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MATERIALS SHORTAGES

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PERMANENT SUBCOMMITTEE ON INVESTIGATIONS

OF THE

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UNITED STATES SENATE

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MEMORANDUM

To: All members of the Permanent Subcommittee on Investigations.
From: Senator Henry M. Jackson, chairman.
Subject: Materials shortages—Paper.

This Committee print, another in our series of indepth studies of material shortages, focuses on the paper industry. In highly industrialized nations paper is one of the most important commodities, and its usage correlates highly with a country's level of development.

The study shows the intricacies involved in developing paper from wood pulp, and the decreasing capacity of paper manufacturers to meet the per capita consumption needs of highly industralized nations due to rising costs of materials and labor.

The Subcommittee, under the direction of Senator Walter D. Huddleston, has previously examined shortages in the iron and steel, petrochemicals and aluminum industries.

We are indebted to John E. Blodgett, Analyst in the Environmental Policy Division and Angele Gilroy, Economic Analyst, Economics Division, Congressional Research Service of the Library of Congress, who prepared this report for the Subcommittee.

In closing, let me thank Senator Charles H. Percy, the ranking minority member, and the minority staff for their cooperation and assistance.

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MATERIALS SHORTAGES: PAPER

Introduction

Paper and paper products are important components of highly industrialized societies. Paper usage correlates highly with a country's level of development. In the United States, per capita consumption of paper and paperboard reached 639 pounds in 1973, compared to world per capita consumption of just over 75 pounds. The pulp and paper industry is the fourth largest U.S. manufacturing sector; $27.9 billion worth of paper was purchased in the United States in 1972.

The major consumer of paper, the United States also is the world's major producer: in 1969, domestic production was 38 percent of the world's total. Nevertheless, the United States is a net importer of paper; domestic production has fallen 8 to 10 percent short of consumption the last several years (slightly less, however, than the deficit of the 1920's, when production fell 12–15 percent short). In fact, however, the United States is entirely or largely self-sufficient for all but one paper product, and significant quantities of some grades are exported, mainly of paperboards; the exception is newsprint, with 70 percent of domestic consumption imported (representing 95 percent of all U.S. imports of paper). (See Table I–1.) Nearly all imports are from Canada.

TABLE I–1.—DOMESTIC PRODUCTION AND CONSUMPTION OF PAPER AND PAPERBOARD—1973

[Tons]

	Production	Imports	Exports	Trade balance	Apparent consumption	Production/consumption percent
All grades	61,833,174	8,477,225	2,846,856	—5,630,369	67,239,937	92
Paper	26,485,764	7,982,943	720,614	—7,262,329	33,748,094	78
Newsprint	3,413,128	7,410,360	97,439	—7,312,921	10,726,049	32
Printing and writing	13,283,624	362,345	379,765	+17,420	13,266,205	100
Packaging and Industry	5,269,078	209,021	133,522	—75,499	5,344,577	99
Special Industry	564,238	1,196	87,200	+86,004	478,432	118
Tissue	3,955,696	21	22,688	+22,667	5,933,029	101
Paperboard	29,654,284	35,575	2,244,534	+2,208,959	27,445,325	108
Wet machine board	134,594	6,883	7,495	+612	133,982	100
Construction paper and board	5,558,532	451,824	97,820	—354,004	5,912,536	94
Pulpwood [1]	107,121,000	1,624,000	3,591,000	+1,967,000	105,154,000	102
Wood pulp	48,355,000	3,993,164	2,343,555	—1,649,609	50,004,609	97
Wastepaper	14,496,640	86,804	683,444	+596,640	13,900,000	104

[1] Estimated.

Note.—Imports and exports do not include finished products.

Source: American Paper Institute; U.S. Forest Service.

North America produces over one-half the world's supply of the basic raw material for paper, wood pulp. U.S. production historically has lagged slightly behind consumption, although small surpluses occurred in 1970 and 1971. For 1973, U.S. production of wood pulp fell short of consumption by about 3 percent.

Despite the size and strength of the U.S. paper industry, however, paper shortages were experienced during the 1973–1974 winter, and fears of further shortages are being expressed (based on anticipated increases in per capita consumption). While part of last winter's shortages resulted from particular extraneous causes—adverse weather and labor strikes—part of the shortages appears to have resulted from internal characteristics of the industry, which is being subjected to the same economic stresses affecting other industries, where shortages are also occurring. These stresses are primarily manifested in greatly increased costs for constructing new capacity and include rising construction costs, higher interest rates, and inflation. Operating costs are rapidly rising too as materials prices and labor costs increase and more stringent pollution and safety regulations are imposed. All these rising costs depress return on investment. It is in the face of these disincentives that new capacity must be built. The extent of expansion will be a key determinant of whether paper shortages will occur in the future, assuming demand continues to rise.

