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Chapter 12

Creating Global Markets: Seaborne Trade in the Pulp and Paper Industry's Products Over the Last 400 Years

Jari Ojala and Stig Tenold

Abstract

The declining cost of sea transport has been a necessary condition for the growth of the global pulp and paper industry especially in regions remote from the economic centres. Thus, pulp and paper industries and international shipping have coevolved, especially since the 1960s, enabling producers to tap global markets and develop global production chains. The paper products trade flows, however, have changed a number of times over the last 400 years. This chapter describes and explains these developments and shows how the technological solutions in global shipping and strategic choices among the pulp and paper companies were interdependent, especially since the 1960s.

Keywords: Shipping, open-hatch, ro-ro, paper industry, transport costs

12.1 Introduction

Companies in the pulp and paper industry have traditionally been nationally located although their markets have been international, or rather intracontinental. Thus, globally operating

multinational companies are a rather recent phenomenon. (Ojala et al. 2006; Sajasalo 2003; Siitonen 2003). Today though, the major companies operate globally and are building up global production chains to take advantage of regional comparative advantages in terms of factor endowments. Thus, where to locate production has always been the crucial question for companies in this business. The availability of raw materials and markets might explain the emergence of paper industry in different regions, but also technology, labour, access to energy, and institutional structures supporting the industry are important drivers for both success and failure of the industry. In addition, transport solutions are important throughout the production line: from forests to factories and from factories to the customers. Thus, the technological solutions for transport and their associated costs are crucial for a high-volume bulk product business such as the pulp and paper industry.

The declining cost of transport made it possible for a bulk industry such as pulp and paper to serve markets far from the source of the raw materials. The decline in transport costs was not only caused by falling ocean freight rates and specialized cargo ships developed for the pulp and paper industry carrying trades but also the development of port facilities and whole logistics systems that ensure efficiency in shipping raw materials and ready products to markets. (Harlaftis et al. 2012; Hazley 2000; Kurosawa and Hashino 2012; Ojala and Kaukiainen 2012)

Waterways have historically been important for the carriage of forest industry products, from floating timber to international trade flows. In fact, water transport has particularly large advantages relative to land transport for bulky, high volume goods such as forest products. While they were usually transported in ships that carried many different cargoes simultaneously, today, they are carried in highly specialised ships. These vessels include, for

example, specialised ro-ro vessels and open-hatch ships designed to carry paper products, and Japanese wood-chip carriers.

This article discusses the overall importance of seaborne trade for the development of the pulp and paper industry. We will first analyse the major shifts in the international trade flows of pulp and paper industry products, thus providing an empirical basis for the development of trade volumes. Thereafter, we will analyse the technological and organizational changes in shipping, with a particular focus on the post Second World War period. It was during these years that seaborne transport of pulp and paper developed from a regional/intracontinental base to an intercontinental industry. The article uses international databases – such as Sound Toll Registers Online collection (STRO) and the material from the Food and Agriculture Organization (FAO) of the United Nations – as its main sources combined with industry- and company-focused research.

12.2 Trade Flows of Pulp and Paper Products

12.2.1 From Early Developments...

Because forest industry products are relatively very bulky, they have been particularly suited to seaborne transport, and this trade has been among the key features in economic and maritime history. The Dutch supremacy in the early modern trades was largely dependent on the forest products carried from the Baltic area, as was the case with the rise of the UK as maritime power and its dependence on (northern) forest products. Initially, trade was centred around round wood, then later on planks of various qualities. While there has been some

intercontinental trade, in particular in hardwoods, for centuries, such trade is more recent for pulp and paper – as are the products themselves.

Pulp and paper emerged among the major forest industry products during the mid-nineteenth century when the technology for producing paper from wood was introduced. This also shifted the dominance of the world's forest industries to the northern hemisphere, which boasted the suitable forest resources, and thereby increased demand for the transport of raw materials needed by and products of this specific industry.

Trade flows with paper products have changed a number of times over the last 400 years. The Baltic Sea area is a prime example of this change. Before the technology for making paper from wood emerged, paper was mainly produced from rags. The major production areas were in the Dutch Republic, France, Britain and in the German-speaking area. Thus, the trade flows with paper products went from the North Sea to the Baltic rather than vice versa, which is the situation today. This early modern paper trade to the Baltic is traceable from the Danish Sound Toll registers, which recorded all ships passing the Sound from the late fifteenth century up to the mid-nineteenth century. The ships passing the Sound had to stop at Danish Elsinore to pay the Sound toll custom dues. These Sound Toll records are well preserved and are available in the Sound Toll Registers Online (STRO) compilation (<http://www.soundtoll.nl/index.php/en/>).

