



Eindhoven Centre for Innovation Studies

***Industry Evolution in Developing Countries:  
the Indonesian Pulp and Paper Industry***

Michiel van Dijk

Eindhoven Centre for Innovation Studies, The Netherlands

Working Paper 03.02

Department of Technology Management

Technische Universiteit Eindhoven, The Netherlands

**February 2003**

# **Industry Evolution in Developing Countries: the Indonesian Pulp and Paper Industry**

**Michiel van Dijk\***

## **Abstract**

Almost all empirical research on industry evolution has been conducted on high or medium technology industries in industrialised countries. In this paper, a detailed analysis of the life cycle of Indonesia's pulp and paper industry is presented as case study to investigate industry evolution in developing countries. Institutional context, industry features and availability of natural resources are identified as the three main determinants of industry evolution.

## **Acknowledgements**

\* Eindhoven Centre for Innovation Studies (ECIS), Faculty of Technology Management, Eindhoven University of Technology, TEMA 1.14, P.O. Box 513, 5600 MB Eindhoven, The Netherlands, Tel. +31 40 247 5358, Fax +31 40 247 4646, m.v.dijk@tm.tue.nl. A previous version of this paper was presented at a conference of the Technology and Economic Growth (TEG) project, August 25 and 26, 2002, Groningen. I would like to thank the participants for comments. I also would like to express my gratitude to the Centre for Strategic and International Studies (CSIS) in Jakarta, Indonesia for accomodating me while collecting the data. Finally, financial support from SOBU is gratefully acknowledged.

# 1 Introduction

Over the last years, there has been a rise in empirical research on evolution of industries. Studies have been predominantly based on the analysis of high and medium tech industries in the US (Anderson and Tushman, 1990; Klepper and Simons, 1997) or at the global level (Bonaccorsi and Giuri, 2000), focussing on the relation between innovation and market structure in the long run. Due to its seemingly wide applicability, the industry life cycle model has become the most important model to describe long run development of an industry from birth to maturity.<sup>1</sup>

In this paper I investigate industry evolution in developing countries, not addressed in the literature above. As pointed out by Nelson (1994; 1999) and Murmann and Homburg (2001), existing studies on long run industry development often fail to address the social and institutional context in which the industry is placed. In developing countries, the conditions under which firms operate are considerably different from those in industrialised countries. The institutional setting is often weak and market failures are significant because of rent seeking, bad governance and the lack of a well-functioning regulatory system. Furthermore, developing countries tend to specialise in technologically mature industries, where innovation is much less important than in technologically advanced industries. The evolution of an industry in developing countries is, therefore, expected to differ substantially from patterns, such as the industry life cycle model, observed in industrialised countries.

To derive insights at industrial evolution in developing countries, I use the Indonesian pulp and paper industry as a case study. The industry is one of the oldest manufacturing sectors in Indonesia, originating in 1923, when the first mill was started up on Java. With an average of almost 20 percent growth per year, the pulp and paper industry has been one the fastest growing industries since the New Order. In the 90s, it experienced a spectacular pattern of catch-up from a backward industry, existing of only a few small mills, into an industrial giant and world-class player.

The research is novel in several ways. Firstly, I have collected data on firms, goods produced and technology used, spanning the complete life cycle of the Indonesian pulp and paper industry. Such data allows us to assess country, industry and firm specific aspects, which are normally blurred in more aggregate studies. Secondly, studies on industry evolution

---

<sup>1</sup> Seminal contributions in this field are the studies by Abernathy and Utterback (1978), Utterback and Abernathy (1975) and Klepper and associates (1996; 1997; 1997). For qualifications of the model see Windrum and Birchenhall (1998) and Bonaccorsi and Giuri (2000).

are relatively scarce because they requires many data over a long time period, which are difficult to obtain. For obvious reasons, collecting these data is even more cumbersome for developing countries. As far as I know this is one of the first studies addressing industry evolution in developing countries.

The paper is structured as follows: I start to describe some features of developing countries, which are expected to be important determinants of industry evolution. Next, some background information is provided on the characteristics of the pulp and paper industry, to help interpret the findings. In section four, I present a historical overview of the Indonesian pulp and paper industry from birth till present. Fifth, structure and industrial dynamics of the industry are analysed. Finally, this paper ends with synthesis of the study's findings.

## **2 Industry Evolution in Developing Countries**

Although there exist many broad industry studies, detailed research on the dynamics and evolution of industries in developing countries has, to my knowledge, not been done. Difficulties in gathering the data are the most likely reason. Studies on industry evolution require longitudinal micro datasets, which are even hard to obtain for industrialised countries. For obvious reasons, obtaining this data is even more challenging for developing countries.

Lack of comparative research forces me to draw upon other strands of literature, which provide only circumstantial evidence on industry evolution in developing countries. Institutional context and technology differ considerably between industrialised and developing countries. Next, I will briefly discuss their role with respect to industry evolution in developing countries, followed by a brief overview of some empirical results.

### **2.1 Institutional Context**

A well-known characteristic of many less developed countries is their weak institutional structure (North, 1993; Aron, 2000). Tybout (2000), in his review on the performance of manufacturing firms in developing countries, pointed out six features of the business environment in developing countries, which corresponds to the institutional context in which firms operate.

- *Market size.* With the exception of Brazil, Indonesia, China and India, the size of the domestic market for manufactured goods is relatively small. Besides for basic products, such as food and clothing, demand is low.

- *Access to manufactured inputs.* Capital goods and intermediate inputs have to be imported frequently because they are not produced locally. Consequently, production costs are raised.
- *Human Capital.* The education level is low and there is a general scarcity of technicians and engineers.
- *Infrastructure.* Overall infrastructure, such as roads, telephone lines, power and availability of clean water, is limited.
- *Volatility.* Macroeconomic volatility is more extreme in developing countries than in industrialised countries. The financial crisis in Latin America in the 80s, the Peso crisis in 1994 and the Asian crisis in 1997 underline this.
- *Governance.* The legal and regulatory system is often inconsistent and not well functioning; the rate of corruption is relatively high; and property rights are ill defined. A common feature of many developing countries is infant industry protection, which often leads to inefficient production (Bell *et al.*, 1984).

Various surveys repeatedly point out that, among others, taxes, corruption, lack of demand, lack of infrastructure and lack of credit, are perceived by managers as severe obstacles to growth in developing countries.<sup>2</sup>

These institutional factors are expected to have major important consequences for industry evolution. Competition is likely to be seriously distorted and will therefore not function as a selection mechanism. Consequently, inefficient firms are able to survive and turnover will be low.

## **2.2 Technology**

In his survey, Klepper (1997) indicates that the industry life cycle model applies to “[...] new industries, particularly technologically progressive industries with rich opportunities for product and process innovation” (Klepper, 1997, p.145). Basically all research on industry evolution has focussed on medium and high-tech industries such as automotives, turboprop engines, computers and semiconductors. In contrast, developing countries produce mainly low-tech products because the low level of income per capita biases demand towards basic manufacturing goods, such as food and clothing. Furthermore, developing countries have a comparative advantage in mature industries, where competition is on production costs (e.g.,

---

<sup>2</sup> See Brunetti *et al.* (1997), quoted in Tybout (2000). Sleuwaegen and Goedhuys (2002) present results on the obstacles to growth managers perceive in Côte d'Ivoire. They also give references to similar surveys in other countries.

labour costs) and products and technology are standardised (Vernon, 1966; Hirsch, 1967). Technical and scientific knowledge is less important because it is largely embodied in the product or production process. The standard example is the textile industry, and the pulp and paper industry also seems to fit this description (see section 3).<sup>3</sup>

What will be consequences for industry evolution if a mature industry is considered? One could assume that in a mature industry, firms have the opportunity to exploit technology, already used by industrialised countries, without going through the painstaking trajectory of research and development (Gerschenkron, 1952; Abramovitz, 1986).<sup>4</sup> I therefore do not expect a shakeout phase in which product and process innovation drive the entry and exit of new firms, as predicted by the industry life cycle. In addition, a characteristic of many mature industries is their scale and capital intensity (Perez and Soete, 1988).<sup>5</sup> Given, the relatively low level of demand and considerably high entry barriers in developing countries, concentration in these types of industries is expected to be exceptionally high.

### **2.3 Empirical Results**

For many developing countries, many studies found high concentration levels combined with a dual market structure (Nelson, 1968; Blomström and Wolff, 1997; Sleuwaegen and Goedhuys, 2002). Within the same industry, two groups of firms operate simultaneously. One group consists of large-scale capital intensive firms, while the other consists of very small traditional companies, operating outdated or craft technology. Three intertwined explanations have been put forward to explain the dual market structure (Tybout, 2000). Firstly, large firms have advantages relative to small and, often, informal competitors because they are better in lobbying the government for support; banks offer them preferential access to credit because they are regarded as less risky; and they are better equipped to find their way to the maze of inconsistent regulations. Secondly, the absence of a transportation network allows the existence of small isolated markets which are served by small scale local production. Thirdly, the lack of engineers and technicians and the relative abundance of unskilled labour stimulates small-scale low tech production.

In contrast to the evidence on concentration, other expected industrial dynamics have not been confirmed by the empirics. Tybout (2000) compared a large number of studies on turnover and efficiency in industrialised and developing countries and did not find any significant differences. The explanation for these disappointing findings can be subscribed to

---

<sup>3</sup> See James (2002) for a critique and discussion of the international industry life cycle model.

<sup>4</sup> Off course, firms still need to develop the technical capabilities to use and adapt the technology acquired.

