3 Information Technology and Paper Demand Scenarios

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3.1 Introduction

A debate on whether electronic information technology (IT) will make paper products obsolete has continued for decades. It is now known that the early predictions of the "paperless office" have turned out to be premature. The debate has not died away, however, indeed, it appears to have gained momentum. Nevertheless, there continues to be widely differing opinions on this issue, which, to some extent, reflect the different interests among the various stakeholders.

It should come as no surprise that the paper industry (Horner 1997) sees the demand for paper products increasing more rapidly than do the developers of new information technology (Negroponte 1995). Some media professionals have even projected a rapid and dramatic change in the demand for conventional paper-based media. For example, James Adams, the CEO of United Press International (UPI) recently stated "I believe we are watching the demise of the traditional media, as we have known it for much of this century" (Adams 1998). There are also signs that the paper industry is beginning to acknowledge the challenge coming from the rapid development of electronic IT. For example, in 1996, paper industry organizations established a pressure group called The PaperCom Alliance in order to promote the use of paper-based products and services in the face of competition from electronic IT (PaperCom 1998). Nevertheless, the Alliance still argues that new IT and paper are largely complementary, i.e., they are promoting the *integrated* development of electronic and printed information.

The purpose of this article is to analyze the likely long-term tendencies in the world demand for paper products, with special emphasis on the impact that IT is likely to have on paper consumption. Furthermore, the analysis is restricted mainly to *communication papers*, i.e., newsprint and printing and writing papers. This is because the more significant impacts of IT are likely to be on communication papers rather than on packaging papers. Of the total world paper and paperboard production in 1996, the share of newsprint was 12.3%, printing and writing papers 29%, and packaging papers (mainly liner, fluting and boxboards) 45% (FAO 1998). The rest consists of mainly papers used for hygienic, health care and other specialized purposes.

This article is structured as follows; first the recent FAO (1997a) provisional long-run assessment of the outlook for demand for paper products up to 2010 is summarized. After that, the potential impact of different scenarios for economic (GDP) growth on the demand projections are discussed. This analysis leads to a discussion on the changes that the development of electronic IT may have on the structural relationship between economic growth and demand for paper products. Because of the nature of the subject, and the fact that academic research on the impact of IT on paper demand is almost non-existent, the purpose is not to provide specific quantity estimates. Rather, the purpose is to analyze the different channels through which the development of information technology is likely to affect paper products.

3.2 Paper Demand Projections to 2010

In terms of their economic significance, paper and paperboard products are the single most important forest product category. In 1994, they accounted for approximately 44% of the value of world forest product exports (sawnwood and wood panels accounted for 21% and 13%, respectively) (FAO 1997b). An important question, therefore, is how will the demand for these products develop up to 2010?

In the past decade, forest economists have provided a number of long-term outlooks on the demand for forest products (e.g., Brooks 1997 and Solberg 1996). These studies are often based on formal models, in which the primary factors determining the demand for forest products are economic growth, population growth and prices of forest products. The strength of these studies is in their systematic and analytical framework. However, the (econometric) models implicitly assume that the structure and behavior of the forest product markets remain the same as in the past. Nevertheless, factors such as political, demographic, environmental and technological changes are also among the forces which may change these behavioral relationships in the forest product markets (cf. Della Senta and Park, article 2 in this Volume). Thus, in order to be able to assess the effects of these forces, one needs to search for additional information outside the formal model projections.

One of the most systematic projections of the demand for forest products is the recent FAO outlook for global forest products consumption, production and trade to 2010 (FAO 1997a). Some of the main results of this outlook are discussed here (for other recent projections, see e.g. Solberg 1996 and Brooks 1997). Specific attention is paid to their sensitivity to development of economic growth and IT (for a detailed description of the FAO model, see FAO 1997a and Zhang et al. 1993).