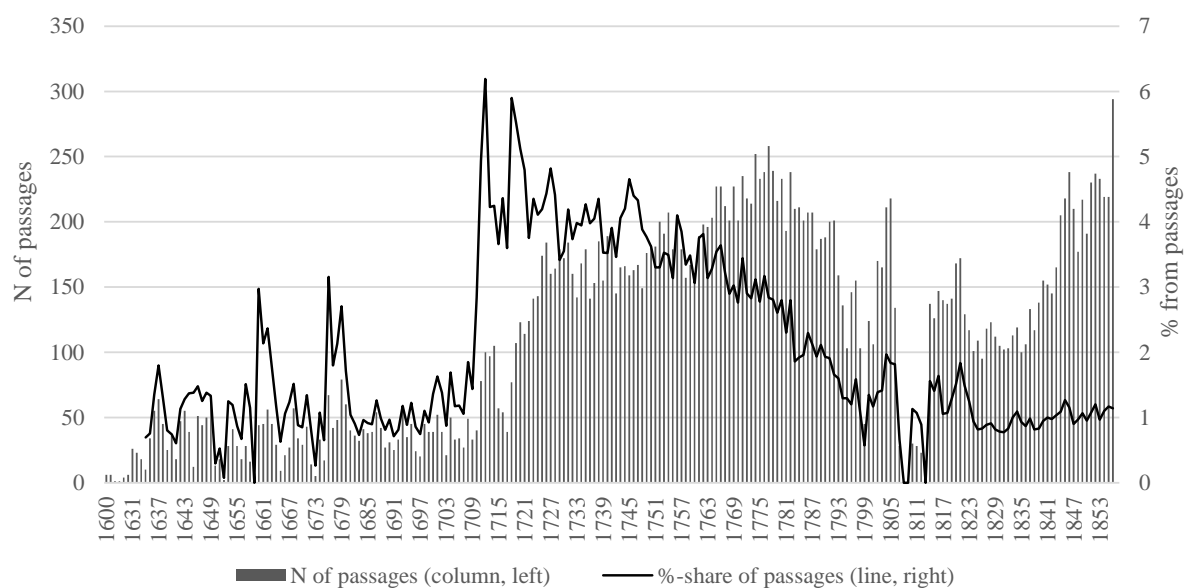


Figure 1. Paper trade through the Danish Sound 1600–1857. Number of passages (left axis) and % share from all passages (right axis) (n=25,934, N= 1,483,976)

Source: The Danish Sound Toll Account (STRO, <http://www.soundtoll.nl/index.php/en/>, accessed 19 August 2016)

Keyword "pap", N=25,934, number of passages, 265 products.

Note: only frequency, no volumes nor values. Around 90% of the voyages are ships carrying paper to the Baltic, while around 10% are ships moving westward from the Baltic with paper.

Forest industry products were among the major items in the early modern trade flows through the Danish Sound, consisting of all sorts of timber products and large quantities of tar and pitch produced in the northeast corner of Europe. (Scheltjens 2015; Åström 1988). The volume of paper traded through the Danish Sound was more modest, but it grew alongside the spread of literacy, the expansion of the economy and increasing paper consumption. Early modern paper production was, though, mainly local; thus the records do not show large trade volumes. Nevertheless, the Danish Sound toll captures trade in these products (Figure 12.1). Altogether c. 26,000 ships passed the Sound from the mid-seventeenth century to the mid-

nineteenth century with cargoes of paper on board. The majority of these shipments came from the Dutch republic (65%), whereas France, the UK, Spain and Portugal together accounted for 20% of shipments. Paper was not, however, the major commodity on board these vessels passing Elsinore. Rather it was just another good carried by ships designed to carry all sorts of tradeable items. Even the paper grades varied: Sound Toll accounts specify 265 different paper categories passing the Danish officials collecting the custom dues at the Sound.

As Figure 12.1 shows, there was a growth in shipments of paper during the eighteenth century and a decline thereafter, when calculated by the simple measure “the number of passages”. In reality, the trade expanded as the volumes per passage grew bigger. However, the paper trade declined relative to other products; as a whole, paper made up to less than two per cent from all passages to and from the Baltic in the years 1600–1857. The substantial increase in the early eighteenth century paper trade shown in the Figure 12.1 can mainly be explained by the paper imports to St. Petersburg, which was founded in 1703 and grew rapidly to be among the most important cities in the Baltic. The first paper machines were developed in the early nineteenth century, and the Sound Toll data also capture paper machine deliveries through sea routes; the first one came to the Baltic through the Sound in 1830.

12.2.2 ...to Industrialised Paper Production

Above, we used the Baltic paper trade as an example for the early growth of these trades. Unfortunately, we do not have similar data available on a global scale for the period from the early 1860s to the 1960s. Nevertheless, various studies show that the trade in pulp and paper

products increased from the mid-nineteenth century after wood emerged as the raw material for manufacturing these products. (e.g. Lamberg et al. 2006; Krawany 1910; Rjestoff 1913) There has traditionally been a strong correlation between GDP and paper consumption – thus, the growth of the global economy can be seen in the production of and global trade in pulp and paper. (Hazley 2000; Järvinen et al. 2009; Järvinen et al. 2012). This, however, does not necessarily hold anymore, especially in developed western countries, as there seems to exist a saturation point after which the increasing wealth of nations and individuals does not increase the consumption of paper (Hetemäki and Obersteiner 2001; Järvinen et al. 2012). The existence of a “Kuznets curve” in paper consumption suggests that *per capita* demand for paper outside Western Europe and the Western Offshoots was limited well into the twentieth century. Moreover, the fact that pulp and paper producers primarily served regional markets was reflected in production.

At the beginning of the twentieth century mechanized and industrialized papermaking was almost entirely concentrated in Europe (primarily northern and western Europe) and North America. (Table 12.1) As late as the 1970s, almost 80% of the world’s paper was still produced in these two regions. However, this share fell to below 60% by the early new millennium. Today, old western-based companies that are struggling with over-capacity in their declining domestic and regional markets also own a significant amount of productive capacity on other continents. (Hetemäki 1999; Hetemäki and Obersteiner 2001; Järvinen et al. 2012)

Table 12.1 *Global paper and paperboard production 1908 and 1961–2012, average shares (%)*

	Eastern Asia	Northern & Western Europe	Northern America	Other regions	Total
1908	1.5	48.2	41.7	8.6	100.0
1961 - 1969	11.3	22.7	49.7	16.2	100.0
1970 - 1989	15.7	21.4	42.0	20.9	100.0
1990 - 2012	26.6	21.0	31.0	21.4	100.0
Total av.	22.9	21.2	34.8	21.2	100.0

Source: FAOSTAT faostat.fao.org (accessed 16 August 2016); Krawany 1910

Note: Averages calculated on the basis of annual production figures.