<sup>5</sup> The textile industry is an exception.

the set-up of previous research, predominantly based on plant level data from manufacturing censuses.<sup>6</sup> The analysis is performed on broad samples, lumping together firms producing different goods or using various technologies, which might not be comparable. Furthermore, the time period covered is generally short and, therefore, long term phenomenon are not observed. Finally, previous studies do not take into account multiple ownership of firms. In many developing countries only a few conglomerates control large shares of industries, which may seriously bias the results.<sup>7</sup> Tybout points out that: "Careful case studies that collect detailed price data and monitor the behaviour of individual players are probably the only means through which convincing conclusions about these problems can be reached" (Tybout, 2000, p. 30), which is precisely what this study aims to do.

### **3 Industry Characteristics**

The pulp and paper industry can be characterised by several global technological and economics characteristics, which, as I will argue below, also have strongly influenced the evolution of the Indonesian pulp and paper industry:

- The industry is composed of two sub-sectors, which are strongly connected. In the pulp sector, the raw material, mainly wood, is transformed into pulp. In the papermaking part, the pulp is transformed into paper, basically done by one piece of equipment, the paper machine. Pulp and paper making can be either vertically integrated into one mill or be separated into two mills.
- The pulp and paper industry is a supplier dominated industry (Pavitt, 1984). In this class of industries, new technology is mainly introduced by suppliers of machinery; process innovation is relatively much more important than product innovation.
- The pulp and paper industry ranks among the most scale and capital intensive in manufacturing. In the US, the average annual investment is US\$ 16,000 per employee, four times the average of US\$ 4,000 (Carrere and Lohmann, 1996). The construction of a single state of the art pulp mill can cost up to one billion US\$ and the largest paper machines have a price of over US\$ 300 million (Kenny, 1997).
- The drive for capital and scale intensive production is driven by price-based competition in the pulp and paper market. Paper is a standardised commodity product and therefore

---

<sup>6</sup> See Roberts and Tybout (1996) for a collection this type of studies.

<sup>7</sup> Examples of this are the Chaebols in Korea (Amsden, 1989) and large locally owned conglomerates operating in the raw material processing industries in Latin America (Katz, 2001). This seems to be the case in Indonesia as well (Temple, 2001).

companies compete on price instead of quality, although other factors such as reliability of supply and brand also play a role for some paper grades.

- The demand for pulp and paper is positively correlated with the level of GDP (Diesen, 2000).
- The industry is environmentally sensitive. To guarantee a constant supply of raw material, sustainable forest management is required. Furthermore, the pulp and paper industry is ranked among the top five in terms of the quantity of toxic materials generated per unit of output and average pollution abatement costs (Herbert-Copley, 1999).
- The last 20 years the pulp and paper industry has started to shift from industrialised to developing countries, in particular, Brazil, Chile and Indonesia (Carrere and Lohmann, 1996). These countries have a natural competitive advantage in the production of pulp and paper because of their abundant natural resources. Furthermore, the rotation time of pulpwood is 7 to 10 years in countries with a tropical climate, while it is around 40 years in the Scandinavian countries. Consequently, raw material costs are much lower in the emerging countries (Paperloop, 2003).

## **4 Historical Overview**

In 1996, Before the Asian crisis, the pulp and paper industry was Indonesia's tenth largest industrial sector in terms of value added. Especially in the 90s, the industry went through a phase of enormous growth of on average 20 percent per year, becoming an important international player. At the risk of over simplifying, the development of the pulp and paper industry can be divided into four sub periods, which resemble, to a large extent, the overall development of the manufacturing sector in Indonesia.<sup>8</sup>

### **4.1 First Paper Mills: 1923-1974**

In 1923 the first Indonesian paper mill, N.V. Papier Fabriek Padalarang, was established on Java, by the Dutch paper producer, N.V. Papier Fabriek Nijmegen. The mill was built to produce printing and writing paper from rice straw to provide the needs of Dutch colonial government. In 1939, the same Dutch firm, which owned the mill in Padalarang, established a second mill in Letjes, East Java, with a capacity of 3,000 tons per year (tpy). After independence, similar to much other developing countries, the Indonesian government adopted a policy of state led industrialization to build up of a strong national industry (Hill,

---

<sup>8</sup> See Hill (1996) and Fane (1999) for an historical overview of the development of the Indonesian economy and the manufacturing sector.



1996). This also applied to the pulp and paper industry (World Bank, 1981). In 1958, like many other formerly Dutch owned companies, Padalarang and Letjes were nationalised and renamed, PN Kertas Padalarang and PN Kertas Letjes, respectively. Their main use was serving the demand for writing books and paper from the Ministry of Culture and Education. The Indonesian government further increased the local supply of paper through the construction of five more mills owned between end 50s and early 70s.

[TABLE 1 ABOUT HERE]

Table 1, presents a brief overview of the seven mills in operation in 1971/1972 taken from Koehler (1972). Four of the mills are located in Java, the main domestic market. Rice straw and bamboo are the dominant raw materials. Except for the Siantar and Martapura mill, the use of pulpwood as input is limited. Installed capacity amounts to a total of 47,500 tpy but due to various problems such as the lack of spare parts and shortages of raw material, described in the final column of the table, actual production was only 18.000 tons reflecting a utilization rate of about 40 percent. Altogether, the Indonesian pulp and paper industry in the early 1970s was uncompetitive. By international standards all firms were small and “under the present circumstances there is as yet definitely no export potential in the field” (Koehler, 1972 p. 101).

**4.2 Import Substitution Led Growth: 1974-1984**

Between 1974 and 1984, pulp and paper industry went through a phase of rapid development. The number of mills increased from 7 to 33 mills and installed paper capacity grew from 67,000 to 606,000 tpy (Figure 1 and Figure 3). The industry also diversified as the first board and tissue paper producers entered the market. All new mills were privately owned. The predominant factor, behind the rapid expansion was the introduction of high tariff protection, stimulating the investment in new, mainly non integrated mills (World Bank, 1981). This policy was part of the overall aim of the Indonesian government to stimulate growth through import substitution in the end of the 70s and beginning of the 80s (Fane, 1999). Tariffs were levied on all grades of paper up to 60 percent but not on pulp (see Table 2). The World Bank (1981) estimated that the effective protection, taking into account prices of inputs, is on average 90 percent, ranging from very high numbers for smaller mills, making their contribution to domestic value added negative, to 60 percent for larger mills. Subsidised

energy prices also contributed to high effective protection rates (FAO, 1984). About 50 percent of the plants, were only profitable because of tariff protection.

[TABLE 2 ABOUT HERE]

Another factor, encouraging the pulp and paper industry to expand, was the rapid growth in demand for paper products caused by the overall growth of Indonesia. Paper demand is highly correlated with the level of income in an economy. The World Bank estimated this to be 1.9 for Indonesia during the period 1970-1980 (World Bank, 1981). In 1975, consumption was 285,000 tons but domestic production supplied only 18% of this demand, indicating a wide scope for expansion of local production (World Bank, 1981).

[Figure 1 ABOUT HERE]

### **4.3 Backward Integration, Large-Scale Production and Exports: 1984-1997**

In the end of the 80s, the industry started to integrate backward into the production of pulp. The pioneering company was Indah Kiat, which set up the first large non-integrated pulp mill in Riau, Sumatra with a capacity of 100,000 tpy in 1984. The mill was started up with the intention to supply the paper mills in the Indah Kiat group, which were still dependent on expensive imports. In 1989, the first large non-integrated pulp mill, PT Inti Indorayon Utama, fully aimed at producing market pulp started production with a capacity of 180,000 tpy (Laurila, 1989; Harianto *et al.*, 1998). In the next years, pulp capacity was boosted by the expansion of the existing mills and the start-up of several world-class pulp mills. With a capacity of 750,000, the pulp mill of Riau Andalan Pulp and Paper (RAPP) was the single largest pulp line in the world (Stafford, 2000).

The initial expansion of pulp capacity was accompanied by a second wave of paper capacity growth. Production of paper increased from 402 to 4,821 thousand tpy over the period 1984-1997. In 1987, Indonesia became a net exporter of paper, while it still had to import almost fifty percent of its pulp demand. Much of the paper exported to the fast growing NICs, which lack the necessary raw material to produce their own paper. Between 1984 and 1997, the production of pulp increased more than seventeen fold from 178 to 3,058 thousand tpy. As a consequence of the rapid expansion, Indonesia became a net exporter of

pulp in 1995. In 1996, Indonesia ranked seventh and sixteenth, on the list of the worlds largest exporters of pulp and paper, respectively (FAO, 2002). Figure 2 and Figure 3 clearly illustrate the phenomenal expansion of the industry in the 80s and 90s.

[Figures 1 and 2]

The foremost reason for the enormous expansion of the pulp and paper industry over the last two decades was the determination of the Indonesian government to establish a world-class pulp and paper industry. In the end of the eighties, the ministry of industry and trade announced its plan to rank Indonesia among the top ten pulp and paper producers of the world by the year 2000. To achieve this goal, 56 pulp and paper mills should be constructed or expanded and 10 percent of Indonesia's land mass had to be converted into plantations (WALHI/ YLBHI, 1992).

Three underlying motives for this “master” plan can be distinguished. First, in the eyes of the Indonesian government and, in particular, the ministry of industry and trade, a world class pulp and paper industry was seen as a tremendous opportunity to replace the declining oil industry as source of foreign exchange (WALHI/ YLBHI, 1992; Stafford, 2000).

