



# THE EVOLUTION OF GLOBAL PAPER INDUSTRY<sup>2</sup>

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## ABSTRACT

Industries are assumed to follow a specific life cycle characterized by stages of nascence, growth, maturity and decline apparent in firm numbers, production volume and technological activity. Pulp and paper industries not exceptions to this rule. Quite the contrary. The history of these lines of business seems to follow similar path dependent evolution in any given country. Constrained with market growth, available resources and technology, pulp and paper industry has experienced stages of growth, maturation, and even decline in a numerous mature economies.

## LIFE CYCLES IN PULP AND PAPER INDUSTRY

The underlying assumption in the economic history of industries is the deterministic nature of the industry life cycle. That is, industries are assumed to follow a specific life cycle characterized by stages of nascence, growth, maturity, and decline apparent in firm numbers, production volume, and technological activity. At a high level of abstraction the evolution of any industry is a function of changes in product market demand, technology, the surrounding institutional environment and organizational solutions. A new industry emerges as a result of a technological opportunity that encourages the entry of a large number of firms. As the winner, i.e. the dominant design (e.g. Anderson and Tushman 1990; Murmann and Frenken 2006; Suarez 2004), emerges, a shakeout in firm numbers takes place (e.g. Klepper and Miller 1995; Willard and Cooper 1985). Thereafter, the industry shifts to an era of incremental change and stagnation in firm numbers (e.g. Abernathy 1978; Kim and Pennings 2009; Roy and McEvily 2004).

Even though there is a conceptual agreement on the life cycles of industries, with certain metrics like number of active firms (Hannan and Freeman 1989; Klepper 1996, 2002; Murmann 2003; Nelson

and Winter 1982), earlier studies usually concentrate on the issue only at the level of one country, analyzing either one or several branches of industry. Our study on paper industry history of the past 200 years suggests that these kinds of evolutionary patterns can be found in the case of this specific industry from a number of countries (Lamberg & al. 2006; Lamberg & al. 2012).

Paper industry has been among key businesses for economic and societal development during the period of industrialization; one may argue that paper has been more important for global economic growth than the steam engine – although the latter has usually been emphasized in economic history (Kuisma 2008). The industry has also experienced a rapid period of growth – at least until the turn of the Millennium. In the USA alone, the total industry capacity increased 20 per cent between 1978 and 1992 (Pesendorfer 2003).

The pulp and paper industry has gone through periods of growth, maturation and decline in different segments, technology and use of raw materials during the past 200 years. The development has been relatively incremental and predictable. Even though major innovations, such as the beginning of the mechanical production of paper or the introduction of wood fiber as raw material, created revolutionary business opportunities, it took decades rather than years before these major innovations were implemented. Therefore, shifts in global industry dominance have been slow. The first industrializing countries, like Britain, France, and Germany dominated paper industries at the very beginning of mechanized production. During the latter half of the nineteenth century, Northern hemisphere countries (North America and the Nordic countries) acquired dominance for the following century, whereas the dominance shifted around the turn of the new millennium to the Southern hemisphere and to the Far East. By and large, pulp and paper industry has followed the international trends of industrial globalization, though depending on

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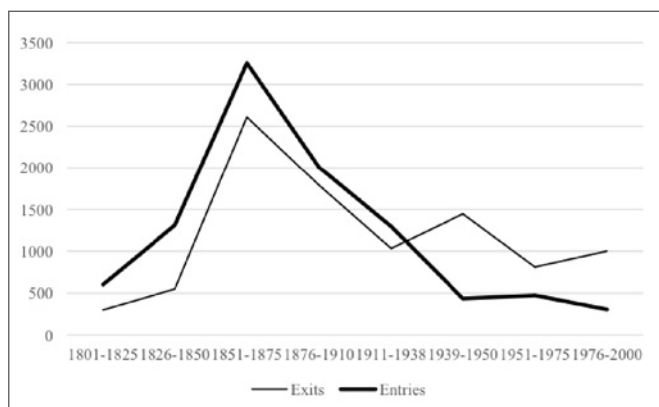
2. This overview is based on following articles published by Springer in 2012, with kind permission of the publisher: Lamberg, Juha-Antti, Ojala, Jari, Peltoniemi, Mirva and Särkkä, Timo, *Research on Evolution and the Global History of Pulp and Paper Industry: An Introduction*, in Juha-Antti Lamberg, Jari Ojala, Mirva Peltoniemi and Timo Särkkä (eds.), *The Evolution of Global Paper Industry 1800–2050: A Comparative Analysis*. World Forests, Vol. 17. Dordrecht: Springer 2012, pp. 1–18; Ojala, Jari, Voutilainen, Miikka and Lamberg, Juha-Antti; *The Evolution of the Global Paper Industry: Concluding Remark*, in Juha-Antti Lamberg, Jari Ojala, Mirva Peltoniemi and Timo Särkkä (eds.), *The Evolution of Global Paper Industry 1800–2050: A Comparative Analysis*. World Forests Vol. 17. Dordrecht: Springer 2012, pp. 345–363.