The trade flows were still mainly regional from the mid-nineteenth to the mid-twentieth century and concentrated in two areas: European and North American markets. In Europe the Nordic countries met western Europe's (especially the UK, Germany, and France) demand for pulp and paper, while in North America Canadian products were transported to US markets. (See especially Särkkä 2012; Kuhlberg 2012; Toivanen 2004; 2012; Lamberg et al. 2012).

The trade in pulp and paper became more global after the Second World War. This was mainly related to two factors. First, the demand for pulp and paper grew in line with rising income levels and the diffusion of economic growth. Second, companies operating in this business internationalized and took advantage of developments in (sea) transport when utilizing their comparative advantages in global trade. (Lamberg et al. 2006) For this growth period – from circa 1960s to the turn of the millennium, we also have more comparable data, compiled by the FAO.

As Figure 12.2 shows, the total volume of global pulp and paper production has increased by a factor of more than five from the early 1960s to 2012, while pulp production grew

threefold. The share of paper production that was exported grew from c. one-fifth to nearly one-third, but diminished during the first decades of the twenty-first century. In contrast, exports of pulp have always played a more significant role, representing a roughly one-third share until the early 1990s, subsequently growing to nearly 60%.

Thus, the pulp and paper industry has evolved over centuries from being a local and regional/intracontinental to a global business in which the international transport systems play a crucial role. Exports of both paper and pulp have mainly been transported via sea routes. Moreover, some of the paper industry products have also been transported domestically on water. Trains and trucks are competitive on short distance routes and especially in carrying raw materials.



Figure 12.2 Paper and pulp production and export share of production 1961-2012

(Production (left axis, million tons) and export share of production (right axis, %))

Source: FAO (faostat.org, accessed 19 August 2016)

Note: only paper and paperboard, newsprint is not included. Moreover, only pulp for paper is included, not wood pulp.

To get a more coherent view on global trade flows of pulp and paper, we analysed the countries that are the most important players in these trades: eight countries represent c. 60 to 70% of imports and 70 to 80% of exports of global pulp and paper trade in the period 1961 – 2012. (Figures 12.3 and 12.4) Furthermore, we selected four cross-cutting years (1961, 1981, 2001, and 2012) to analyse further these trade flows.

From the 1960s to the early 2000s the USA clearly dominated the pulp imports with almost a one-fifth share. (Figure 12.3) In exports, on the contrary, there was no clear dominant player. First was Sweden's share, which was almost one-third, but it diminished thereafter rapidly as the country's own paper industries used more pulp produced domestically (Andersson et al. 2016). The trend in Finnish pulp exports, though with smaller figures, were the same as in Sweden, and the reason was also the same: increase in domestic use of pulp. (Jensen-Eriksen and Ojala 2015) Canada, in turn, increased its share of global pulp exports from below one-fifth to one-third. The most striking change occurred from the turn of the millennium, when China's share increased first to c. 15%, and then to roughly one-third of global imports of pulp for paper. At the same time Brazil increased its export share from 5% in 1981 to 16% in 2012. Chile and Indonesia are similarly new entrants in global pulp exports, with both targeting Chinese markets in particular.

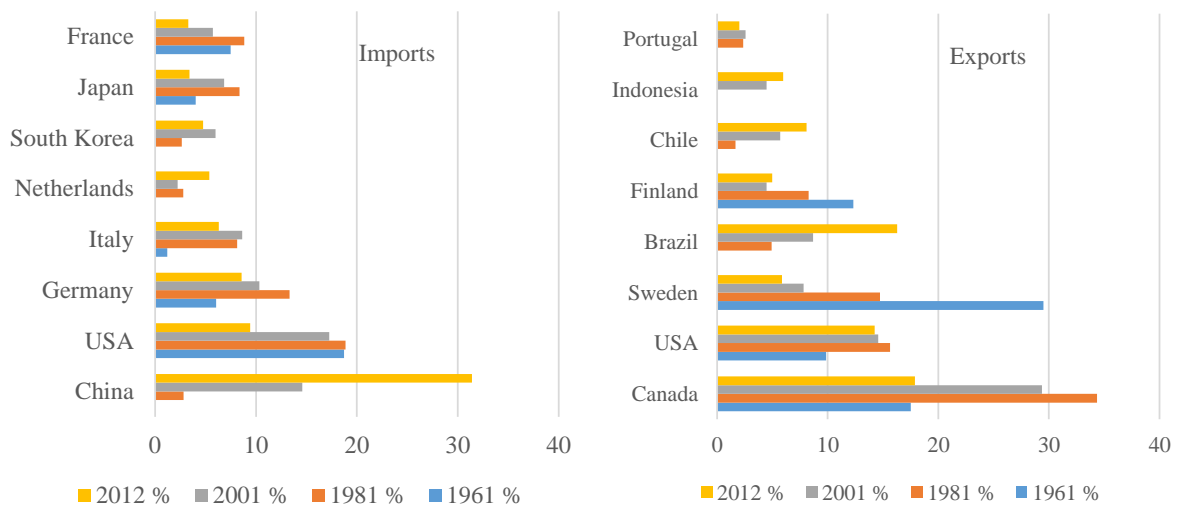


Figure 12.3 Trade flows of pulp: imports in left, exports in right (% share of global trade flows)

Source: FAO (faostat.org, accessed 19 August 2016)