The purpose of this study is to provide an introduction to the pulp and paper industry and its position with respect to today's economic turbulence, so the reader can assess the possibilities of future paper shortages.

I. PAPER AS A COMMODITY

In reference to its basic raw material, the pulp and paper industry is often referred to as the "cellulose industry," for most of its products are made from cellulose fibers, derived primarily from trees. Small amounts of other fibers, such as silk, cotton, asbestos, and synthetics, may also be used.

One product made of these cellulose fibers is the paper which is the basis for the printing medium and for writing papers; other products find major uses in wrapping and packaging, insulation, and fulfilling various absorbtive needs including napkins, towels, tissue, and sanitary napkins.

The conversion of trees into these diverse products involves a series of manufacturing processes which, taken together, explain much of the evolution and structure of the industry. Figure I–1 presents a schematic view of the fiber flow in the U.S. paper industry.

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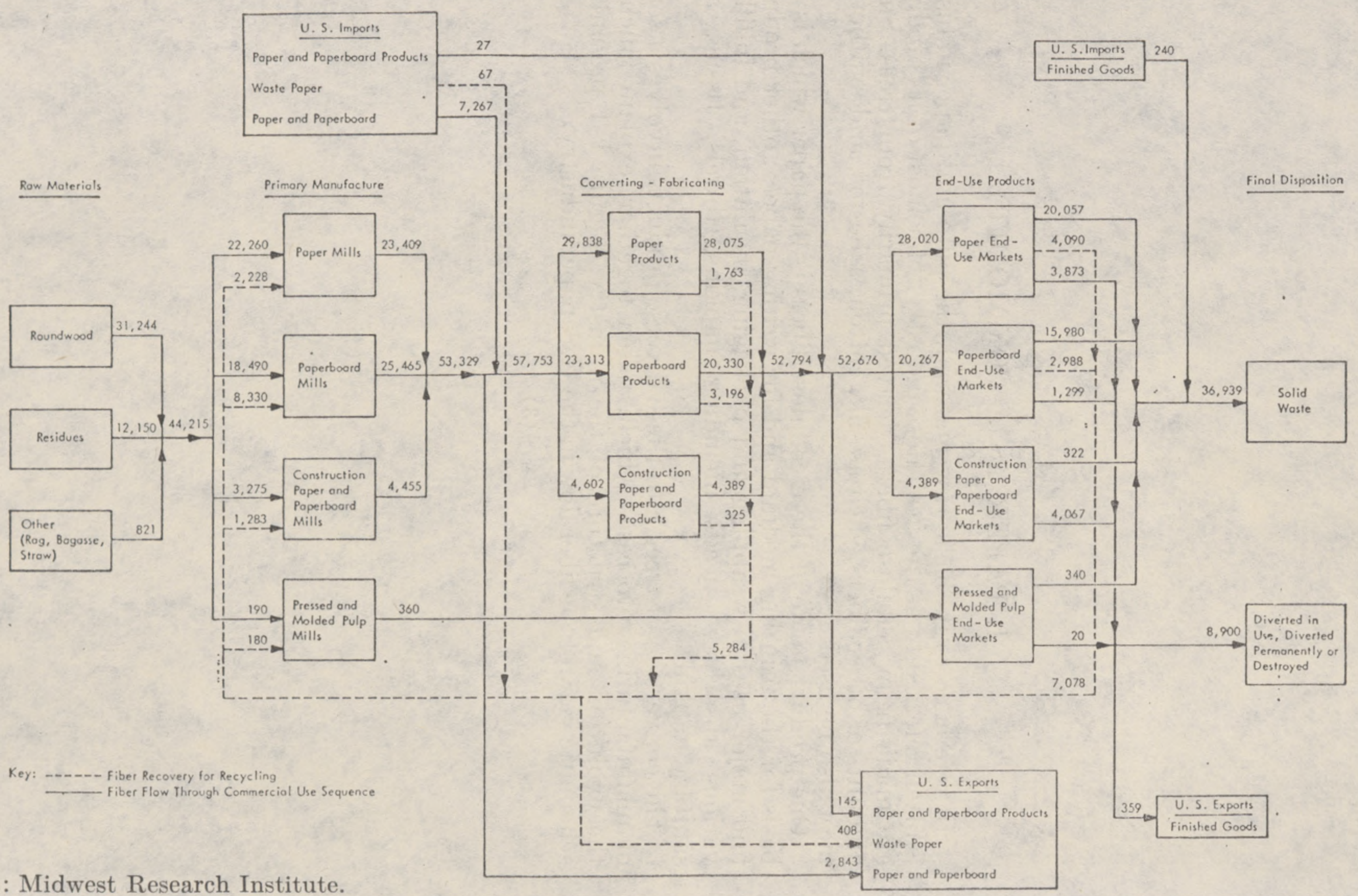
FIGURE I–1.—Fiber Flow in U.S. Paper and Paperboard Industry—1970.