Secondly, the upward integration from a wood-based industry to a wood processing industry fitted perfectly in the strategy of resource based industrialisation, which Indonesia has pursued since the start of the new order (Auty, 1987). In 1966, Indonesia started to promote large scale commercial logging of the rich hardwood forests on the Outer Islands.<sup>9</sup> Initially, the ‘timber boom’, led to rapid expansion of the sawn wood industry, exporting mainly raw logs. To increase the value added of production and exports, the Indonesian government introduced the log export ban in 1981, with the goal of completely phasing out the export of logs in 1985. The immediate effect of the ban was an explosive increase in wood-processing capacity such as sawn and timber mills. As a consequence, the exports of plywood increased enormously and Indonesia was the largest exporter of plywood in the world, producing more than 78 percent of total world exports. The pulp and paper industry provides the logical next step in backward integration of the wood industry.

Thirdly, a large pulp and paper industry was supposed to provide a partial solution to the deforestation problem. Due to a combination of corruption, lax control and over expansion, caused by the log export ban, forests were depleted at enormous speed. In 1992, in

---

<sup>9</sup> Since the beginning of the nineteenth century, teak forests in Java have been logged for timber. However, until 1967, the Outer Islands hardwood forest have been largely untouched (Barr, 2001).

total 5.7 million hectare of forested areas were categorized as “critical” (WALHI/ YLBHI, 1992). To make profitable use of this land, the government introduced a new system of concessions designed especially to stimulate the establishment of commercial plantations, so called HTIs (Human Ataman Industry), predominantly for the growth of pulp and paper wood. The HTIs were specifically meant to be placed on degraded or unprofitable logged over land. To start-up the mills were allowed to use the “left overs” to bridge the period in which their wood plantations would come on-line.

#### **4.4 Financial Crisis and Debts: 1997-present**

The East Asian financial crisis, triggered by the fall of the Thai Bath, had a disastrous effect on the Indonesian economy. GDP growth decreased from 8 percent in 1996 to –13.6 percent in 1998, Inflation jumped by a factor of ten from 6.5. to 65 percent (Hill, 2000). Likewise, Indonesia’s economic crisis put an end to the expansion of the pulp and paper industry. The industry was affected in several ways. First, before the crisis set in, large pulp and paper mills were already heavily indebted due to the financing of the gigantic capacity expansion they pursued. When the Rupiah depreciated, the in dollar denominated debts started to put considerable financial pressure on the companies. Financial problems forced many pulp and paper companies to delay or cancel their plans for future expansion (Ibnusantosa, 2002).

In contrast, the economic crisis had a positive effect on the international competitiveness of the large pulp and paper mills. Raw material, energy and labour, which constitute the largest share of production costs, are paid in Rupiah, while output, mainly exported, is denominated in US dollars. Production costs declined with 40 percent from on average US\$ 210 to US\$ 125 per ton of pulp due to the depreciation of the Rupiah (Malassu, 1998). On the other hand, real revenue of the exports was still relatively low because of the low global pulp prices. For small non-integrated Indonesian mills, which have to buy their raw material in US dollars and sell their products in Rupiah, the crisis only had negative effects.

Finally, the move to a more democratic political system, triggered by the economic crisis, allowed for critical assessment of Indonesia’s environmental performance (World Bank, 2001). With respect to the pulp and paper industry, it became clear that its development has been unsustainable (Barr, 2001). Due to a combination of corruption and bad governance, large pulp and paper mills were able to install pulp capacity much times in excess of available wood resources.

## 5 Industry Structure and Dynamics

In this section, the evolution of the pulp and paper industry is analysed by investigating data on number of establishments and concentration over time. Similar to many other industries the pulp and paper market is composed of several sub markets or segments of roughly homogenous products, which are only weakly related in terms of demand and supply (Sutton, 1998; Bonaccorsi and Giuri, 2000). I distinguish five sub-markets: printing and writing paper, pulp, board, newsprint, and tissue paper.<sup>10</sup>

[Figures 4 and 5 ABOUT HERE]

Figure 4 and Figure 5 summarize the industrial dynamics of each segment over its life cycle. Most of the information was provided by the Indonesian Pulp and Paper Association (APKI). Since 1989, APKI has been publishing a bi-annual industry directory, which contains information on capacity, start-up year and paper produced by grade for all pulp and paper mills active in Indonesia. For the years not covered by the directory, APKI supplied additional unpublished data. Finally, for older data, the database was completed by information from World Bank (1981), FAO (1984), APKI (1985), CIC (1990) and unpublished data sheets from the Ministry of Trade and Industry, which all present data collected by APKI, similar to the industry directory.

Figure 4 depicts the number of plants between 1923 and 2000 by sub-market. For all segments, except tissue, the number of plants has stabilized or even decreased after a period of initial growth but there is no sign of shakeout. Exit has been relatively low for all sub-markets. Only 11 out of the in totalm 69 mills, which have been active in the Indonesian pulp and paper industry, went out of business during the industry life cycle of about 80 years. The number of establishments in Figure 4 do not add up to the total in Figure 1 because many mills produce various grades of paper simultaneously and are, thus, counted in several segments.

---

<sup>10</sup> I do not discuss specialty papers because this segment of is composed of a large group of heterogeneous products, such as cigarette paper, Chinese praying paper and art paper, and therefore not really comparable with other producers or segments. Furthermore this market consists only of a few very small plants.

Figure 5 presents the concentration rate per sub-market measured by the market share of the four largest firms (C4). In addition, the market share of Asian Pulp and Paper (APP), the dominant player is shown. There is not sufficient information to compute concentration measures for the pulp market.

In the next section I discuss the evolution of each paper segment separately. I elaborate in particular on the printing and writing market because it is the oldest segment and reflects very clearly two characteristics, which can be considered common elements of industry evolution in developing countries: import substitution and dual market structure. Next, the other sub-markets are briefly reviewed.

## **5.1 Printing and Writing Paper**

### **5.1.1 Import Substitution: 1974-1984**

After a period of slow growth, triggered by a policy of import substitution, the market for printing and writing paper start to develop rapidly between 1974 and 1984. The aim of the Indonesian government was to build up strong national pulp and paper industry, composed of large scale, integrated pulp and paper mills, which were able to compete internationally (World Bank, 1981). However, the policy did not generate the expected results. Although private investment was boosted and the number of printing and writing mills increased from 5 to 15 between 1974 and 1985 (Figure 4). “[...] the type of development which has taken place is largely based on imported pulp rather than indigenous fibres, is compromised of small mills which are not internationally competitive, is primarily in Java, and has concentrated on the production of only a few grades leaving many essential grades, which could be produced economically in Indonesia, to be imported” (World Bank, 1981, p. i). Only two mills were integrated and three mills reached international standards of production (Laurila, 1989). Other plants had low productivity caused by technical and marketing problems, lack of working capital, fibre losses, too much water consumption and high energy consumption.

Data on paper machines installed gives a good picture of the relative size of the Indonesian plants in comparison with international best-practice. Figure 6 presents the capacity of paper machines (PMs) for producing printing and writing paper, currently in use, by year of installation over the complete life cycle of the industry. For the older machines, the capacity reported may overestimate the actual capacity of the PM during start-up because PMs are sometimes retrofitted over time to increase their production. All PMs are imported because there are no domestic equipment producers. According to the data collected, in total

51 PMs have been in operation over the period analysed. Figure 6 also depicts the world PM technology frontier, constructed on the basis of historical data on global best-practice technology. Capacity has increased continuously over the last 100 years, caused by improvements in speed and width of the PM.

[ Figure 6]

The figure also shows the evolution of the technology gap over time. The first three machines were installed by the Dutch in 1923, 1931 and 1940, in the Papier Fabriek Padalarang and Letjes, respectively. These were all new machines of good quality from Escher-Wyss, a leading German producer of paper machines at that time (World Bank, 1980, survey data). The PMs installed by the public companies (there is no data available for Siantar) in the 60s and 70s were of similar type as the PMs of Padalarang and Letjes and, hence, for that time already outdated. The figure clearly shows that the PMs installed during the import substitution period were small in comparison to international best practice. All PMs were either second hand or cheap, low quality machines from Taiwan and Korea.

There are three reasons why the industry developed in the direction of non-integrated small mills instead of the more economically beneficial large-scale type of plants. First, the tariff structure, with zero import duty on pulp and 30-60 percent tariff on paper, gave more incentive to produce paper than to pulp. Secondly, especially for local entrepreneurs, it was difficult to raise sufficient capital to establish large integrated mills. In comparison to industrialised countries, the establishment of large integrated mills in developing countries demands even more investment. High transport costs forced integrated mills to be located close to the supply of wood, often located in remote areas where infrastructure, such as roads, and ports, are lacking. Finally, the combination of uncertainties of investing (complex licensing, tax laws) in Indonesia promoted the establishment of financially less risky small mills.

### **5.1.2 Dual market structure and Dominant Firms: 1984-...**

After 1984, the printing and writing market expanded rapidly. However, growth of the industry was a very unequal one, resulting in a dual market structure. Figure 7 plots size distribution per mill between 1975 and 2000 in terms of printing and writing paper capacity

installed.<sup>11</sup> The figure reveals the development of a skewed/dual market structure after 1990. In 2000 about five very large mills are dominating the market with a capacity of above 100,000 tpy. In addition, there is one firm in the "middle" with a capacity of 68,000 tpy and a large competitive fringe consisting of 14 smaller mills with a capacity of 24,000 tpy and less.