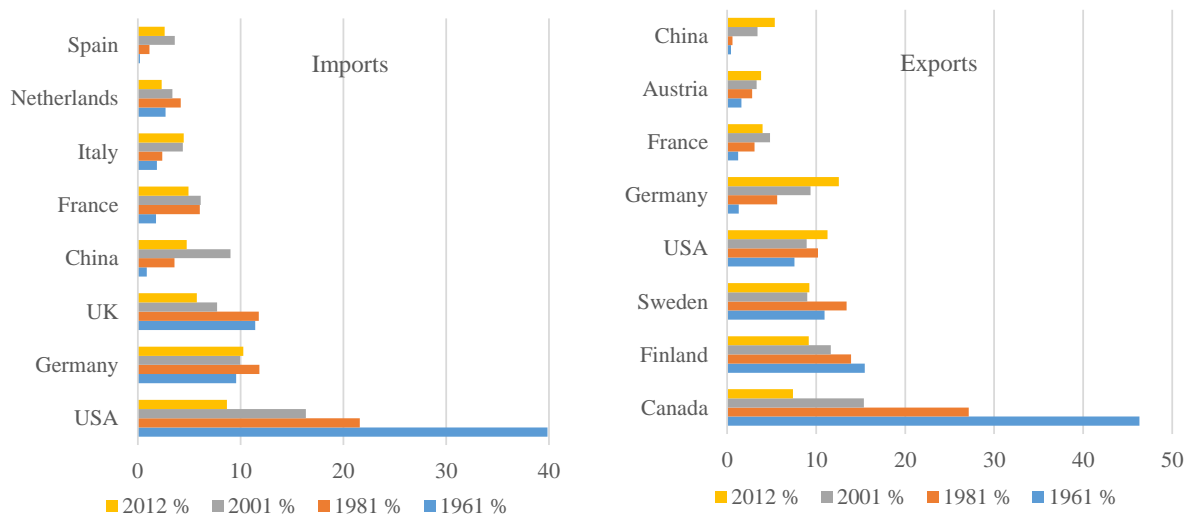


Figure 12.4 Trade flows of paper and paperboard: imports in left, exports in right (% share of global trade flows)

Source: FAO (faostat.org, accessed 19 August 2016)

Trade flows with pulp to and from the eight most important export and import countries can be divided into three geographical clusters, and the overwhelming majority of this pulp trade

was transported by sea. First, the North American cluster has been dominated by Canadian exports to the USA, though some South American countries have also been important in this trade. In 1997, for example, 81% of pulp imports to the US came from Canada. Over the last decades this has gradually been transformed into a “Pacific” cluster, as Canada has also shipped a large volume of pulp to Asia. In 1997, for example, Canadian pulp made up 40% of all pulp imported to Japan. Already by the turn of the millennium, China had emerged as the second most important market for Canadian pulp.

The second cluster is the European one in which Nordic countries (especially Sweden and Finland) have served other European countries. This market has not changed much in terms of trade flows, though occasionally the USA and some South American countries have played some role in this trade. In 1997, roughly a quarter of German’s total pulp imports came from Sweden and one-fifth from Finland; these figures were roughly the same a decade later.

The third geographic area is the expanding Asian cluster. Up until the 1990s Japan was the leading market in this group, which was served by American, Canadian and Brazilian pulp producers. The growth in demand from China and South Korea changed the focus in this trade. Canada, for example, now sells more pulp to China than to Japan, and for Chile, South Korea and China have been the major export trade targets. In terms of ton-miles this cluster was the largest one due to geography, and thus the diminishing cost of transport was especially important for this trade.

Also trade flows in paper products show changes from the 1960s to 2010s. The most striking change in paper imports is the declining share of the US. In fact, still in the early 1960s its imports amounted to roughly 40% of all paper traded globally. Thereafter this share

diminished first to 22% (1981) and to below 10% by 2012. The explanation for this change is, on the one hand, the absolute rise in the global paper trade and increased demand in other countries. On the other hand, the increase in domestic production in the USA at least partly explains its diminishing import share. Moreover, paper consumption in USA has decreased.

The growth of paper consumption in China does not show in the figures of the global paper trade as its demand has primarily been satisfied by domestic production from imported pulp. European countries – the UK, Germany, France, Italy, the Netherlands and Spain – have all been important importers throughout the period, though the UK especially has clearly lost its former share.

In terms of paper exports, Canada's decline is even more dramatic than the decline of US imports. Canada suffered especially from the decline of American markets. The USA, Germany, Austria, China, and to a certain extent France have succeeded in increasing their share of global paper exports, while both Finland and Sweden have declined.

The geographic trade flows of paper follow to a certain extent the trends of the pulp trade described above. The trade between Canada and the US dominates the North American cluster. Exports from Sweden and Finland dominate the European cluster, with an increasing role played by Germany. The paper trade flows to Asia do not show clearly in the FAO's statistics, however, the US seems to play the most significant role in Chinese markets.

Figures 12.5 and 12.6 combine the imports of pulp and paper to the clusters described above, namely the USA, Europe, and Asia. These three areas represented between 80 and 90% of global pulp and paper imports in the years 1961 to 2012. As these figures illustrate, the share

of paper imports to the USA has declined rather dramatically from 40 to 9%, while the Asian share increased from 7 to 25%. European paper imports, in turn, first saw a period of increase during the 1960s when the share grew from one-third to roughly half of the world's paper imports. During the 1990s, Europe's share declined by roughly five percentage points, but it remained well above 40% of global paper imports. Thus, in all, paper imports have remained important in Europe, but less so in the USA.