The FAO (1997a) projections for the world demand for paper products up to 2010 are summarized in Table 3.1 and Figure 3.1. By comparing the historical demand structure (1970–1990) to the future projections (1994–2010) a clear slowdown in the growth rate in world demand for *paper and paperboard* products can be observed. The projected world annual growth rates are 3.3% and 2.5%, respectively. However, the growth figures vary greatly across different geographic regions. In particular, in the two largest consuming regions, Europe and North and Central America, the growth rates are significantly smaller than in the rest of the world.

In 2010, the world's largest consumption and production region for paper and paperboard products is projected to be Asia, followed by North and Central America and Europe (Figure 3.1). Because of its rapid population and economic growth and urbanization, the importance of Asia in world forest products markets increases significantly (see Zhang and Buongiorno, article 19 in this Volume). Although the production of pulp and paper products in Asia is projected to increase rapidly, it will still be a big net importer (15 mill. tonnes). Europe and North and Central America, on the other hand, will be net exporters, with net exports of 11 and 7 mill. tonnes, respectively.

The FAO (1997a) projections are in line with a

Table 3.1: Average annual growth rates (%) for paper products demand

Region	Total paper and paperboard		Printing and writing paper		Newsprint	
	1970–1990	1994–2010	1970–1990	1994–2010	1970–1990	1994–2010
Africa	4.3	2.8	4.9	4.5	2.4	3.7
Asia	6.1	3.9	7.9	4.8	4.0	2.5
Europe	2.7	1.8	4.2	2.4	1.9	1.9
North/Central America	2.4	1.7	4.2	2.1	1.7	2.5
South America	4.0	2.5	5.3	3.5	0.8	2.4
Former USSR	2.4	4.2	2.1	3.8	2.4	1.7
Oceania	3.0	2.4	6.2	4.2	1.6	1.7
World	*3.3*	*2.5*	*5.0*	*3.2*	*2.2*	*2.3*

Source: FAO (1997a)

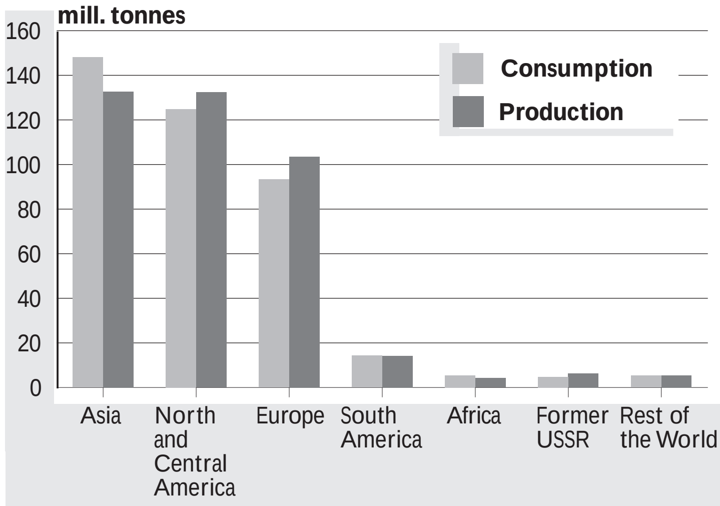

Figure 3.1: Paper and paperboard production and consumption, 2010 (FAO 1997a)

number of other recent projections (see e.g., Brooks 1997, Solberg 1996). The different studies tend to provide rather similar projections, because the underlying factors determining the demand are expected to develop in a more or less similar manner. Of these factors, the GDP and population development are the most critical.

The projections discussed above are based on FAO's (1997a) median scenario, which is considered to be the "most probable" among the three scenarios presented. If the FAO scenarios for GDP growth are compared with the latest IMF (1998) medium-term outlook, it can be observed that even FAO's highest growth scenario (scenario 3) assumes a significantly lower world GDP growth than the IMF (1998) has forecasted for the medium-term (up to 2003). Therefore, should the IMF projections for GDP growth turn out to be more accurate than FAO's, the world forest products demand would also be greater than estimated by FAO (1997a), other things being equal. However, the main point is that FAO's demand estimates, like all the other existing model-based projections, are very sensitive to the assumptions concerning GDP growth.