[Figure 7 ABOUT HERE]

The existence of a dual market structure is mainly caused by the behaviour of one dominant market player, Asian Pulp and Paper (APP), owned by the Sinar Mas Group, one of the largest conglomerates in Indonesia.. Figure 5a shows concentration, measured as the share of the four largest mills, and the market share of APP starting from 1980, based on tons of printing and writing paper produced. Concentration, already high with 67 percent in 1980, increased to about 90 percent in 2000. Three out of the four largest mills, Tjiwi Kimia, Pindo Deli and Indah Kiat (Riau), and two smaller mills are owned by APP and together account for almost 90 percent of total production. In 2000 its market share decreased a little bit because Riau Andalan Pulp and Paper (RAPP), brought on line its first PM with a capacity of 325,000 tpy.

A series of aggressive expansions and takeovers are responsible for the establishment of APP as the prime producer in the printing and writing market. Average production of APP mills increased from around 3,000 tpy to 460,000 tpy, while the output per mill of its competitors stayed the same (Figure 5a). In the 90s, it installed seven out of the nine largest PMs in Indonesia. Two of them belong to the twelve world's largest printing and writing paper machines, installed between 1996 and 2000 (Rudd, 1999).<sup>12</sup> Only RAPP, the second largest pulp mill in Indonesia and part of large business conglomerate, has installed a PM of similar quality and capacity, which also appears on the list of largest machines installed in the world. All other firms are operating with obsolete technology far from the technology frontier.

After, the period of import substitution, the number of firms stabilised at around 18 in the printing and writing paper market. The aggressive expansion of APP absorbed any increase in demand, which made it difficult for new companies to enter the market. Entry barriers are extremely high because APP continuously installed best-practice technology and could use

---

<sup>11</sup> Data on tons of paper produced could also have been used but this data is only available from 1980 onwards. Size measured in output, value added or labour is not a useful measure here because firms are operating in different paper segments and would therefore give a biased view.

<sup>12</sup> Underlining the aggressive expansion of APP, it is worth noting that two other world's largest machines were also installed by APP in China.



low cost pulp through its access to large quantities of natural forests. In an industry where a product is highly standardised, economies of scale prevail and competition is on costs, all profitable entry was completely eroded. Since 1985 only three new mills entered the market and only one exited. All entrants were already established producers. Two are relatively small tissue and board mill, which entered in 1989 and 1991, respectively. I do not have any information on these mills to explain their entry. The other one was RAPP.

The expansion of APP, characterised by AUSNEWZ (AUSNEWZ, 1999), a leading pulp and paper consultant, as “unprecedented by a single entity in the history of the paper industry” (AUSNEWZ, 1999, p. 88) has been the central force shaping the structure of the printing and writing market after 1984 and therefore deserves some explanation. APP’s dominant position in the printing and writing segment cannot be regarded in isolation. The company simultaneously increased capacity in other segments of the paper and pulp industry and is currently also the largest producer in the board, tissue, and pulp markets (Figure 5a,b,c). On the basis of APP’s and ARIL’s enormous expansion lies the access to cheap raw materials and subsidised finance, which will be discussed below in the section on the pulp market.

The question remains, why have so many small firms managed to survive, next to giants, such as APP and APRIL. This is a difficult question as not much detailed information is available on these mills. Several explanations can be offered. First, there is evidence that some of these mills produce in niche markets. A case study on PT Kertas Padalarang revealed that it now uses part of its capacity to make specialty papers (e.g. bank paper) (Minderhoud, 2002). Obsolete small PMs can still be profitably used to make this type of paper because it is produced in small quantities, during short production runs. Due to the high fixed costs, large-scale modern PMs are only profitable if they produce 24 hours a day. Secondly, the large mills APP and RAPP are producing mainly for the export market. The APP mills exported around 70 percent of their output between 1998 and 2000. Competition in the domestic market is less interesting for them, which allows space for smaller competitors to operate. Finally, other explanations have to be sought in standard explanations for the emergence of a dual economy, such as isolated markets and market failures, emphasised in section 2.

Finally, it is remarkable that the Asian recession not has led to a "cleansing" of inefficient mills. One should expect that small mills, which are not exporting and are dependent on imported raw materials, would be troubled by the depreciated Rupiah. My data on the number of mills and turnover runs to 1999, which might be a too short period to see any effect. Further research should answer this question.

## 5.2 Other Segments

### 5.2.1 Pulp

Currently there are six market pulp mills in Indonesia, of which five are large scale state-of-the-art pulp plants owned by four Indonesian conglomerates (APP owns two mills). The remaining mill is a small facility on which I do not have much information. The rapid expansion of the pulp market started in the mid 90s, although already in the 80s two market pulp mills were active, of which one was closed after environmental protests in 1999 (Sonnenfeld, 1998).

The main factor behind the establishment of the pulp industry has been access to natural wood resources and subsidized finance (AUSNEWZ, 1999; Barr, 2001). To stimulate the development of a large scale modern pulp and paper industry, the Indonesian government offered capital subsidies, including the approval to use natural forest in the wood rich areas of Sumatra and Kalimantan as raw material.<sup>13</sup> In addition, the weak regulation of Indonesia's financial system enabled pulp and paper companies to obtain almost unlimited access to finance. All conglomerates with investments in the pulp industry own banks, which they used to get credit far in excess of what would have been considered reasonable. Finally, international financial institutions allowed the Indonesian pulp producers to borrow large sums of money without assessing the viability of the raw material supply or the legality of the financial practices. Entry in the pulp market has therefore been limited to large conglomerates which enjoyed certain benefits not available to other companies. Consequently, APP and APRIL have used this advantage to integrate backwards into the production of paper.

The Asian Crisis clearly revealed the drawbacks of enormous investments in the pulp industry. In 1999, the four conglomerates held pulp- and paper-related offshore debts just under 13 billion US dollar, of which the largest share was owned by APP.<sup>14</sup> It is not clear what will happen with the highly indebted Indonesian pulp mills but it seems clear that, given increased environmental awareness and restructuring of the financial system, it will be impossible to set up large scale pulp mills in the way as it was done before.

---

<sup>13</sup> Costs of harvesting 1 m<sup>3</sup> of mixed tropical hardwood (natural forest) are only 17 US\$, while they are 26 US\$ for plantation pulpwood. In contrast, plantation wood costs in Scandinavia are between 41 and 46 US\$/m<sup>3</sup>. (PT Binakarya Dayakusuma, 2000).

<sup>14</sup> The figure is based on table 4.6 in Barr (2001). Besides offshore debt, the companies also hold large outstanding loans to IBRA, the Indonesian Bank Restructuring Agency.

### **5.2.2 Board**

Similar to printing and writing, the number of board mills increased rapidly because of the high protection rates during the period of import substitution. Data on board machines (not presented), resembles Figure 6. Board mills were relatively small and inefficient in comparison with world best-practice and were therefore not able to compete internationally (World Bank, 1981).

Subsequently, the expansion of the board market has been driven by growth of the manufacturing sector and growth the economy. Board reflects a relatively large group of paper grades, mainly used for packaging. Investment in this segment is therefore strongly correlated with economic growth. After 1984 the number of plants gradually increased till 1994, where it stabilized around 36. Although less pronounced than the printing and writing market, the board industry also shows signs of a dual market structure, composed of several small mills and a few large plants. Capacities range from around 250 tpy for the smallest producer to more than a million tpy. With around 40 percent (Figure 5b), APP is again the dominant market player but there are also a number of other large competitors active.

The board market is not as distorted as the pulp, and printing and writing segments because the economic incentives for constructing large mills have been limited. In contrast to the other two markets, Indonesia does not have a particular comparative advantage in the production of board because the raw material is waste paper instead of wood. The recovery rate of waste paper is low and currently more than 50 percent still has to be imported. Board is mainly produced for the local market.

### **5.2.3 Newsprint and Tissue Paper**

Newsprint and tissue paper are considered commodity products in industrialised countries but they can be considered luxury goods, only affordable to a certain group of people in most developing countries, like Indonesia. The share of newsprint and tissue is therefore very small in comparison with the other paper segments (7 and 3 percent in 2000) and both grades can be considered niche markets. Virtually all newsprint and tissue is consumed in Jakarta and other large cities in Indonesia.

The newsprint market is heavily concentrated (Figure 5d). Currently there are five mills, which have enough capacity to supply the complete market as only 1 percent of newsprint was imported and 65 percent exported in 2000. The first entrant was ASPEX paper,

which is still the dominant player today.<sup>15</sup> Entry barriers are relatively high in this segment because, like printing and writing, PMs are large and expensive. APP is not active in the newsprint market.

The number of tissue paper mills has increased substantially in the 90s up to 13 in 1999 (Figure 4), stimulated by increased demand. Tissue machines are smaller and cheaper than printing and writing and newspaper machines. Entry barriers are therefore lower than in other pulp and paper sub-markets, which explains there are relative many mills in operation. Competition does not seem to have been fierce because since the start up of the first tissue mill in 1976, no firm has exit the market. In 1991 APP also started to produce tissue paper and is presently controls almost 60 percent of the market (Figure 5c).

## 6 Synthesis and Conclusion

This paper presents a detailed description and analysis of the evolution of Indonesia's pulp and paper industry from its birth in 1923 to the present. I distinguish five sub-markets: printing and writing paper, pulp, board, newsprint, and tissue paper. In particular I focus on the dynamics of the printing and writing industry because it most clearly exhibits features that might be considered general for industries in developing countries.