Pulp imports, in turn, paint a rather different picture. Namely, the share of European imports declined from 70 to 36%, while Asian imports increased from 3 to 47%. US imports, in turn, declined as well. In relative terms the decrease – from roughly 20 to 10% – was as large as the European one, but due to the lower starting point, the effect on the world market was less.

The absolute tonnage of paper imported, though, increased in the US until the turn of the millennium. Similarly, the volume of European tonnage also increased quite significantly during the same period. Also in absolute terms pulp imports to Europe increased although the share declined. The same trend also occurred in the US.

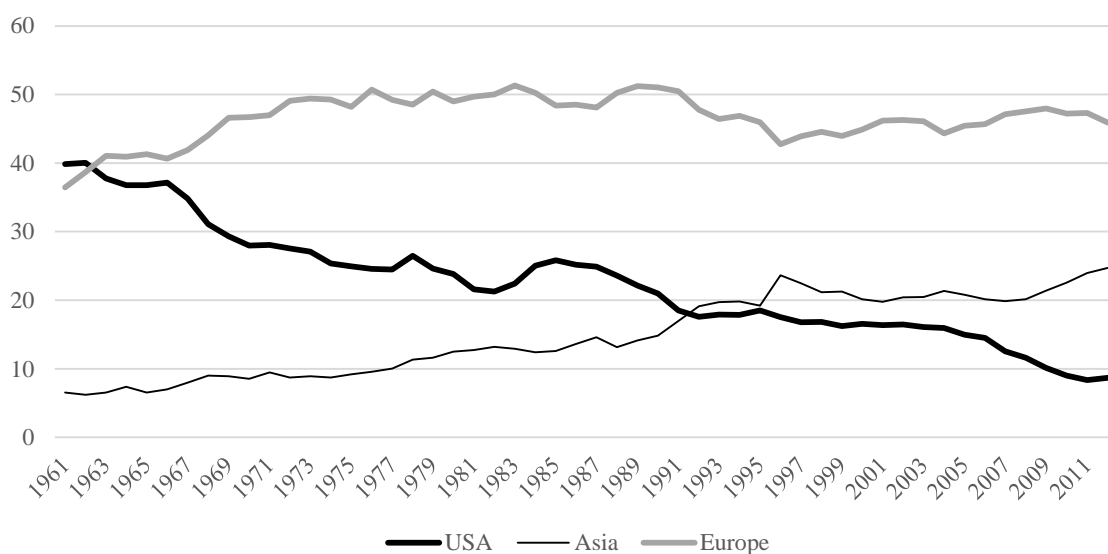


Figure 12.5 Share of global paper imports in different areas (%)

Source: FAO (Faostat.org, accessed 19 August 2016)

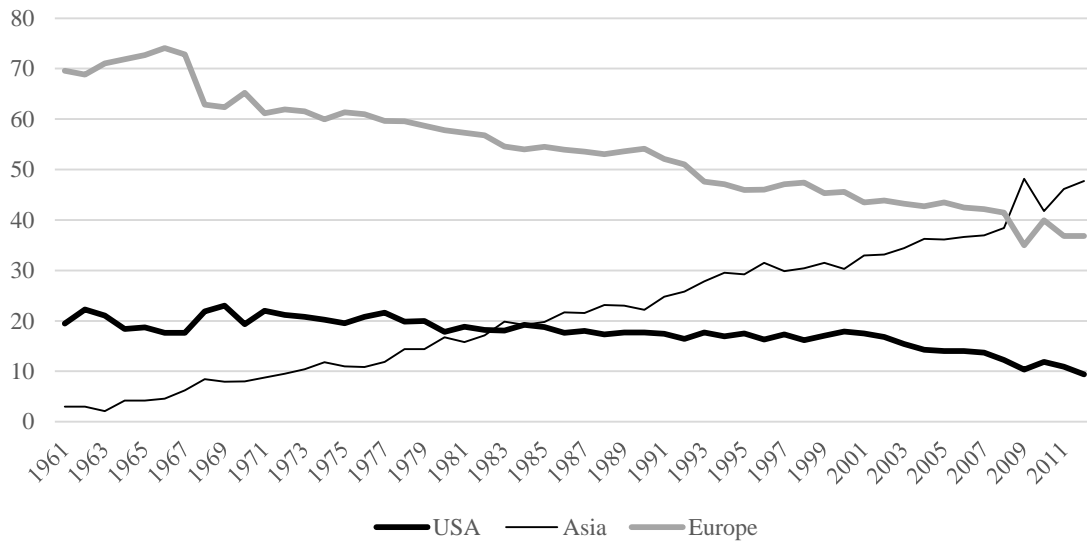


Figure 12.6. Share of global pulp imports in different areas (%)

Source: FAO (Faostat.org, accessed 19 August 2016)

12.3 Shipping Pulp and Paper Products

The global trade in pulp and paper products has mainly utilized sea routes.

Turning to the evolution of this seaborne transport of pulp and paper products, the focus will be on developments after the Second World War. Prior to the conflict, there were no specialized, purpose-built vessels to carry pulp and paper products: ordinary, general cargo carriers were used in these shipments, as had been the case over centuries. The pulp and paper items would be individually packaged and handled, and loading, unloading and stowing it would be slow, cumbersome and often lead to damage to the product itself. The earliest specialized ships were purpose-built to transport cargoes from Canada to the US, although other modes of transport were also used. The efficient solutions in sea transport even made it

possible for the pulp and paper industry to emerge in several regions in which there was limited internal demand. This is especially relevant for South America, as pulp (and paper) from Brazil, Chile and Uruguay was shipped in large quantities to South Korea, Japan, China and the US. (Tenold 2015, p. 191)

In all, the shipping of pulp and paper industry products coevolved in line with the development of the pulp and paper industry, and also in line with the overall development of the global shipping industry, whereby specialized ships were introduced in a number of trades and for several cargoes. When looking at the pulp and paper industry, three factors are particularly important for the development of the fleet carrying these products. First, as the international trade in these products grew (Figure 12.2) it became economical to develop specialized ships to carry the products. At the same time, the cost reduction that the specialized ships brought about made it more beneficial to trade on a global scale, creating a benign feedback loop.