Besides the importance of being able to accurately forecast the future GDP growth rate, there is potentially another problem related to the relationship between economic activity and demand for forest products. Namely, the quantitative relationship between GDP growth and demand for paper may change. According to the FAO (1997a) estimates, the income (GDP) elasticity of demand for world paper products is roughly one. In other words, a one percent increase in world GDP results in a one percent increase in the demand for paper. However, the income elasticities in FAO (1997a), as in any other model projection based on econometric estimates, are based on historical data (in the case of the FAO estimates it appears that the most recent data used was for 1994). Thus, it is implicitly assumed that the quantity relationship that has existed between GDP growth and demand for paper products in the past, is going to hold also in the future. Is this likely to be the case for paper products and GDP?

Indeed, there are already indications of structural changes in some countries and certain paper products. One notable example of this is the relationship between newsprint demand and GDP growth in

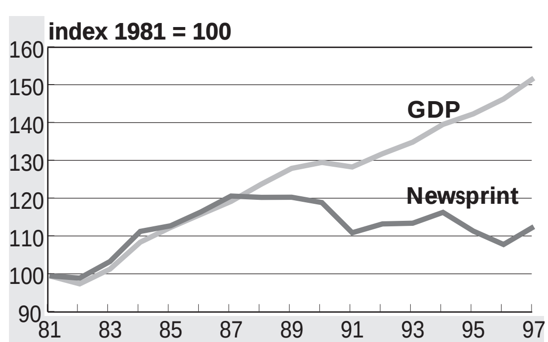

Figure 3.2: The U.S. newsprint consumption (tonnes) and real GDP (1992 dollars), 1981–1997 (Canadian Pulp and Paper Association and Department of Commerce 1998)

the U.S. Figure 3.2 shows the U.S. real GDP growth and newsprint consumption during 1981–1997. Up to 1987, the growth of these two series have followed a similar historical pattern, i.e., both have grown along the same trend. Since the end of the 1980's, however, the consumption of newsprint has stagnated even though GDP growth has continued to increase. This change is an important development in the world newsprint markets due to the dominant role of U.S. consumption. Its share of the total world newsprint consumption in 1994 was 39%, which is larger than that of the whole of Europe and the former USSR together (30%) or Asia (24%) (FAO 1997a). Moreover, it appears that the rate of growth of newsprint consumption is also slowing down in Western Europe (Otto 1998).

The main reasons behind the stagnation of newsprint consumption in the U.S. are declining readership and circulation. Fewer adults read newspapers – the percentage of daily newspaper readers from the total population over 18 years is down from about 80% 30 years ago to 59% in 1997 (NAA 1998). One important factor behind these tendencies, and the slowing of the growth of newsprint consumption in the U.S. and other high-income industrialized countries, is undoubtedly the increasing use of electronic IT. As will be discussed below, the rapid development of IT is likely to have a significant impact on the consumption of communication papers in general. This is the major question that now will be analyzed in more detail.

3.3 Information Technology and Impact on Paper Demand

Rapid Development in Information Technology

Throughout the 20th Century, the increased demand for information has resulted in higher paper consumption. Generally, it is considered that up to now the information revolution has multiplied rather than replaced paper use (e.g., World Business Council… 1996). Is this trend likely to continue?

The electronic IT sector is not usually well defined. The term is often loosely used to describe the entire computing and communications sector. In this article the term represents all electronic (increasingly digital) media used for information, communication, entertainment, and commerce. In recent years, a number of governments (e.g., Canada, France, Japan, the United Kingdom, and the United States) and regional economic and political organizations (e.g., the EU and OECD) have published comprehensive reports which attempt to describe the development of IT and its impacts on societies (for references, see http://www.ecommerce.gov). All these documents point towards a very rapid development in IT and to the substantial changes that this development will have on the conventional media, such as the printing and publishing industry. For example, a recent study by the U.S. Department of Commerce (Dept. of Comm. 1998) states that computer and communication industries currently make up more than 8% of the U.S. economy, and that these industries are growing twice as fast as the economy as a whole. A similar development is taking place in other industrialized countries (European Commission 1997a).