specific raw materials and markets. Therefore, purely market factors such as demand and raw material supply explain significantly the evolution of pulp and paper industry in the respective countries.

We analyzed pulp and paper industry life-cycles in a global context by comparing the entries and exits of new companies in each country during certain cross cutting years. The data used was mainly compiled from specific industry directories (Phillips 1910; 1950; 1971; 1974; 2000). These directories include, at least in theory, information on *all* paper industry companies in the world<sup>2</sup>. The data consists of cross-sectional information on pulp and paper industry's population variables from 15 countries and its spans from the early nineteenth century to 2000. Following the previous empirical studies, we traced down the entries and exits in pulp and paper industry in each analyzed country in order to isolate the periods of turbulence (high rates of entries and exits) from the population. According to previous studies (Agarwal and Gort 1996; Baldwin and Gorecki 1991) the levels of turbulence should be highest during the early phases of the life cycle, leveling off towards industrial maturity.

According to our analysis, the population of the European pulp and paper industry grew until the beginning of the Second World War, although the highest rates of turbulence are measured during the period 1851–1875. Figure 1 suggests that the exits passed entries in European pulp and paper industry during the early decades of the 20<sup>th</sup> century. Similar patterns of development can be found from other areas as well (detailed analysis and figures in Ojala, Voutilainen, and Lamberg 2012).

Furthermore, our analysis suggests that the paper industry producing countries can be roughly divided to pioneers and latecomers (Ojala, Voutilainen, and Lamberg 2012). The pioneering countries include Finland, Norway, Sweden, France, and Britain. Russia, South Africa, the USA and Canada can also be included to this pioneering group with emerging paper industry and initial stages of high-turbulence (entries and exits) before the First World



**Figure 1.** Entries and exits in pulp and paper industrial development in Europe 1800-2000 (number of firms)

Source: Ojala, Voutilainen, and Lamberg 2012.

War. The latecomers include countries that experienced the peak-population phase after the First World War, including countries such as Italy, the Netherlands, Japan, China, Brazil, Portugal, and Spain. The three last mentioned countries experienced maturity phase only after the 1970s.

### INDUSTRY DOMINANCE IN PULP AND PAPER INDUSTRY: TECHNOLOGY, RAW MATERIALS AND MARKETS

The life cycles of pulp and paper industry are interrelated with the technology development, raw material acquisition, markets, and products produced at any given time and in any given country. In an international context the relationships between technology transfer and leadership, raw material dependence and products varies globally. The crucial question is whether the international dominance in the pulp and paper industry is a function of technological leadership or if technological leadership is a co-product of rapid market growth.

The major technological change in paper industry occurred in the early nineteenth century with the advent of machine based papermaking. However, it took almost one hundred years for machine based papermaking to supersede traditional manual papermaking (Munsell 1980; Salzman 1911; Spicer 1907). The basic technology of making paper continuously has not changed dramatically in 200 years, although the size of the machines has increased. Besides the paper machine itself, a number of other important innovations were also implemented during the nineteenth century, such as the use of wood fiber as a source of pulp, and sulfite and sulfate pulp technologies

The availability of raw materials is probably the single most important determinant for the geographical location and dominance of pulp and paper industry. Northern conifer wood proved to be both technically and economically the most suitable choice for large-scale papermaking during the latter part of the nineteenth century. The use of wood fiber changed the industry dominance for over one hundred years to the Northern hemisphere countries with their larger forest resources, namely to the USA, Canada, and the Nordic countries. (Järvinen & al. 2012; Kuhlberg 2012; Toivanen 2012). The lack of wood based raw material is among the most important reasons for the decline of the British paper industries (Särkkä 2012). Since the early 1990s the use of eucalyptus has moved the industry dominance to South America and Southern Europe (Gutiérrez-Poch 2012; Lima-Toivanen 2012).