Second, as the pulp and paper companies grew larger and introduced global strategies, the economies of scale in logistics played a more vital role in their operations. This did not only include transport at sea, but also port facilities, terminals and inland transportation. Indeed, in many areas trains and trucks were more competitive than ships in carrying the products shorter distances. Moreover, the “just-in-time” concept was also introduced to carrying pulp and paper products in the early 1980s with the demand for faster deliveries and lower warehouse costs at ports. The concentration of the industry made the use of economies of scale possible: the ten largest European paper industry companies produced less than a third of the total European sales in 1980, but by the mid-1990s their share was already around one-half. In the US this concentration started earlier. Both in Europe and North America the basis for the increased concentration was mergers and acquisitions.

Third, the value added of traded pulp and paper products increased. This, in turn, meant that there were strong incentives to lower the risk of damaging the cargo during its transport. Nordic pulp and paper producers in particular increased the value added of their products. Whereby they previously export pulp, now they produced paper (with higher value added grades) to be exported abroad. (Jensen-Eriksen and Ojala 2015) Thus, this focus on new and different products also needed new types of carriage capacity.

All these developments in the pulp and paper industry created a situation in which paper products were no longer “a fillings cargo for conventional ships”, as one major shipping entrepreneur put it in the early 1980s (Lennerfors 2016, p. 52). Now pulp and paper goods were the only, or the main, items to be transported, and they were valuable enough to justify specialized ships to carry them. The main aim was to increase productivity especially in loading and discharging the cargoes, and thus decrease the turnaround time at ports.

The cargo handling revolution since the Second World War has been referred to as the second revolution in shipping – the first one being the change from sail to steam and wood to iron during the nineteenth century. The efficiency gains in ports also enabled yet another substantial change in post war shipping: the enormous growth of the average size of the ships that, in turn, led to an increase in productivity and reduction of the unit costs. (Tenold 2006)

The cargo handling revolution in pulp and paper trades relates to two specific ship types: open hatch and ro-ro. Both were used in other trades as well, but were particularly suitable to carrying pulp and paper products. Ships with wide hatch openings and gantry cranes onboard were introduced in the early 1960s; they were first designed to carry paper cargoes on a long-

term contract and in a fixed trade. The open hatch technology was developed as a cooperative endeavour involving naval architects (Spaulding, Seattle), paper producers (Crown Zellerbach, US/Canada) and ship owners (Østberg, Norway). The two pioneering ships were first used to carry paper from British Columbia to California in the 1960s. (Bakka et al. 2009, pp. 50–51)

The advantages with the open-hatch system were manifold. They were unobstructed, completely box-shaped holds without overhang; the speed and security of gantry cranes (faster, labour-saving and with the potential to reduce exponentially the risk of damage); and specialized equipment that was purpose-built to handle a variety of cargoes (both bulk and unitized commodities, including containers). Open hatch ships were especially suitable for forest products, particularly those made by the pulp and paper sector. Thus, open hatch ships were sometimes referred to as “lumber carriers”. (Drewry 1978, pp. 5–7; Drewry 1974, pp. 76–77) They would typically be employed in trades where some major customers – for instance paper producers – had entered into long-term Contracts of Affreightment for a certain portion of the capacity, while the remainder of the ships’ space would be sold on a voyage-by-voyage basis.

There has been quite a substantial increase in the size of the world fleet of open hatch vessels since the first ships were delivered in the early 1960s. The world fleet of these type of vessels was smaller than 500,000 dwt in 1970, but by 2010 the world leader (Gearbulk) alone had a fleet of 2.1 million dwt. The maximum size of individual vessels increased from 10,000 to 70,000 dwt and crane capacity from 13.6 to 70 tons over the same period.

According to Martin Stopford (2009), the design of the open hatch bulk vessels, specifically the manner in which space in the holds can be more fully utilized, increases cargo carrying capacity by around 20% compared with traditional bulk ships. As a result of the specialized cranes and the improved operating environment, the cargo handling rates today are around 80% higher than for conventional bulk carriers. In the 1970s the difference was even larger, and by turning to open-hatch vessels one could cut the turnaround time at port in half and improve both the speed and quality of the cargo handling. (Lennerfors 2016, p. 19) Table 12.2 illustrates the productivity gains with open hatch vessels at ports, resulting in ca. 18-fold productivity increase. A quotation from a presentation of the first purpose-built open hatch ship, *Bessegen*, summarizes this change: ‘to handle 9,000 tons of newsprint loading or discharging would normally take three days and employ 60 men, but with these cranes it is expected that 10 men will be able to accomplish the task in ten hours.’ (Talbot-Booth, 1963)

Table 12.2. Productivity change with open hatch vessels at port

	Previously	Open hatch
Gangs (number)	12	4
Rolls (per hour)	50	300
Rolls/ man hour	4.17	75

Source: Herbert 1979, pp. 131–141.

The second important type of vessels used for pulp and paper shipments were ro-ro (roll on – roll off) and sto-ro (including also side-doors to roll on/off cargoes) ships beginning in the 1970s. Besides being efficient in loading and discharging cargoes, ro/sto-ro ships offered shelter from the weather conditions at ports; valuable paper rolls were not exposed to rain and snow. In a similar vein, in the open hatch segment special “totally enclosed bulk carriers”

(TEBC) were developed by the late 1980s to be “weatherproof” during the loading and discharging.