One important example of the rapid development of IT is the Internet. Although the number of individuals who use the Internet is difficult to measure accurately, various surveys show an exponential growth in the number of people using the Internet. The number has roughly doubled every year in the 1990's (e.g., Network Wizards 1998 and NUA 1998). Interestingly, the relative (not absolute) development pattern is similar both in the advanced economies (e.g., North America and Western Europe) and in the lower income countries (e.g., Asia and South America). According to the NUA Internet Survey, the number of people with online access to the Internet in the world in August 1998 was 130.8 mill. This number was divided among the regions as follows: Canada and the U.S. 70.0, Europe 32.5, Asia/Pacific 19.3, South America 7.3, Africa 0.8 and the Middle East 0.8 mill. users (NUA 1998).

What will the impact of electronic IT be on the demand for paper products? So far, there has been only a few studies on the subject, mainly by consulting firms. The studies by CAP Ventures (1997) and the Electronic Document Systems Foundation (EDSF 1997) are among the most recent and comprehensive ones. According to these studies, the consumption of paper is likely to continue to increase during the next 20 years. However, the paper consumption growth is projected to be linear while electronic IT is growing at an exponential rate. Moreover, CAP forecasts that digital printing will account for 47% of all paper growth, while in traditional publishing the use of paper will remain steady or grow at a very slow pace (0–3%) through the 20-year study period. The EDSF study (collaborative project of the INTERQUEST consulting firm and the University of Virginia School of Engineering and Applied Science) projects a gradual evolution towards new IT and not a sudden replacement of conventional printing and publishing. However, the study sees that in business, work-related environments and education, documents will be multimedia compositions that will decreasingly involve printed material. According to the study, there is no doubt that the teaching and learning process at all levels will shift from print- and paper-based media to digital and electronic formats.

Although the above type of studies are a very valuable source of information, they suffer from the lack of a formal analytical basis. Moreover, there is always the danger that the results may somewhat reflect the interests of the commissioner, rather than being purely independent analyses of the subject. Indeed, objective assessment of the situation is difficult because of an almost total lack of independent (academic) research on the topic.

The only econometric study on the impact of electronic media on paper demand would appear to be by Zhang and Buongiorno (1997). They examined the demand for communication media (computers, televisions and radios) and printing and publishing papers in the U.S. during 1960–1991. Printed materials and computers were found to be luxury goods, i.e., as consumers income increased, people spent proportionally more on printed materials and computers. Moreover, during the study period, the demand for printed materials was affected essentially by income and the price of the materials, with little effect from the prices of electronic communication media. The results support the general view that the electronic media have not yet significantly affected the demand for printing and publishing papers. However, since the data reflect the development in 1960–1991, they do not provide information on the recent changes, such as the spread of the Internet and digital IT.

Thus, on the basis of the existing knowledge, it is difficult to draw any clear conclusions about the extent and timing of the impact of IT on the demand for paper products. However, a number of routes can be identified through which the development of IT may affect paper products. In particular, technological changes have historically followed certain patterns which can also be expected to characterize the future development of IT. In particular, Sedjo (1997) quotes Vernon Ruttan's definition of technological change, according to which it is (i) the substitution of inexpensive and abundant resources for scarce and expensive resources, (ii) the substitution of knowledge for resources, and (iii) the release of the constraints on growth imposed by inelastic resource supplies. All these forces can be expected to have an impact on the development of IT.

Characteristics of the Information Technology Change

Within the above, rather general, classification of technological change, specific factors can be identified which are likely to characterize IT development and the demand for paper products. Although somewhat overlapping, they are: (i) cost; (ii) time; (iii) consumer preferences; (iv) environmental concerns; and (v) institutional changes.