(Thousand Tons)



Source: Midwest Research Institute.

A. SOURCES OF FIBER

Cellulose fibers comprises approximately 40 to 50 percent by weight of the trunks and branches of trees and of the stems of plants. The fibers, which are long and hollow like miniature pipes, are bound together by lignin. Papermaking consists of separating out the cellulose fibers, either mechanically or chemically, and then matting them into sheets.

The fiber characteristics vary considerably among species of trees and plants, and to some extent among different plants of a single species. Generally, softwood (coniferous) trees such as spruce, pine, and fir have longer fibers than hardwood (broadleafed) trees such as oak, birch, poplar, and eucalyptus. Most annual plants also have shorter fibers, such as bagasse and straw; but a few like flax have very long fibers. The long fiber is an important determinant of the strength of the ultimate paper product.

Historically, softwoods completely dominated the pulp industry. The longer fibers made pulping easier and provided the greatest flexibility in use. In 1955, for example, only approximately 10 percent of U.S. pulp was derived from hardwoods (in Japan, the figure was about 20 percent); by 1970, however, pulp derived from hardwoods had risen to 25 percent in the United States and to over half, 58 percent, in Japan. This increase in utilization of hardwood fibers has resulted from greater technological capability to pulp and make paper from hardwoods and from declining available softwood resources. Also, each cord of hardwood yields slightly more pulp than a cord of softwood. As much of the unexploited timber in the world is hardwood, especially in the tropics, increasing use of hardwoods as a source of pulp can be expected.

A number of plants beside trees can be and have been used in paper making. Bamboo, bagasse (sugar cane refuse), straw, reeds, and grasses have all been used in economic pulp and paper mills, and in 1969, about six percent of world pulp production was based on these materials. This low proportion results from difficulties in managing crops and from marginal economic success; most of these mills are located in areas of very limited forest resources. Nevertheless considerable research is being conducted on species which could be regularly cropped for fibers for pulping.

Besides the use of virgin fibers, paper products can also be made by repulping waste and used paper. Today, the U.S. recycles over 20 percent of its waste paper. Recycling varies considerably from country to country, ranging from low rates of 10–20 percent to high rates of over 40 percent.

B. PULPING

Pulping is the process of separating the plant fibers. Basically, there are two methods of manufacturing pulp: mechanical and chemical.

Mechanical pulp, or groundwood pulp, as it is also called, is produced by grinding or abrading wood so the fibers are separated by physical force. Whole logs can be ground or more recently, chips may be used. Also, chemicals can be used to soften the wood before grinding, a process called chemi-mechanical pulping. The mechanical process is much cheaper than chemical processes, both in initial investment and in operation; and it is more efficient in that virtually all of the wood is

converted to pulp. But the mechanical action is more destructive of the cellulose fibers, so groundwood pulp cannot be used where high strength is necessary; and as the lignin is not removed, it does not retain its brightness or strength for long. Newsprint is a major use of groundwood pulp. About one quarter of the world pulp production is groundwood, but only 10 percent in the United States, largely because the bulk of U.S. newsprint is imported. Mechanical pulping is energy intensive, and will therefore be sensitive to supplies and costs of energy.

Chemical pulps are produced by cutting the plant material into "chips," and then "cooking" the chips in a chemical solution to dissolve the binding lignin and thus to separate the cellulose fibers with minimal degradation. For any given raw fiber type, chemical pulp will yield a stronger paper than a groundwood pulp; but losses of wood are much higher, 50 percent or more, as the non-cellulose constituents of the wood are dissolved out.