Industry dominance has also been closely linked to technology dominance in papermaking. The early technology development occurred in the Netherlands, France and Britain, then spread to Germany and later to the USA (Bouwens 2004, 2012; Toivanen 2004, 2012; Turunen 2012). After the Second World War the technological development has occurred especially in North-European countries, most notably in Finland and Germany.

<sup>2</sup> On limitations of these sources, see Ojala, Voutilainen, and Lamberg 2012 and Lamberg and Ojala 2006.

Besides raw materials and technology, markets play a crucial role in the geographical location of pulp and paper industry. Today, when the bulk of investments in the industry are made in China with fast growing demand for paper products, markets have become ever more important. During the early history of mechanical papermaking, Britain, Germany and France possessed not only technical skill and know-how, but had relatively large domestic markets for paper. In fact, for a number of countries, such as Germany, Russia, the USA, Britain and Japan, domestic markets have played important role in the development of the industry (Kurosawa and Hashino 2012; Mashkina 2012; Särkkä 2012; Toivanen 2012; Turunen 2012). For the Nordic countries and Canada especially, the export markets have been more significant than domestic markets (Järvinen, Ojala *et al.* 2012; Kuhlberg 2012). For the demand for paper products fairly simple variables are the most important ones: population growth, GDP *per capita*, consumption patterns, and literacy rate. Thus, demographic development does not alone explain paper consumption. Rise in income, witnessed in GDP *per capita* growth, led the way to modern consumerism that created various uses for paper products.

The industry life cycle in different countries is also determined by the institutional development, including governmental policies and regulation. In turn, an unfavorable institutional environment may be an obstacle to the industry development, as can especially be seen in the case of Germany (Turunen 2012). In such countries where pulp and paper industry was a dominant line of business, attention was paid to creating a favorable regulatory environment, as the companies had bargaining power in governmental policies. The Nordic countries are primary examples of this kind of pattern (Hazley 2000; Järvinen, Ojala *et al.* 2012; Kuisma 2008; Lamberg 2005). The environmental legislation affecting the opportunities to exploit raw materials has grown in importance globally during the last decades of the second millennium. In emerging pulp and paper industry countries, most notably in South America, increasing attention has been paid to environmental regulation (Lima-Toivanen 2012), which is a new challenge and different phenomenon than any faced by the first entrants in the nineteenth century.

## CONCLUSIONS

Longitudinal analysis allows us to witness several changes in industry dominance defined as the agglomeration of production capacity, technological knowledge, and management and marketing capabilities (cf. Chandler 1990; Murmann 2003). In the beginning of the twentieth century the industry dominance changed from Britain to the USA and Germany; in the mid-twentieth century from the USA and Germany to Canada and Japan and to the Nordic countries; in the beginning of the new millennium the dominance has slowly shifted to China and to South America. In these changes, the dominance has always shifted to the region with the highest market potential in terms of population size and speed of economic growth. These markets may be domestic or export oriented. The industrial growth and the accumulation of technological knowledge require a certain maturity of political systems, regulation and organization of research and development. Equally, similarities between regions that lose their competitive advantage are characterized by saturation of demand, thereby weakening incentives to invest in production capacity. Germany, Japan, China and the USA are examples of countries with large market potential in terms of proximity of potential customers. Furthermore, the Nordic countries, Canada and to some extent South America represent settings in which the main competitive advantage is the availability of forests suitable for harvesting and use in industrial production. This competitive advantage affects many aspects in industrial evolution: focus of research and engineering knowledge, organization of market activities and structure of industrial populations.

Transitions of competitive advantage from one region to other regions used to be comprehensive: as a result of changing market dynamics new firms emerged in regions, local producers catalyzed new types of technological inventions, and so the dominance shifted regularly and predictably. Globalization has radically changed this dynamic. The evolution of regional firm populations takes a different shape than it has historically, as we have increasing number of multinational corporations that may expand to any emerging market, thus bypassing the nascent domestic firms. ■

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