012a, 2014a). Dissemination of new technologies and development of new production processes and markets require services along the whole value chain.

4. Conclusions and discussion

This study set out to analyze the increasing role of services from the viewpoint of industrial policies and development at an international level. The topic is very wide and the analyses remain at general level. More in-detail studies, including also concrete examples and case studies, are needed to elaborate the field of investigation further. The study was based on data from policy documents, technical reports and studies from the year 2000 onwards. These documents provide information on the issues emphasized in the international collaboration, but they do not analyze a wider set of change factors, tradeoffs between different goals, or for example the industrial policy goals at national or regional levels. Thus, for future analyses, also these aspects could be explored. The contribution of this paper is to draw attention to the need for further research about services and related changes also in the production modes of the forest-based sector.

The study found that the increasing role of services has been assessed from several dimensions for industrial policies and development; the traditional sectors and concepts are blurring, but also what is the target of an ‘industrial policy’. Recently the attention has drawn to the technological changes that increasingly inter-twine services with manufacturing and call for redefining what is ‘production’. Raw materials can be newly sourced or re-used, but the knowledge
flows that they carry are important throughout the different stages of production, use, re-use, recycling and end-use. Services, either as in-house operations or supplied from external service providers, are important for efficiency and productivity. Instead of taking services as support activities for production as they often are presented in the forest-based sector strategies (Pelli et al., 2017), the industrial policies target services also as sources of innovation and economic growth. In technology-enabled production both tangible and intangible resources can be organized in novel ways. This affects all stages of the forest-based value chains: the material processes from forest extraction to processing and to existing and new industrial uses, as well as to knowledge processes of natural resources management and forest governance.

The study summarized briefly the ongoing work on methods and approaches how to assess the developments: new metrics, datasets and approaches have been sought in the international and national economic analyses as well as sectoral analyses and case studies. These methods can also be used for assessing the increasing role of services in the forest-based sector, for example: Which services are provided and traded along the forest-based sector value chains? What is the effect of services sectors, business services in particular, on the forest-based sector productivity? What role(s) services have in innovation systems, for example, in the business ecosystems forming around the forest-based biorefineries? What is the service content of forest industry products, where value is created and how it is distributed at different stages of production? Answering these questions would provide a better understanding on the present role of services in and for the forest-based sector.

For future-oriented analysis also the overall trends in the operating environment are important. The analyzed documents highlight globalization and technology as major drivers behind increasing role of services in the industrial processes. These two drivers interact and have strengthened each other in enabling the production to be organized in new ways. The global supply chains and their dynamics make economies more interdependent and exposed for rapid and more
unpredictable changes. The forest-based sector processes focus on raw materials and interim products mainly, but the sector boundaries are expanding for example towards energy, chemicals and textiles sectors. The new bio-based materials and products are not necessarily directly applicable to the further downstream production but require also adjustments in the customer industry processes (cf. Bauer et al., 2016). Optimization of the upstream processes with improved wood mobilization, extraction of forest resources and processing of materials is already developed, but the technology-enabled processes will also enable data and feedback loops from the further downstream processes back to the operations in forest. This creates both opportunities and challenges: What types of services do the further downstream industries need in order to adopt new technical solutions or bio-based materials into their own production processes? Where are the opportunities for companies and start-ups to find the niches that open in the evolving bioeconomy supply chains? What kind of support is needed to develop new solutions; does it require location close to the raw material base, close to the customer or which are the crucial resources needed? How to compare the opportunities and risks related to the higher value-added end of the globally distributed value chains, including services activities, vis à vis the opportunities and risks of keeping the focus on the raw materials end of the evolving production? Investigation of these questions could help mapping out opportunities and challenges related to the future forest-based value chains.

The study found that upstream of supply chains and the natural resources base is relatively little addressed in the industrial policy and development documents. Mainly the issues of access to raw materials, substitution by (new) bio-based materials/products and efficiency in resource use is elaborated in the documents, together with the potential in environmental technologies. Bioeconomy is first and foremost a technological issue from the industrial policy perspective; it is one of the promising technological areas expected to change the production modes and contribute to productivity growth. This is quite a different perspective compared with the
description of a forest-based bioeconomy or green economy in the forest-related programmes (EC, 2013; FOREST EUROPE 2011; UNECE/FAO, 2014). Whether or not bioeconomy is anything radically new within the forest-based sector (cf. Pülzl et al., 2014), it is not necessarily understood with similar connotations in the customer industries or among their customers. An interesting perspective to the ‘next production revolution’ opens up from the expertise of the forest-based sector, for example in sustainable forest management, governance of natural resources and ecosystem services. Further elaboration of what is defined ‘as service’ in the future could provide a more balanced view to a bioeconomy compared with the technology emphasis presented in the industrial policy and economic collaboration processes: What types of sustainability services could support the further downstream industries? How to assess and define the ecosystem services ‘as service’ in the new production paradigm? What does the algorithm revolution mean in the context of non-market forest goods and services? These types of questions seek to connect the upstream and downstream operations in a new way.

To conclude: Instead of thinking the increasing role of services as a trend, it can be interpreted as a symptom of more profound changes underway in the production modes and logic how operations are organized. In a short term the identification and analyses on the volume and number of services in the forest industry are useful in making the role of services visible in the forest-based sector as well as its customer industries’ processes. For the analyses about a longer time horizon, also the evolving new modes of operation should be addressed. In the analyzed documents these were explained with concrete examples or mini case studies. For macro-level analyses the OECD (2016) highlights the need for technology foresights, on one hand to develop stakeholder networks and capacities, and on the other hand to support policy making in the situation when outcomes of the evolving technologies, speed or direction of change are difficult to predict. Technology forecasting and impact analysis, including assessment of potential radical innovations in competing solutions for biomass-based materials and products, could be useful to assess possible
structural changes in the forest-based sector and to develop alternative scenarios (cf. Hurmekoski and Hetemäki, 2013). By assessing the role of services only with the accustomed metrics we limit our perception on the present-day production modes only, and important opportunities and challenges may remain unrecognized for the forest-based sector.

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