Chemical pulping originated in the mid 19th-Century. Several methods have been developed and are in use, but the most important is the "kraft" process (with variations known as the sulphate, alkaline, or soda process); about half of the world's virgin wood pulp is being produced by this method. Virtually any plant fiber can be pulped by this process with minimal degradation and most hardwoods are pulped by this method. In the process an alkaline cooking liquor is used, and the chemicals employed are reclaimed and reused, reducing pollution problems and increasing economy. Moreover, a kraft mill can be designed to be highly energy self-sufficient, by burning spent pulping liquor and wood wastes such as bark.

The second major chemical pulp is produced by the sulphite process. In this process, wood chips are cooked in a solution containing calcium, magnesium, or ammonium bisulphite and an excess of sulphur dioxide, under pressure and at high temperatures. This is an older process than kraft pulping, and long involved problems of corrosion and disposal of wastes. Also, the early types of sulphite pulping could only utilize certain softwoods. Recent engineering, however, has improved the process to where more plant species can be used and chemicals can be recovered.

These basic pulping processes can also be combined in various ways with each other or with specialized processes to obtain special pulps. For example, there are several techniques for combining chemical and mechanical processes in ways to trade off more favorably fiber preservation and costs. Specialty high quality pulps, called alpha and dissolving grade pulps, are made by modifications of the sulphite or kraft processes. Use of unusual plant species also may require special pulping processes.

Pulp contains various impurities, lumps, and discoloring materials, and the pulp is washed and screened and, if intended for use in white papers, is bleached both to remove discoloring compounds and to change residual colored matter to stable colorless forms, Bleaching is typically a multistage process; chlorine is usually employed in bleaching chemical pulps while hydrogen peroxide or sodium peroxide is employed in bleaching mechanical pulps. Zinc or sodium hydrosulphite may also be used to whiten mechanical pulps. The capital investment for bleaching equipment and the costs of bleaching chemicals are high. In addition, bleaching results in a loss of yield of up to 10 percent.

TABLE I–2A.—*Pulp yield per cord of roundwood*

Pulp type:	*Tons (approximate)*
All pulp	0. 6
Mechanical and chemimechanical	1. 0
Kraft (sulphate):	
Unbleached	. 5
Bleached	. 4
Sulphite	. 4

Sources: U.N., Food and Agriculture Organization of the United Nations; U.S. Forest Service.

TABLE I–2B.—*Pulp yield per ton of wastepaper*

Pulp:	*Tons (approximate)*
Not deinked	0. 9
Deinked and bleached	. 7

Source: National Commission on Materials Policy.

While technological changes have slightly increased pulp yields from wood, other changes have offset the gains. The shift to the kraft (sulphate) and semichemical processes increased yields somewhat, and also permitted exploitation of hardwoods, which yield more pulp per cord than softwoods. But increased proportions of bleached pulps have cancelled these gains. Thus today's yield of 1 ton of pulp per 1.6 cords of wood is virtually identical to the yield in 1920. Some experts project future gains, however, and the U.S. Forest Service study of timber demand in the year 2000 projects a yield of 1 ton of pulp per 1.5 cords of wood. (See Table I–2.)

For recycled wastepaper, homescrap can be repulped with little loss of quality, except that the process generally breaks some fibers and thus results in some loss of strength. Post-consumption waste paper recycling involves additional problems of removing contaminants and of deinking, processes which may result in further reduction in quality. In addition, while recycling without deinking can be accomplished with little loss (1 ton of pulp per 1.1 tons of wastepaper) deinking results in a considerable loss (1 ton of pulp paper per 1.4 tons of wastepaper), plus causing pollution problems. Nevertheless, recycled paper is perfectly usable for many purposes; and repulped material can also be mixed with virgin pulps to extend supplies of the latter, although usually virgin fibers and secondary fibers are handled at different mills.

C. MANUFACTURING PAPERS

The manufacture of paper involves three stages: preparation of stock, actual papermaking, and finishing.

The pulp is first prepared for the paper machines by mechanical processes which beat and/or refine the fibers. These processes are designed to brush out clusters of fibers and to cut them to uniform lengths, and to fray the cellulose fiber walls, so they will felt better, and thus strengthen the paper. Next, chemicals are added to the pulp to obtain desired characteristics. These chemical additions may include aluminum sulphate and certain resins to give resistance to water penetration and add wet strength; fillers to enhance opacity and brightness; pigments or dyes; and deflocculants to reduce fiber agglomeration. Other additives affect strength, absorbency, and softness.