From the various time and market specific explanations, proposed in the analysis, three main factors can be derived, which have ultimately influenced the evolution of the Indonesian pulp and paper industry. Although their strength and impact has varied over time, all of them have been of importance at some time over the life cycle of the industry. The factors correspond closely with the causal forces, identified by Murmann and Homburg (2001) and Nelson (1999), who investigate patterns of industry evolution across countries.

*1. Institutional context.* In particular Indonesia's weak institutional structure, which can be considered “typical” for developing countries, has been a key element in shaping the development of the pulp and paper industry. Industrial policy has had major impacts on the evolution of the industry. Like many other developing countries, Indonesia pursued an import-substitution policy to build up a national industry. The consequence of the policy was not the desired competitive industry but the entry and survival of many small, inefficient plants, which were not able to compete internationally. In the 90s government support, allowing access to cheap cost and subsidized credit, caused the emergence of dominant firms controlling exceptionally large shares of the market. In addition, several national institutional

---

<sup>15</sup> In fact the first Indonesian Newsprint paper was the Siantar mill in 1959 (Table 1) but the mill was dismantled in 1981.

factors, such as a weak financial system and lack of competition laws, have significantly affected the industrial dynamics observed. Overall, it can be concluded that the institutional context has severely distorted competition, causing low rates of turnover, dual market structures, and high rates of concentration.

2. *Industry characteristics.* The paper and pulp industry is one of the oldest manufacturing sectors in existence. It is a mature, resource based industry characterised by economies of scale, standardised products and cost based competition. All these elements determined the dynamics of the industry in their own way. An example are the high barriers to entry caused by the combination of access to resources, economies of scale and vertical integration, which caused a high degree of concentration in some market segments. Lastly, the fact that paper is a basic commodity product, which demand is strongly correlated with GDP, has also played an important role in growth of the industry.

3. *Natural Resources.* The availability of natural forest has been an essential element in the evolution of the Indonesia pulp and paper industry. It has provided Indonesia with a considerable cost advantage in the production of pulp and paper in comparison to other countries, like Sweden and Finland. On the other hand, there is compelling evidence that abundance of natural resources in developing countries negatively affects long-run growth and leads to rent seeking and overcapacity (Auty, 1993; Sachs and Warner, 2001). This has certainly been the case in the Indonesian pulp and paper industry. No doubt, the development of the pulp and paper industry would have been completely different in a country without abundant wood resources.

Of the three factors above, especially institutional context is expected to differ significantly between industrialised and developing countries. It is, therefore, no surprise that the pattern, as predicted by the industry life cycle model, is not observed. The model is solely based on case studies of industrialised countries and therefore not suitable to describe industry evolution in countries where divergent conditions prevail.

Finally, I think that some of the industrial dynamics and their causes described for Indonesia's pulp and paper industry can also be observed in manufacturing sectors of other developing countries. Especially resource based and scale intensive sectors, such as the steel, cement or glass industry in large resource rich-countries, such as Brazil, Argentina or Russia, might exhibit the same kind of dynamics. However, more detailed research on industry evolution in other developing countries and other industrial sectors is necessary to reach more definite conclusions.

## References

- Abernathy, W.J. and J.M. Utterback (1978), 'Patterns of Industrial innovation', *Technology Review*, 50, 41-47.
- Abramovitz, M. (1986), 'Catching Up, Forging Ahead, and Falling Behind', *Journal of Economic History*, 46 (2), 385-406.
- Amsden, A.H. (1989), *Asia's Next Giant*. Oxford University Press: New York.
- Anderson, B. and M.L. Tushman (1990), 'Technological Discontinuities and Dominant Designs: A Cyclical Model of Technological Change', *Administrative Science Quarterly*, 35, 604-633.
- APKI (1985), *Laporan Pengurus Harian*. APKI: Jakarta.
- APKI (various issues), *Indonesian Pulp & Paper Industry Directory*. Gramedia: Jakarta.
- Aron, J. (2000), 'Growth and Institutions: a Review of the Evidence', *World Bank Research Observer*, 15 (1), 99-136.
- AUSNEWZ (1999), *The Pulp and Printing & Writing Paper Sector in Post-Suharto Indonesia*: North Hobart.
- Auty, R.M. (1987), 'Backward versus Forward Integration In Resource-Based Industrialisation: Malaysia and Indonesia', *Tijdschrift voor Economische and Sociale Geografie*, 78 (2), 82-93.
- Auty, R.M. (1993), *Sustaining development in mineral economies: The resource curse thesis*. Routledge: London.
- Barr, C. (2001), 'Profits on Paper: The Political Economy of Fiber and Finance in Indonesia's Pulp and Paper Industries', in C. Barr (ed.), *Banking on Sustainability: Structural Adjustment and Forestry Reform in Post-Suharto Indonesia*, Center for International Forestry Research (CIFOR) and WWF Macroeconomic Program Office: Washington DC.
- Bell, M., B. Ross-Larson and L.E. Westphal (1984), *Journal of Development Economics*, 16, 101-128.
- Blomström, M. and E.N. Wolff (1997), 'Growth in a Dual Economy', *World Development*, 25 (10), 1627-1637.
- Bonaccorsi, A. and P. Giuri (2000), 'When Shakeout doesn't occur. The Evolution of the Turboprop Engine Industry', *Research Policy*, 29, 847-870.
- Carrere, R. and L. Lohmann (1996), *Pulping the South*. Zed Books: London.
- CIC (1990), *Pulp and Paper Industry in Indonesia*. CIC: Jakarta.
- Diesen, M. (2000), *Economics of the Pulp and Paper Industry*. Fapet oy: Helsinki.
- Fane, G. (1999), 'Indonesian Economic Policies and Performance, 1960-98', *World Economy*, 22 (5), 651-668.

- FAO (1984), *Indonesia: Status of the Pulp and Paper Industry and Trade*, Working Paper, 32.
- FAO (2002), *FAOSTAT*, <http://apps.fao.org/>.
- Gerschenkron, A. (1952), *Economic Backwardness in Historical Perspective*. Harvard University Press: Cambridge MA.
- Hariato, F., A. Armand and W.W. Soedibjo (1998), 'The Indonesian Pulp and Paper Industry: Transforming Family Business to International Institutions', in Y. Sato (ed.), *Changing Industrial Structures and Business Strategies in Indonesia*, Institute of Developing Economies: Tokyo.
- Herbert-Copley, B. (1999), *Innovation, Regulation and Environmental Management in the Chilean and Canadian Pulp and Paper Industries*. UMI Dissertation Services: Ann Arbor.
- Hill, H. (1996), *The Indonesian Economy Since 1966*. Cambridge University Press: Hong Kong.
- Hirsch, S. (1967), *Location of Industry and International Competiveness*. Clarendon Press: Oxford.
- Ibnusantosa, G. (2002), *Recent Position of Indonesian Pulp and Paper Industry*, mimeo.
- Indonesian Customs Tariff (Tarif Bea Masuk) (various issues).
- James, J. (2002), *Technology, Globalization and Poverty*. Edward Elgar Publishing Limited: Cheltenham.
- Katz, J.M. (2001), 'Structural Reforms and Technological Behaviour. The Sources and Nature of Technological Change in Latin America in the 1990s', *Research Policy*, 30, 1-19.
- Kenny, J. (1997), 'APP Aims for Pole Position', *Pulp & Paper International*, 39 (9), 22-23.
- Klepper, S. (1996), 'Entry, Exit, Growth, and Innovation over the Product Life Cycle', *American Economic Review*, 86 (3), 562-583.
- Klepper, S. (1997), 'Industry Life Cycles', *Industrial and Corporate Change*, 6 (1), 145-181.
- Klepper, S. and K.L. Simons (1997), 'Technological Extinctions of Industrial Firms: An Inquiry into their Nature and Causes', *Industrial and Corporate Change*, 6 (2), 379-460.
- Koehler, K.G. (1972), 'Wood Processing in East Kalimantan: A Case Study of Industrialisation and Foreign Investment in Indonesia', *Bulletin of Indonesian Economic Studies*, 8 (3), 93-129.
- Laurila, E.J. (1989), *Pulp and Paper Industry in Indonesia: Prospects for Development*, Forestry Studies, IV-3.
- Malassu, A. (1998), 'A Change of Scenery for Asian Producers', *Pulp & Paper International*, (August).
- Minderhoud, S. (2002), *Technological Performance in Indonesian Paper Industry*, M.SC Research Report. Eindhoven University of Technology: Eindhoven.

Murmann, J.P. and E. Homburg (2001), 'Comparing Evolutionary Dynamics Across Different National Settings: The Case of the Synthetic Dye Industry, 1857-1914', *Journal of Evolutionary Economics*, 11, 177-205.

Nelson, R.R. (1968), 'A "Diffusion" Model of International Productivity Differences in Manufacturing Industry', *American Economic Review*, 58 (5), 1219-1248.

Nelson, R.R. (1994), 'The Co-evolution of Technology, Industrial Structure, and Supporting Institutions', *Industrial and Corporate Change*, 3 (1), 47-63.

Nelson, R.R. (1999), 'The Sources of Industrial Leadership: A Perspective on Industrial Policy', *De Economist*, 147 (1), 1-18.

North, D.C. (1993), 'The Ultimate Sources of Growth', in A. Szirmai, B.v. Ark and D. Pilat (eds.), *Explaining Economic Growth*, Elsevier Science Publishers B.V.: Amsterdam.

Paperloop (2003), [Http://www.paperloop.com](http://www.paperloop.com).

Pavitt, K. (1984), 'Sectoral Patterns of Technological Change: Towards a Taxonomy and a Theory', *Research Policy*, 13, 343-373.