Three rather expensive TEBC ships, each with a garage-like box on top of the deck with telescopic gantry cranes, were built in order to cater to the “Just-in-time” needs of one major Japanese pulp and paper importer at the late 1980s. Around half of the vessels’ capacity was tied up to a joint venture between Canfor and Oji paper to transport roughly 200,000 tons of newsprint annually. Due to changes in transport demand, the partners wanted to reduce the amount halfway through the contract, and the owners’ problems of filling the ships illustrate the disadvantages of ships that are too specialized. (Tenold 2015, pp. 200–202, 228–235)

The TEBC ships were developed collaboratively by three parties: the shipping company (Gearbulk), the paper industry (Canfor & Oji Paper) and the shipyard (Mitsui). (Tenold 2015, p. 201) The sto-ro technology was also developed in close co-operation with ship-owners (Sea-link), pulp and paper companies in Finland and Sweden and their specific shipping companies (Transfennica and Combi Shipping company) and shipyards. (Lennerfors 2016) In some cases even some old ro-ro ships could be later converted to sto-ro ones (simply by cutting side doors into the hull), and this enabled simultaneous loading and discharging from three sides of the ship.

Ro/sto-ro ships were especially suitable for the exports of the Nordic pulp and paper companies. Thus, by the mid-1980s major pulp and paper shipping companies and operators such as Transfennica, Combi Shipping company, Finnlines, and Sea-link already used this technology in most of their shipments not only in the European trade but also in voyages to North America and back. In the case of Transfennica, roughly 17% of shipments were

transported by ro-ro ships in 1976, while this share was 54% by 1984 (including sto/ro-ro ships) (Lennerfors 2016, p. 62) Ro-ro ships were further developed during the 1980s and 1990s, including special “cassettes” on which the cargoes were already loaded at port before the ship arrived, and then these steel platforms were simply rolled into the ship.

A third type of ship that made inroads into forest product transport was the specialized wood chip carriers, whereby pneumatic loading reduced port time. Again, the specialized ships first appeared in the early 1960s, when Toyo Pulp in 1963 launched the first such vessel.

Subsequently, the fleet increased rapidly. (Kurosawa and Hashino 2012; 2017) Most of these ships have been owned by Japanese companies, as the use of “wood chips” in production is a phenomenon that is more prevalent in Japan than elsewhere. (Fenton 1982; FAO 1976)

As previously mentioned, the relationship between developments in the pulp and paper industry and the shipping industry had the properties of a virtuous circle. By revolutionizing cargo handling and utilizing economies of scale, ship owners improved efficiency to the point that it led to a dramatic reduction in the unit costs of transport. When this occurs, the basis for trade improves, with a concomitant increase in potential volumes. This was particularly important for areas far from market; some would claim that a country such as Chile became competitive as a result of the services offered by shipping companies (Tenold 2015, p. 192). The development of open hatch bulk carriers, wood-chip vessels and sto/ro-ro ships is an important part of the more general post war shipping trend, namely specialization of vessels carrying world trade.

Still during most of the twentieth century – and during the previous centuries – the ships were not specialized to carry any specific cargo. In fact, in the first decades after the Second World

War, most of the merchant tonnage consisted of general cargo carriers. However, their share diminished, especially from the 1960s onwards. Oil tankers, dry bulk ships and container carriers are perhaps the best known examples of this process that includes dozens of other specialized vessels, including LNG and LPG carriers, chemical tankers and car carriers. Specialized vessels were less flexible, but more efficient with purpose built cargo handling and stowage solutions. This specialization revolutionized sea transport, and again particularly in terms of faster turnaround times that declined in many cases from weeks to hours. (Michel and Noble 2008, p. 34; Tenold 2015, pp. 55–56)

The specialization of ships was part of the industrial logics of each industry; transport emerged as a more integrated part of the logistics of industries with standardization of cargoes handled both on land and at sea. The container is of course the standardized “box” *par excellence*. (Donovan and Bonney 2006; Levinson 2006). The same principles revolutionized the transport for the pulp and paper industries. The specialized ships enabled a rethinking of the twentieth century idea of vertically integrated industrial complexes located in one place. Namely, with declining unit freight costs, just-in-time concepts, specialized vessels, and global pulp and paper companies, this integration could be extended between areas, countries and even continents. Thus, raw materials and semi-finished products (such as wood chips, pulp or recycled paper) could be transported from far-away places to pulp and/or paper factories. The evolution in transport also enabled the true globalisation of the markets for pulp and paper products; still in the 1970s companies were mainly operating in regional/intracontinental domains (e.g. Europe, North America or Asia) rather than on a global scale. (Sajasalo 2003; Siitonen 2003) Moreover, the emergence of efficient transport put new areas on the map of the global pulp and paper industry, most importantly South America. (Tenold 2015, p. 191; Lima-Toivanen 2012) Pulp and paper companies aimed for

long term contracts with ship owners as ships became an integral part of the production chain, streamlining the logistics. This motivated the ship owners, in turn, to invest in expensive, specialised vessels.

The other important change in international shipping had already emerged during the early modern period but has intensified ever since the specialization of shipping enterprises.