Paper machines convert the prepared pulp "stock" into paper. The most common paper machine is the Fourdrinier machine, invented in 1799. At one end, the cellulose fibers in a water suspension—1

part pulp to 200 parts water—are fed onto a continuously moving wire belt. Much of the water drains through the wire, leaving a mat of fibers which forms a fragile sheet still 80 percent moisture. This sheet is passed through a press section, where more water is squeezed out, until the moisture is reduced to 35 to 45 percent and the sheet is strong enough to be self-supporting. The pressed sheet is then passed through a series of steam-heated drying cylinders, finally reducing the moisture to 4 to 10 percent. Upon leaving the driers, the sheet passes through a "calendar" section which smooths the paper and imparts the desired finish.

While the basic process is the same for making any paper, certain parts of the machine may be modified for special purposes. The cylindrical machine differs by forming the paper web as a wire cylinder rotates in a vat of water suspended pulp. Much slower than Fourdrinier machines, cylindrical machines are especially used in processing waste-paper. Light papers are commonly dried on a single "Yankee" drier. For very thick insulating-type paper products, both Fourdrinier and cylindrical machines are used.

Paper machines are generally more economic the bigger they are. The most modern Fourdrinier machines fabricate paper over 30 feet wide at speeds in excess of 2,500 feet per minute. A machine this size can produce over 1,000 tons of paper per day and depending on the region, can consume the wood from a quarter of a million acres of timberland per year. Such a machine takes two to three years to build and bring on stream, so decisions to expand involve both sizable additions to capacity and expectations of demand three or more years in the future.

Several kinds of paper, such as newsprint, much book and magazine paper, and wrapping type papers, are normally shipped in the rolls directly off the paper machine. Other papers are given special treatment, for example to improve the finish or to coat the papers for fine printing. "Converted papers" are those finished products which require a further manufacturing process before completion; they include sanitary papers, paper bags, shipping sacks, boxes, shipping containers, packaging accessories, games, toys, novelties, office supplies, and composite cans.

D. PAPER PRODUCTS

The paper industry produces two basic categories of products: (1) Paper grades, including converted papers, account for printing and fine papers, newsprint, packaging and industrial converted papers, and tissue and sanitary papers. These grades accounted for 43 percent of 1973 U.S. paper production.

(2) Paperboard, defined as sheets $\geq$0.009 inch thick, is the basic intermediate material of the packaging industry. It includes containerboard, made of two sheets of "linerboard" sandwiching a layer of "corrugating" material to make the omnipresent corrugated cardboard box; and boxboard, used to make folding cartons, milk cartons, and food service containers. Paperboard accounted for 53 percent of U.S. 1973 paper production.

The remaining 6 percent of paper production was for specialized and miscellaneous materials, including wet machine board and heavy papers for construction and insulation board.

Although consumption of papers and of paperboards have both grown more rapidly than population, paperboard has grown faster, as paper packaging has penetrated more and more markets. Paper packing has replaced wood and textiles in many instances; and in addition many goods are now sold in individual wrappers. Faced with competition from plastics and other materials in packaging, the industry has introduced innovative films, laminations, and lock structures.

Each grade of paper demands particular characteristics, which are met by the kind of raw fiber, the pulping method, and the additives used. Cultural papers—printing and writing papers—demand opacity, smoothness, evenness, and inking characteristics required by printers. For paperboard, used primarily in the packaging industry, strength is usually of major concern.

II. INDUSTRY STRUCTURE

A. INTEGRATION

The recent development of the paper industry has been marked by trends toward integration into the total forest products industry and toward integration into finished paper products.

1. *Horizontal integration.* Horizontal integration within the forest products industry has become particularly important since World War II. This development is based on the multiple use of the basic raw material—timber—to produce a variety of end products: lumber, veneer and plywood, particle board, fiberboard, pulp, and fuel. (See Figure II–1.) The production of pulp in an integrated mill is very significant, for forest byproducts, including defective logs, small trees, limbs, wastes, chips, and even sawdust can be pulped; the development of these sources for pulp is one of the major trends of the past several years. Horizontal integration has been most prevalent in developed countries since it usually requires large scale operation.