Perez, C. and L.L. Soete (1988), 'Catching up in Technology: Entry Barriers and Windows of Opportunity', in G. Dosi, C. Freeman, R.R. Nelson, G. Silverberg and L.L. Soete (eds.), *Technical Change and Economic Theory*, Pinter Publishers Ltd.: London.

PT Binakarya Dayakusuma (2000), *Studi Hutan Tanaman Industri (HTI) Berkelanjutan Sebagai Jaminan Pemenuhan Bahan Baku Bagi Industri Pulp*.

Roberts, M.J. and J.R. Tybout (1996), *Industrial Evolution in Developing Countries: Micro Patterns of Turnover, Productivity, and Market Structure*. Oxford University Press: Oxford.

Rudd, N. (1999), 'Most U.S. Paper Machines Need Significant Technology Upgrades', *Pulp & Paper*, September, 55-60.

Sachs, J.D. and A.M. Warner (2001), 'The Curse of Natural Resources', *European Economic Review*, 45 (4-6), 827-838.

Sleuwaegen, L. and M. Goedhuys (2002), 'Growth of Firms in Developing Countries, Evidence from Côte d'Ivoire', *Journal of Development Economics*, 68, 117-135.

Sonnenfeld, D.A. (1998), 'Social Movements, Environment and Technology in Indonesia's Pulp and Paper Industry', *Asia Pacific Viewpoint*, 39 (1), 95-110.

Stafford, B. (2000), 'Indonesia: Debt and Disappearing Wood Challenge Pulp and Paper Mills', *Papermaker*, September, 19-22.

Sutton, J. (1998), *Theory and Market Structure*. The MIT Press: Cambridge, Massachusetts.

Temple, J. (2001), *Growing into Trouble: Indonesia After 1966*, mimeo.

Tybout, J.R. (2000), 'Manufacturing Firms in Developing Countries: How Well Do They Do, and Why?', *Journal of Economic Literature*, 38 (March), 11-44.



Utterback, J.M. and W.J. Abernathy (1975), 'A Dynamic Model of Process and Product Innovation', *Omega*, 3 ( 6), 424-441.

Vernon, R. (1966), 'International Investment and International Trade in the Product Cycle', *Quarterly Journal of Economics*, 80, 246-263.

WALHI/ YLBHI (1992), *Mistaking Plantations for the Indonesia's Tropical Forest*. Wahana Lingkungan Hidup Indonesia: Jakarta.

Windrum, P. and C. Birchhall (1998), 'Is Product Life Cycle Theory a Special Case? Dominant Designs and Emergence of Market Niches Through a Process of Coevolutionary-Learning', *Structural Change and Economic Dynamics*, 9, 109-134.

World Bank (1981), *Indonesia: Pulp and Paper Subsector Review*.

World Bank (2001), *Indonesia: Environment and natural Resource Management in a Time of Transition*.

**Table 1: Indonesian Paper mills (1970/1971)**

| <i>Location</i> | <i>Mill</i>              | <i>Year of start-up</i> | <i>Installed capacity (tpy)</i> | <i>Technical and economical problems</i>  |
|-----------------|--------------------------|-------------------------|---------------------------------|---|
| Java            | PN Kertas Padalarang     | 1923                    | 3,000                           | Very old equipment. Main raw material, rice straw, supply bottlenecks if production expanded  |
| Java            | PN Kertas Letjes         | 1939                    | 9,000                           | Future Shortages in main raw material, rice straw, if mill is expanded  |
| Sumatra         | Siantar                  | 1959                    | 4,500                           | Only wood pulp mill, but problems with continuous supply of raw material waste paper. Lack of spare parts and insufficient working capital. |
| Kalimantan      | Martapura                | 1959                    | 3,000                           | Raw material input is not feasible for the given cost structure of this mill.   |
| Java            | PN Kertas Blabak         | 1961                    | 7,000                           | Power supply problems and technical problems within production process  |
| Sulawesi        | Perum Kertas Gowa        | 1967                    | 9,000                           | Lack of spare parts and shortage of funds. Technical problems of production process.  |
| Java            | PN Kertas Basuki Rachmat | 1971                    | 9,000                           | Lack of spare parts causes shutdowns, very high cost for imported chemicals   |

Source: National Progress report, cited in Koehler (1972), capacity from World Bank (1981) and APKI (unpublished data).

**Table 2: Tariff Protection for Pulp and Paper (1975-2000)**

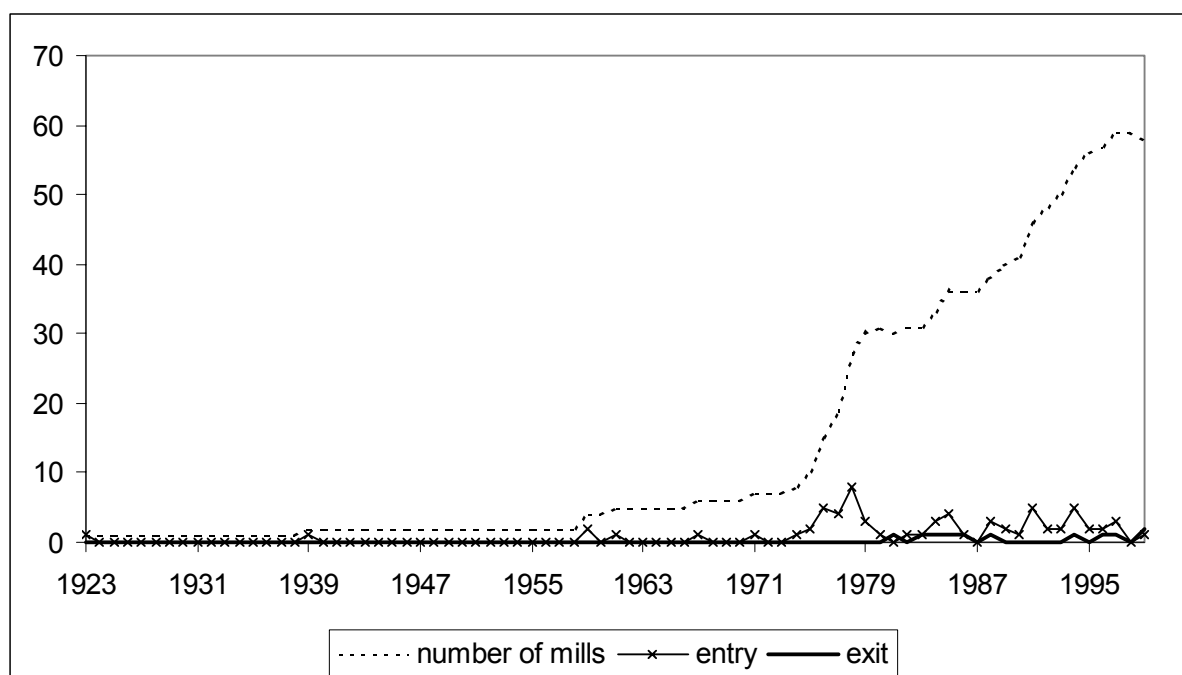
| <i>Product</i>             | <i>1975*</i> | <i>1980</i> | <i>1985</i> | <i>1990</i> | <i>1995</i> | <i>2000</i> |
|----------------------------|--------------|-------------|-------------|-------------|-------------|-------------|
| Pulp                       | 0            | 0           | 5           | 5           | 0           | 0           |
| Waste Paper                |              | 60          | 40          | 0           | 0           | 0           |
| Newspaper                  |              | 20          | 5           | 5           | 5           | 5           |
| Printing and writing paper | } 60         | 60          | 30          | 30          | 0           | 0           |
| Industrial paper***        |              | 60          | 30          | 30          | 15          | 5           |
| Tissue paper               |              | 60          | 30          | 30          | 15          | 5           |

\* There is no detailed data on tariff protection available before 1980 but World Bank (1981) indicates that in 1975 the average tariff on paper grades was 60 percent and import of pulp was duty free.

\*\* Industrial paper is board and wrapping paper.

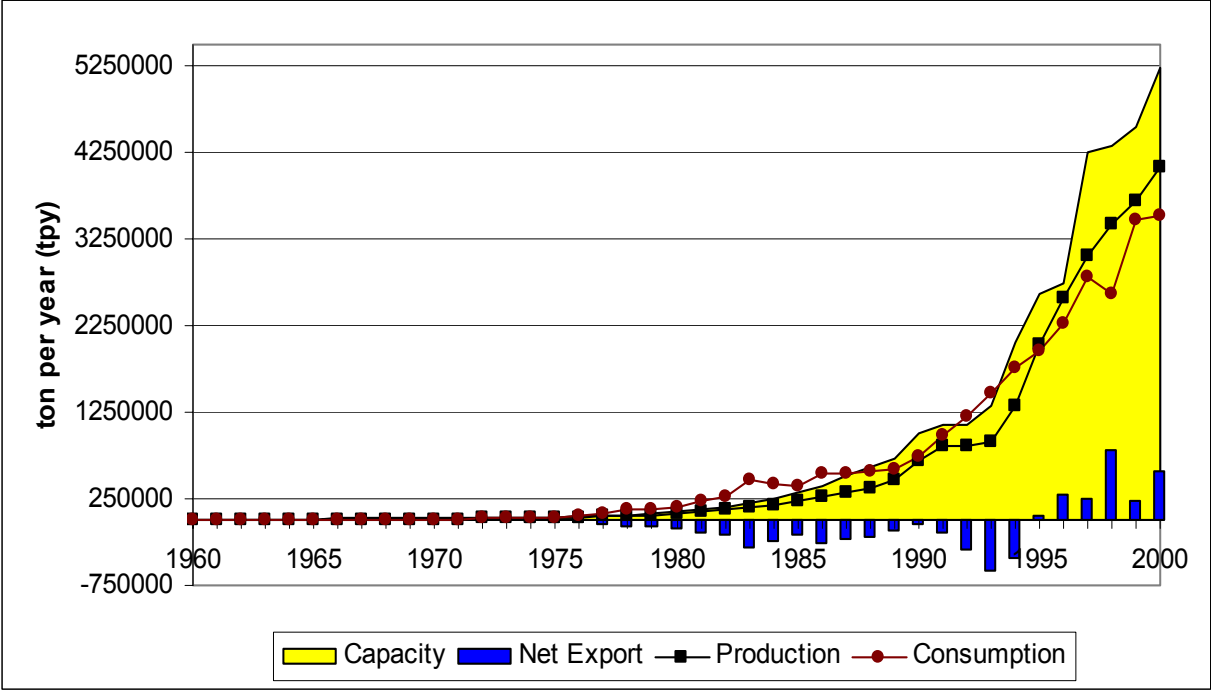
Source: Ministry of Industry and Trade (unpublished data), Indonesian Customs Tariff (Tarif Bea Masuk) (various issues).