The Cost of Information Production and Consumption

The rapid spread of new IT is partly a result of the economies of information: new IT reduces production and consumer costs. For example, the advantages of the Internet over newspapers and magazines include lower costs of production and distribution. It has been estimated that the paper, printing and distribution costs account roughly for 30 to 40% of the cost of newspaper and magazine publishing (Dept. of Comm. 1998). With the Internet, the marginal costs of distributing information are very low and the cost difference between distributing it to one or 1 000 households is minimal. Less paper and ink is required and virtually no transportation (distribution) cost. Print-on-demand publishing – i.e., printing documents only when they are needed and in the quantity needed – reduces paper, inventory and storage costs and it allows for publishing decisions based on demand rather than supply.

The same tendencies work both for information consumers and producers. The costs of using computers have fallen drastically over the past couple of decades. For example, computer power now costs only 0.01% of what it did in the early 1970's. Also, the speed of information transmission over the Internet is increasing rapidly, and with it, the cost of receiving information decreases. For example, new technologies such as ADSL (Asynchronous Digital Subscriber Line) enable copper telephone lines to send data on the Internet at speeds 100 to 1 000 times faster than today's Internet (Dept. of Comm. 1998). This will dramatically reduce the costs of sending and receiving information.

The new satellite systems are also likely to have a major impact on the cost of communication services and their global development. A satellite system may also provide an alternative to less developed countries, which do not yet have extensive copper or optical cable networks, or the resources to build them in the near future.

One important change through which production and consumption costs will be reduced, and which will affect paper use, is the rapid transfer of trade and commerce to the Internet, i.e., the so-called *e-commerce.* In the coming years, e-commerce is expected to grow exponentially (Dept. of Comm. 1998). For goods and services that can be ordered and delivered over the network, the Internet is truly a global marketplace. The contents of many *intangible goods*, whose value does not rely on a *physical form* (e.g., newspaper and magazine articles, news broadcasts, stocks, airline tickets, bank transfers, letters), may also be transferred in digital form over the Internet. E-commerce provides consumers and producers with immediate access to worldwide markets without the time, costs and inconveniences associated with having to physically make the trip to various retail shops. The need for costly inventory stock can also be reduced. Thus, one of the key motives for the adoption of this technology will be the reduction of the costs of producing and consuming intangible goods. Inevitably, this development will also reduce paper consumption (Pearson 1998).

The Time Factor

The new IT exponentially increases the information readily available to consumers. However, the use of this information is limited by human comprehension and time. As Nobel laureate economist Herbert A. Simon puts it: "What information consumes is rather obvious: it consumes the attention of its recipients. Hence a wealth of information creates a poverty of attention, and a need to allocate that attention efficiently among the overabundance of information sources that might consume it" (quoted in Varian 1995: 200). The total amount of time (and capacity) consumers can spend on information or entertainment is finite. The growth of a new information medium, such as the Internet, will consequently and inevitably result in choices between different information sources and ways to receive information. Electronic IT will increasingly compete with other media for users' time, as well as for their money. "Over the past 30 years, the average amount of time people spend with media has increased by about 90 minutes per day. However, research indicates that there is little potential for significant further expansion in consumers' media time or expenditure budgets" (European Commission 1997b: 3).

Newspapers and magazines have already been affected by the Internet. Cyber Dialogue, an Internet research company that analyzes Internet use for the U.S. market, recently reported that 16% of Internet users report a decrease in reading newspapers and magazines, and 35% watch less TV (Cyber Dialogue 1998). Similar figures were found by another survey (WebCensus 1998), according to which Internet users spend 12% less time reading newspapers and print information and 22% less time watching TV (WebCensus 1998). These tendencies are likely to increase in the future because of the reasons discussed below.