Shipping agencies and brokerage firms were already known when paper was transported from the Dutch republic to the Baltic in the late eighteenth century. However, the business world of shipping was far more complicated 200 years later. This was also the case in carrying pulp and paper industry products. As previously mentioned, there is a close relationship – and often long-term contracts – between ship owners with pulp and paper transport capacity and companies in the industry. Thus, interplay between these two parties is of vital importance, and collaboration with shipyards and charterers became ever more important in order to have the correct type of ship in operation at the right time and place. For example, Transfennica was a Finnish shipping operator that took specialized vessels on time-charters and operated them exclusively for their own cargoes of pulp and paper. Transfennica was founded in 1976 by the Finnish pulp and paper export associations (Finnpap, Finncell, Finnboard and Converta), which in turn were owned by the Finnish pulp and paper companies. After the consolidation of Finnish forest firms and the dissolution of these associations, Transfennica was sold first to the major paper companies (in 1994) and later to the Netherlands.

There were also a clear movement by the shipping companies to concentrate their operations on certain routes. Sea-Link, for example, carried 25% of Swedish and Finnish paper exports to the UK during the mid-1980s (representing 15% of total paper imports to the UK), though its share of total forest industry exports was smaller; four per cent in the Swedish case and six

per cent in the Finnish case, respectively. (Lennerfors 2016, p. 75) Within open hatch, Gearbulk had a particularly strong position in Latin America, while its compatriot and main competitor, namely Star Shipping, was the market leader in British Columbia.

Along with the changes in shipping organisation the question of domicile has grown in importance. During the Great Shipping Crises of the 1980s the previously dominant shipping nations in Europe and North America lost a substantial share of tonnage in terms of flag of ships. However, the ownership change was not as dramatic as it appears at first glance; the ships were often “flagged out” rather than having undergone a change in their actual ownership. This type of flagging was also rather typical among companies carrying pulp and paper products. Flagging did not necessarily mean changing the flag to low-cost countries or to flags-of-convenience (e.g., in Europe in many cases changing a company’s ownership from one country to another could result in taxation benefits), but often the changes were made to receive assistance for constructing new tonnage. The Swedish firm Sea-Link, for example, operated ships under the Swedish flag but also under the flags of Finland, the UK and the Netherlands. (Lennerfors 2016)

During the twentieth century the separation of foreign trade and shipping has further evolved both on the corporate and national levels. In recent articles by Tenold and Ojala (2017) and Ojala and Tenold (2017), they created a purpose-built indicator to compare the growth of global trade and global shipping, namely shipping/trade-ratio. It captures the development of countries’ and regions’ market shares in world shipping over an extended period of time. This share reveals both the coevolution of shipping and trade on a general level and patterns of specialisation in world shipping. However, the shipping/trade ratio-indicator is too rough to capture developments of shipping and trade at an industry level. Thus, it can unfortunately

not be used directly to capture the possible changes in the pulp and paper industry and shipping on a detailed level.

However, looking at the three types of technology, a clear pattern emerges. Open hatch bulk shipping has been a Norwegian – or more specifically Bergen – specialty. (Tenold 2009; Bakka and Grung 2009) While most of the open hatch fleet has been controlled by a small number of Norwegian companies, it has served customers all over the world, often through Contracts of Affreightment. The shipping companies have invested in terminals to improve efficiency, and have even “developed” and nurtured markets in distant lands such as South America. Ro-ro has been more closely associated with long-term time charters, and a closer relationship with individual pulp and paper producers that bought all the available capacity. The ship owners, like the producers, in Finland and Sweden have favoured this technology, just like the wood chip carriers have been a Japanese phenomenon.

Shipbuilding moved from European countries to low cost Asian yards during the period after the Second World War. This occurred also in the realm of building ships to carry pulp and paper products. Whereas the first open hatch ships were still constructed in “old” western shipbuilding countries (especially Norway and the UK), the specialised ships during the 1970s were mainly constructed in Eastern European countries (e.g., Poland, Yugoslavia etc.) and thereafter in Japan. During the 1980s and 1990s the production moved again, first to South Korea and then to China. Certain ro-ro vessels designed to carry paper products were built in China at roughly half the cost compared to the ones constructed in Europe during the 1990s. (Lennerfors 2016, pp. 168–169; Tenold 2015, pp. 101–104, 133, 230; Lorenz 1991)

12.4 Conclusions

Over the last centuries the products of the pulp and paper industry have moved from local markets, via intracontinental exchange, to global markets. The areas of production have been decoupled from the areas of consumption, with distance playing a smaller and smaller role. The basis for this transformation has been the declining cost of sea transport, which has made it easier for producers to utilize their comparative advantage in raw materials. Cheap and efficient transport has been a necessary condition for the growth of the global pulp and paper industries in regions that are remote from the economic centres. Thus, the pulp and paper industries and international shipping have co-evolved since the 1960s, creating global markets and production chains.

In a post war world where political barriers to trade (e.g., tariffs and trade policy measures) declined rapidly, the practical barriers to trade (e.g., transport and transaction costs) became relatively more important. For the pulp and paper industries, high handling costs and expensive damage during transport discouraged intercontinental trade. Consequently, the benefits from trade could not be realized without new technological solutions within transport being developed, and three groups of stakeholders – the pulp and paper producers, industrially-minded ship owners and ship builders (naval architects and shipyards) – worked together to make improvements.

The result was new ship types – open hatch bulk carriers, ro/ro- and sto/ro-vessels and dedicated wood chip carriers – and a change in the land/sea-interface that improved efficiency and dramatically reduced impairment. This created the potential to transform the

business models, both on the production side and on the consumption side. “Just-in-time”-production, global operations and integrated logistics systems followed.

Both the dominant technological solution and the type of contracts introduced varied between the main “market clusters”. Although the basis for these different strategic choices needs more research, one thing is evident. The global markets for pulp and paper, and the global market for pulp and paper transport, pushed each other forward in a virtuous circle.

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