**Figure 1: Number of Pulp and Paper Mills (1923-1999)**



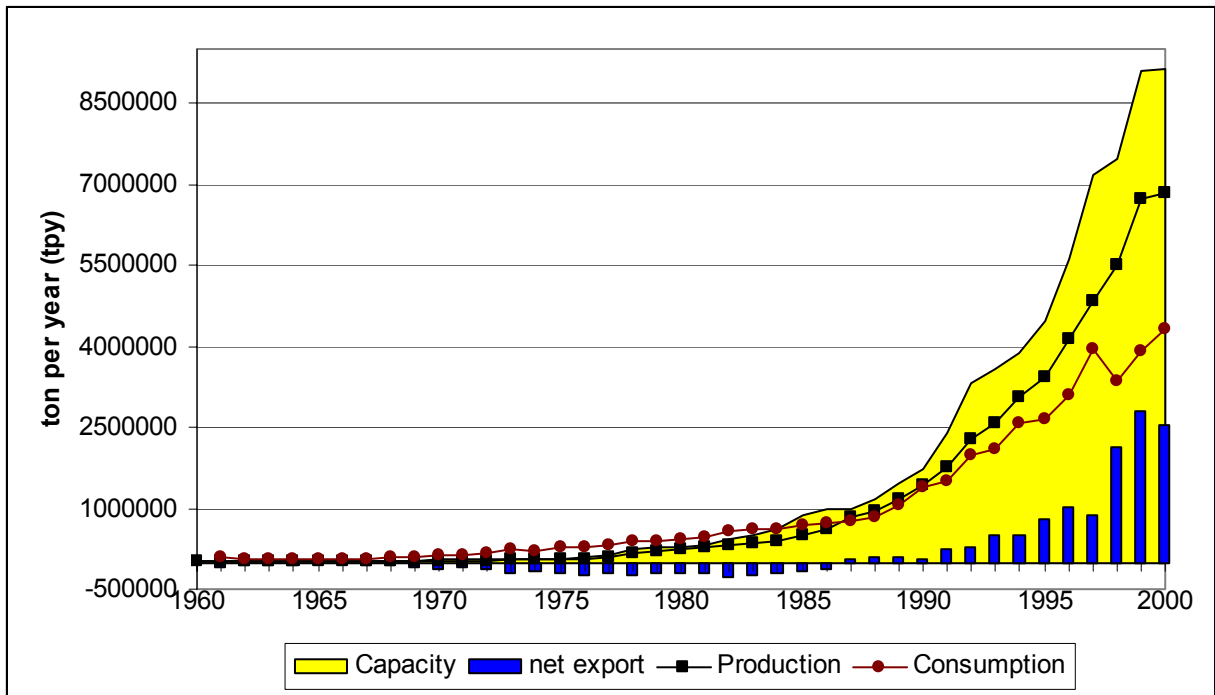
Source: World Bank (1981), FAO (1984), APKI (1985) and APKI (various issues).

**Figure 2: Pulp Capacity, Production, Consumption and Net Exports (1960-2000)**



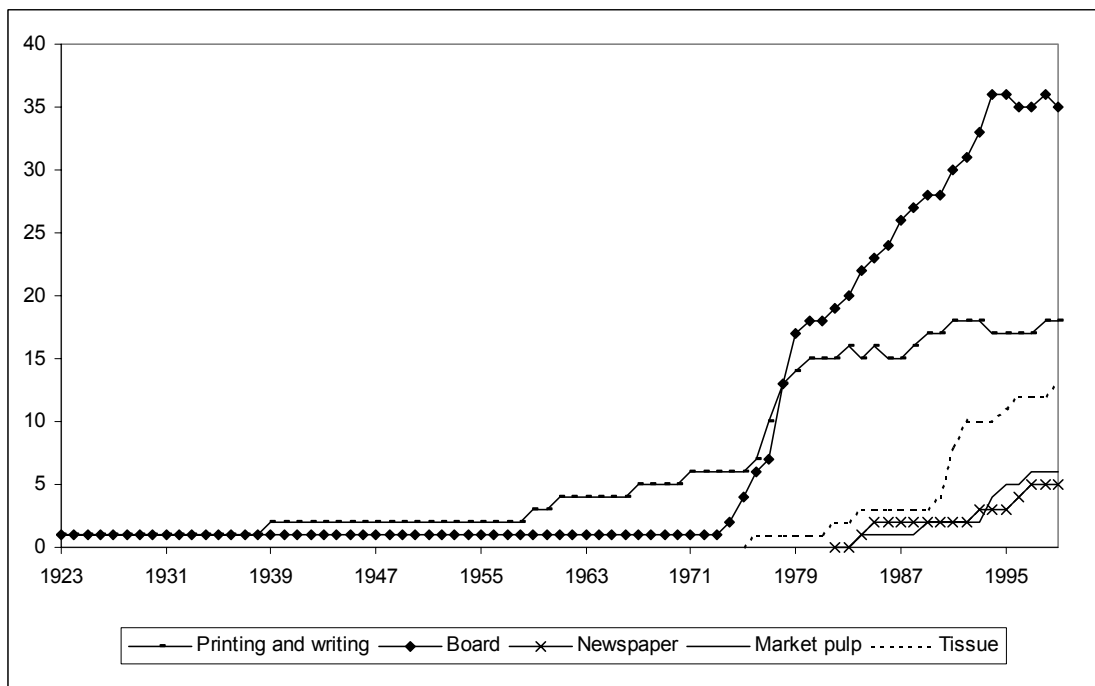
Source: APKI (various issues).

**Figure 3: Paper Production, Consumption and Net Exports (1960-2000)**



Source: APKI (various issues).