Consumer Preferences

For most consumers, paper is not an end but a means. It is a means for information distribution, the role of which it has served well for many centuries. In the long run, however, it would be surprising if this medium will continue to be optimal. With new IT, a new mode of information consumption may evolve. Changes in production technology are likely to affect the way we consume the end products, whose format will change in order to maximize the benefits of consumption. For example, although simply replacing printing presses with digital technology will not necessarily change the way books and newspapers are written and read, the new technology may cause old media not to be the preferred form of information and entertainment. Today, a document is no longer necessarily a piece of paper, but may include various multimedia functions (images, video, voice, etc.). This development is pushing information from paper to the electronic media. Printed books and newspapers simply cannot be integrated as smoothly as digital versions.

People nevertheless need to adapt to and accept the new information technology. How quickly this happens depends to a great extent on cultural questions. History shows that major technological innovations are rarely instantly adopted by consumers. New technologies first appear in a crude embryonic state with only a few specific uses. Improvements and diffusion then occur simultaneously as the technology is made more efficient and adapted for use over an increasingly wide range of applications, through a series of complementary innovations. For example, the two important disadvantages of digital information so far have been that it is very tiresome to read things on the screen, and that computers are not as portable as printed material.

However, it appears that these technological drawbacks may be overcome in the near future. New LCDs with a reflectivity and a luminance-contrast ratio equal to those of newspapers are being developed, as well as new displays that users will be able to roll up and put in their pockets (EDSF 1997). Moreover, the MIT Media Laboratory is currently developing a portable electronic book and reusable paper substrate that can be rewritten multiple times

(Jacobson et al. 1997). According to Jacobson et al. (1997: 3), "the technology already exists for high-quality coating and printing of not only paper, but also of a large range of plastics and other materials." Likewise, at the Xerox Palo Alto Research Center, research is being undertaken to develop an electronic surrogate for paper (Gibbs 1998).

There are also reasons to believe that the cultural adaptation to new IT may not be that slow. Indeed, the Internet adaptation rate has been much faster (exponential) than was experienced with the phone, radio or TV. The rapid spread of the Internet and cellular phones imply that consumers generally accept the new information technology. Moreover, each consumer's willingness to use a particular piece of technology, such as the Internet, depends strongly on the number of other users. There is a so-called *bandwagon effect*, i.e., if an increasing number of people are using the Internet, it makes it more advantageous for you to use it also.

Advertising and subscription revenues flowing to the Internet are also likely to increase rapidly. The more users the Internet has, the more effective means of reaching the markets it will be for advertisers. Current trends in classified and local advertising spending indicate that a significant shift is already taking place (Dept. of Comm. 1998). This trend will to some extent replace advertising in printed newspapers and magazines.

Finally, another important factor that can have a significant impact on consumer adaptation to new IT is the *generation factor*. For example, the generations born after 1985 in western industrialized countries have used computers as their primary source of information and entertainment, rather than books, newspapers and magazines. After 2010, these young adults will be the important consumers, and their values and technical capabilities will drive society's development.

Environmental Impacts

The paper industry often makes the claim for being relatively environmentally friendly compared to other process industries. The claim has its justification in that the industry is largely based on renewable resources (wood or agrofiber), it generates substantial amounts of energy as a side product of the (chemical pulp) process, and the industry's water effluents have been reduced dramatically in recent decades. However, the essential question concerning the use of paper from environmental perspective is: How can the services provided by paper be delivered to consumers with minimal resource use and pollution?

Software, magazine articles, news broadcasts, stocks, airline tickets and insurance policies are all intangible goods whose value does not rely on a physical form. Much of today's intellectual property is produced, packaged, stored somewhere and then physically delivered to its final destination. Consider newspapers and magazines, for example. These are either delivered directly to households or bought from newstands or stationary shops. This requires physical transportation from the publishing house to the customer and then the collection of waste paper from the customer. Paper production also requires large amounts of various raw materials (e.g., wood, energy and chemicals, which, among other side effects, also create environmental problems related to transportation). Moreover, newspapers and magazines include many pages in which the customer has no interest, but cannot exclude.