**Figure 4: Number of Firms by Grade (1923-1999)**



Source: See Figure 1

### Figure 5: Concentration and Market Share by Segment

Figure 5a: Printing and Writing

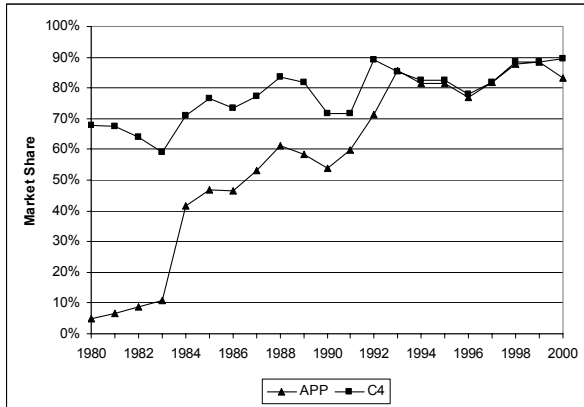


Figure 5b: Board

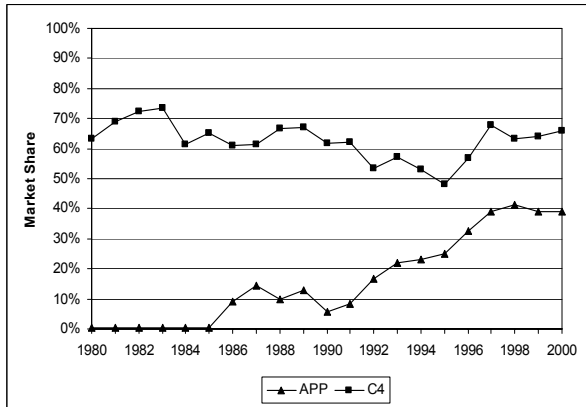


Figure 5c: Tissue

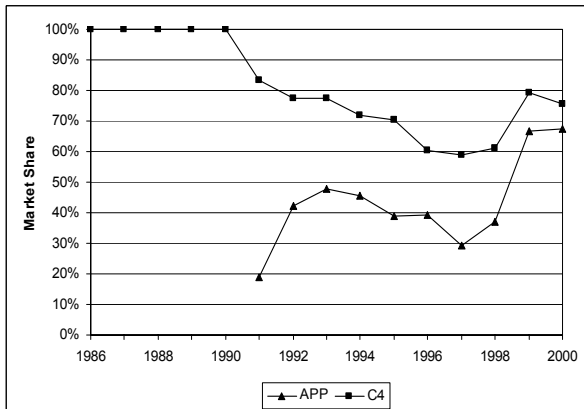
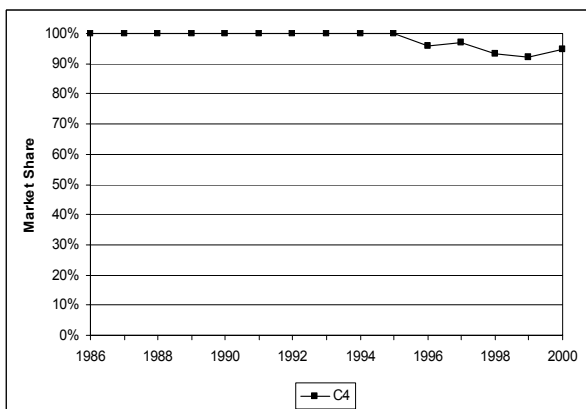
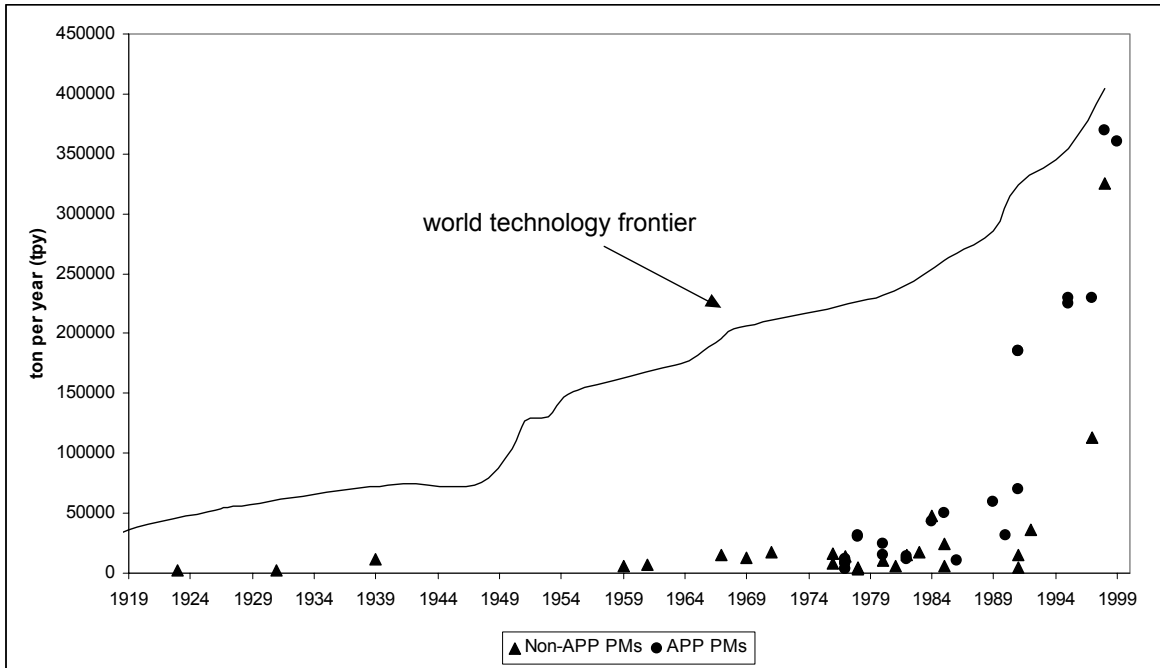


Figure 5d: Newsprint



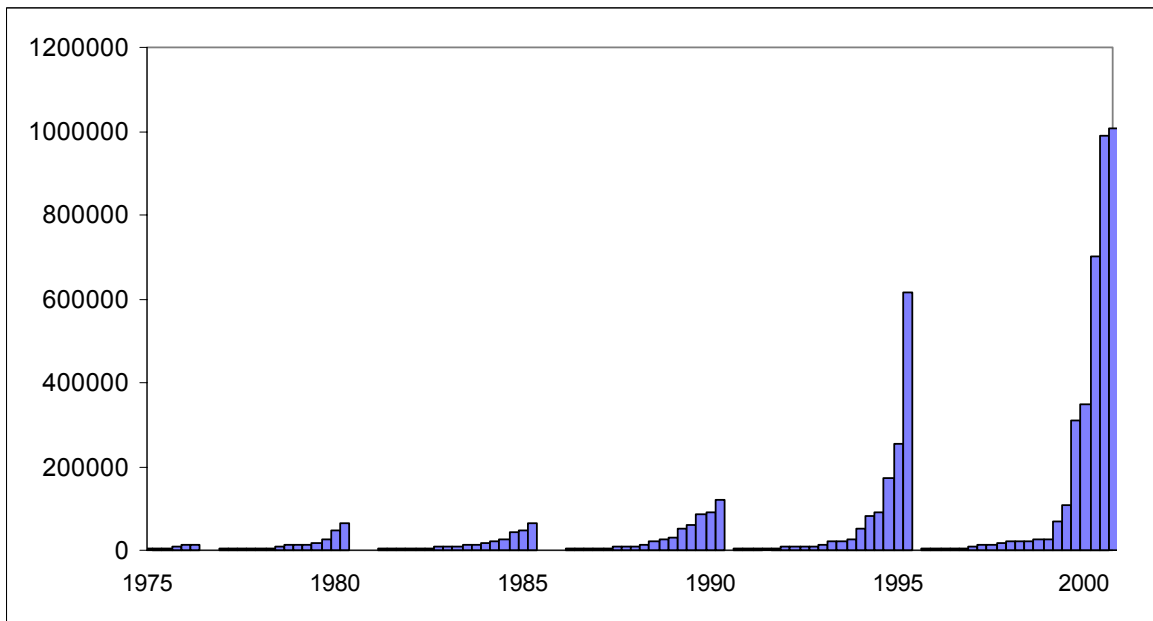
Source: World Bank (1981), FAO (1984), APKI (1985), APKI (various issues), APKI (unpublished data) and CIC (1990).

**Figure 6: Capacity of Operating PMs by year of start-Up (1923-2000)**



Source: The data is drawn from a wide range of sources, such as trade journals, interviews, internet and company reports. World technology frontier is constructed by using information on best-practice speed and width and assuming the standard grammage of printing and writing paper is 70 g/m<sup>2</sup>.

**Figure 7: Printing and Writing Capacity Distribution (selected Years)**



Source: see Figure 5.

## WORKING PAPERS

Ecis working papers 2002-2003 (January 2003):

- 02.01 M. van Dijk  
*The Determinants of Export Performance in Developing countries: The Case of Indonesian manufacturing*
- 02.02 M. Caniëls & H. Romijn  
*Firm-level knowledge accumulation and regional dynamics*
- 02.03 F. van Echtelt & F. Wynstra  
*Managing Supplier Integration into Product Development: A Literature Review and Conceptual Model*
- 02.04 H. Romijn & J. Brenters  
*A sub-sector approach to cost-benefit analysis: Small-scale sisal processing in Tanzania*
- 02.05 K. Heimeriks  
*Alliance Capability, Collaboration Quality, and Alliance Performance: An Integrated Framework.*
- 02.06 G. Duysters, J. Hagedoorn & C. Lemmens  
*The Effect of Alliance Block Membership on Innovative Performance*
- 02.07 G. Duysters & C. Lemmens  
*Cohesive subgroup formation: Enabling and constraining effects of social capital in strategic technology alliance networks*
- 02.08 G. Duysters & K. Heimeriks  
*The influence of alliance capabilities on alliance performance: an empirical investigation.*
- 02.09 J. Ulijn, D. Vogel & T. Bemelmans  
*ICT Study implications for human interaction and culture: Intro to a special issue*
- 02.10 A. van Luxemburg, J. Ulijn & N. Amare  
*The Contribution of Electronic Communication Media to the Design Process: Communicative and Cultural Implications*
- 02.11 B. Verspagen & W. Schoenmakers  
*The Spatial Dimension of Patenting by Multinational Firms in Europe*
- 02.12 G. Silverberg & B. Verspagen  
*A Percolation Model of Innovation in Complex Technology Spaces*

- 02.13 B. Verspagen  
*Structural Change and Technology. A Long View*
- 02.14 A. Cappelen, F. Castellacci, J. Fagerberg and B. Verspagen  
*The Impact of Regional Support on Growth and Convergence in the European Union*
- 02.15 K. Frenken & A. Nuvolari  
*Entropy Statistics as a Framework to Analyse Technological Evolution*
- 02.16 J. Ulijn & A. Fayolle  
*Towards cooperation between European start ups: The position of the French, Dutch, and German entrepreneurial and innovative engineer*
- 02.17 B. Sadowski & C. van Beers  
*The Innovation Performance of Foreign Affiliates: Evidence from Dutch Manufacturing Firms*
- 02.18 J. Ulijn, A. Lincke & F. Wynstra  
*The effect of Dutch and German cultures on negotiation strategy comparing operations and innovation management in the supply chain*
- 02.19 A. Lim  
*Standards Setting Processes in ICT: The Negotiations Approach*
- 02.20 Paola Criscuolo, Rajneesh Narula & Bart Verspagen  
*The relative importance of home and host innovation systems in the internationalisation of MNE R&D: a patent citation analysis*
- 02.21 Francis K. Yamfwa, Adam Szirmai and Chibwe Lwamba  
*Zambian Manufacturing Performance in Comparative Perspective*
- 03.01 A. Nuvolari  
*Open source software development: some historical perspectives*
- 03.02 M. van Dijk  
*Industry Evolution in Developing Countries: the Indonesian Pulp and Paper Industry*