The technology exists to transfer the content of these products in digital form over the Internet. By printing newspapers, magazines, and other documents when needed, and only the contents required, and at sites geographically close to the point of distribution, the environmental side effects of paper products can be reduced significantly. Simultaneously, customers and producers also save time and reduce storage and shipping costs. Thus, digital print-on-demand publications require fewer resources and create less pollution and paper waste, which in turn reduces the material costs and costs of complying with environmental regulations. In view of these advantages, a rapid increase in demand for digital print-on-demand publications can be expected in the near future.

Institutional Changes

The rapid spread of IT will also be enhanced by other institutional changes. There has recently been a number of attempts to strengthen international coordination in the creation of a framework and rules for global IT markets. For example, the World Trade Organization (WTO) Ministerial Declaration on Trade in Information Technology Products (ITA) was agreed in December 1996. The Agreement seeks to eliminate customs duties and other duties and charges on IT products by the year 2000. The current 43 parties to the ITA account for 93% of world trade in IT products. The ITA covers six main categories: computers, telecom equipment, semiconductors, semiconductor manufacturing equipment, software and scientific instruments. Moreover, according to the Global Telecommunications Accord, almost 70 leading nations agree to rapidly deregulate their domestic telecom markets. The deregulation of the IT industry all over the world will increase competition and consequently will tend to decrease prices. This will, in turn, accelerate the spread of digital technology.

Governments will also attempt to develop international agreements to ensure that Internet e-commerce will be based on global free trade (e.g., Dept. of Comm. 1998). If these attempts succeed, this will further enhance the rapid spread of e-commerce.

Impact on Paper Demand

Communication Papers

From the perspective of the demand for paper products, the electronic IT sector is likely to have a number of important effects. First, and more immediately, it will increase the demand for new types of "digital" paper. Secondly, and in the more distant future, it will probably decrease the demand for all communication papers. In fact, electronic IT has already partially or totally replaced certain paper grades. For example, development of computer technology has replaced punch cards and copying machines have almost totally replaced carbon paper.

In future, the surface quality of the paper will be developed to be more suitable for the different requirements of digital information. The demand for new communication paper types will therefore increase simultaneously with a decline of the use of current newsprint and printing and writing paper types. The average growth of coated digital paper is expected to increase 21% per annum during the next 12 years (CAP 1997). The current paper types will continue to be replaced. If this substitution takes place in significant amounts during the next 10 to 15 years, the income elasticities of paper demand used by FAO (1997a) projections may turn out to be too high, and consequently, the demand outlook for communications paper will also be too high. However, the impact of technological developments will differ between the different paper types. For example, the use of newsprint and archive-grade papers, used for storing information, will most probably decline first and office paper last. Also, e-commerce will, among other things, most likely decrease the demand for paper used for advertisements.

Electronic IT is also likely to have an impact on the price development of communication papers. In the last three decades or so, the trend in the real prices of communication papers has been downwards (FAO 1997a: 63), and it is likely that electronic IT will continue to put pressure on these products. Indeed, the only way communication papers can maintain their competitiveness is for their relative price to go down. Although this tendency is clear, it is difficult to project the exact timing and quantity of the impact.

Finally, perhaps the single most important uncertainty as regards the timing and quantity of the above impacts, is the development in the less industrialized countries. Currently, these countries account for about 25% of world paper consumption (World Business Council… 1996). However, the paper industry's hopes and the FAO (1997a) projections concerning the future development for paper products, rely heavily on expectations of a rapid increase in the demand for paper in these countries. In particular, the demand growth in Asia, Eastern Europe and the former USSR is expected to be rapid. What is not known is how quickly the less industrialized economies will be able take advantage of the leapfrog effect, adopting the newest, cheapest, best technology rather than going through the same historical stages as the current industrialized countries. If, as argued above, new information technology turns out to be a more economical way to distribute information than paper, then this creates an important incentive for the less developed countries to adopt the new technology rapidly. Wireless telecommunications would allow countries to avoid the huge effort and expenses of building wired infrastructures through crowded cities and the sparsely settled countryside.

Although there are economical reasons why the less industrialized countries may in fact adopt new IT quite quickly, it will still take time before the new technology will have a large impact on the use of communication papers. The impact will begin to be felt only after the younger generation, which is familiar with the new technology, will start to change consumption patterns. It is therefore most likely that in the next 5 to 10 years the growth of demand for communication papers in less industrialized countries will be rapid.

Packaging Papers

The direct impact of new IT on packaging papers is not likely to be as large as for communications papers. The demand for packaging papers is largely determined by the food and drink industry. The basic forces affecting the demand for packaging papers is economic growth and the development of substitute products (mainly plastic, glass and metals).

Besides the price development of the various packaging materials, the demand is likely to be determined by environmental factors. For example, the impact of increasingly strict legislation in the

European Union and North America on the reuse of containers, together with the reduction and enforced recycling of packaging materials, and the introduction of landfill taxes in various countries, will determine the relative competitiveness of different materials. The advantage of paper and board is that they are more easily recyclable and reusable than, e.g., plastic.

Electronic IT will probably increase the demand for packaging papers. In recent years, the packaging of computers, other electronic equipment and media products has already shown rapid growth. The projected increase in e-commerce (Dept. of Comm. 1998) will in turn increase the demand for packaging. Nevertheless, environmental factors are probably more important for the future demand for packaging papers than the development of electronic IT.

3.4 Conclusions

If the FAO (1997a) projections on the demand for paper products up to 2010 were to be realized, no dramatic change in paper consumption would occur. Demand would continue to grow steadily, although at a slightly lower rate than experienced in recent decades. However, a number of potentially important factors, which may have a large impact on paper demand, had to be excluded from the projection. This article analyzed one such factor, the rapid development of electronic information technology.

Currently, it is impossible to make accurate projections concerning the quantity and timing of the impact of IT on world paper demand. The issues raised in this paper only point to various channels through which the impacts might operate. It was argued that the basic economic factors are likely to be the major determinants for the development of IT and its impact on paper demand. Electronic IT may provide the services that communication paper products produce, but at lower costs. In addition, new digital media can provide more information and entertainment services than paper-based products. For example, the rapid growth of the Internet is largely attributable to its relative cost-effectiveness and strength as a medium of communication, education and entertainment, and, more recently, as a tool for e-commerce.

The likely impacts on paper products in the long run will be of two kinds. First, IT will increase the demand for new paper types suitable for digital printing purposes. Secondly, the rate of growth of demand for many of the present communication paper types will decrease, as will eventually, perhaps, the demand for the bulk of the communication papers. For example, it appears that newsprint consumption in high-income industrialized countries has, in recent years, already started to stagnate. In addition, the increasing competition from electronic IT will tend to push the real prices of communication papers down. However, the timing and extent of the impact on the total world demand and product prices is difficult to project. A large part of this uncertainty depends on the speed at which developing countries will be able to adopt new IT.

Should electronic IT have a significant impact on paper consumption, it could also have a major effect on the utilization of world forests. Less forest resources would be needed for pulp production. It has been estimated that of the world's industrial roundwood production (consumption), which is almost 1.5 bill. m^3, the pulp and paper industry uses roughly one third (World Business Council… 1996). According to Della Senta and Park (article 2 in this Volume) there is even the possibility that in the long-term, "the growing use of the electronic platform may eventually lead to a decline of the paper as the main medium of information exchange and raise the status of forests as ecological (as opposed to economic) assets."

The analysis also pointed out the lack of (academic) research on the topic. So far, it appears that researchers have considered the impact of digital IT to be only a theoretical possibility in the long run, with little affect on paper use in the near future. However, considering the potentially dramatic affect that IT could have on the paper industry, and, therefore, also on the use of world forests, the lack of academic research on the topic is cause for concern.

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