FIGURE II–1.—HORIZONTAL INTEGRATION OF THE FOREST PRODUCTS INDUSTRY

Industrial timber pressure	Products [1]					
	Lumber	Veneer	Particle board	Fiber-board	Pulp	Fuel
Saw logs	[2]		[3]	[3]	[3]	[3]
Veneer logs		[2]	[3]	[3]	[3]	[3]
Small dimensional industrial roundwood			[2]	[2]	[2]	[3]
Forest residuals			[2]	[2]	[2]	[3]

[1] Chemical byproducts may include resin, turpentine, yeast, alcohol, etc.
[2] Principal fiber utilization.
[3] Utilization of residuals resulting in the process.

Source: Food and Agriculture Organization of the United Nations.

A major consequence of horizontal integration has been a geographical shift in the locus of the industry, away from metropolitan areas towards forested regions. The paper industry had its principal beginning in the northeastern section of the U.S., and spread to the midwestern and then to the northwestern sections of the country. The most recent and extensive migration of the industry has been to the Southern sector of the U.S. where the major remaining forest reserves are located. The South now produces over 60 percent of the Nation's pulp and paper. The Southern industry had its beginnings in the 1930's with the development of the Kraft pulping process which could utilize the area's tree species more efficiently, but it was not until the 1970's that harvesting of timber increased sharply in the South, when its potential supplies of many forest products, including timber and plywood, where required to meet the Nation's needs.

Shipping paper from mills located near forests to metropolitan areas is a major cost that has been growing as a result of this trend. The paper industry is the single largest user of freight cars in the U.S.

Freight rates have been rising and are expected to continue rising in the future, so shipping costs will probably be increasing for the industry. The location of mills away from cities also has been an adverse factor affecting the paper recycling industry, because of the expense to ship waste paper from urban areas to mills for recycling and then to reship it back to consumers. It also appears that freight rates discriminate against shipping waste paper. Most new waste paper mills are therefore locating near metropolitan areas.

The diversification of the paper industry into the forest products industry is also involving it in new real estate and land activities. Some companies are actively developing mineral and oil deposits on their lands; other are engaged in recreational developments.

FIGURE II–2

Vertical integration of the forest products industry

Industrial timber resource
↓
Paper grade pulp
↓
Paper and paperboard
↓
Converted products (.e.g., bags, sacks, boxes, books, envelopes)

Source: Food and Agriculture Organization of the United Nations.

2. *Vertical integration.*[1] The second major trend in the paper industry is towards vertical integration, or combining the processes of growing trees, harvesting, pulping, making paper, and converting raw paper into finished products such as tissue, bags, boxes, etc. (See Figure II–2.) Ninety percent of woodpulp is consumed "captively" by its producing firm. But vertical integration has not yet led to monopolistic-type concentration. While in 1970 the top four U.S. paper producers (International Paper, St. Regis Paper, Scott Paper, and Kimberly-Clark) accounted for 48 percent of pulp shipments, they only accounted for 26 percent of paper sales. There are some 400 primary producers and an estimated 3,000 "converters". No one company can act as a price leader. Except for some specialty papers, each producer's product is like any other's in that grade, so buyers can shop around. Integration is not only confined to actual papermaking: three of the major U.S. newsprint producers are directly affiliated with newspaper publishers, and firms such as Proctor and Gamble operate paper plants to facilitate production of their vast array of products.

B. MILL CHARACTERISTICS

The U.S. pulp and paper industry (excluding independent converting operations) consists of approximately 450 companies operating about 673 manufacturing establishments [1971]. Of these 673, about 120 are in New England, 133 in the Middle Atlantic region, 156 in the East North Central region, 21 in the West North Central section, 69 in the South Atlantic area, 46 in the East South Central region, 44 in the West South Central region, and 84 in the West. Mill size varies considerably, with the new mills generally the largest and almost always integrated. For kraft pulp mills, the average size is about 750 tons per day, with the largest mills about 1700 tons per day; for

sulfite pulp mills the average is about 150 tons per day; and for de-ink pulp mills the average is less than 100 tons per day. In paper manufacturing, mills producing commodity products such as newsprint and groundwood printing papers average about 300 to 500 tons per day, but many modern mills produce from 1000 to 1500 tons per day. For coated papers, uncoated book, and fine papers, mill size ranges from about 100 to 1100 tons per day. For production of tissue, mills produce from about 100 to 650 tons per day. For unbleached kraft papers, mill size ranges up to about 1700 tons per day. For linerboard, mills range in size from about 400 to 1650 tons per day. The wide range in size is symptomatic of the fact that many mills in the U.S. are economically marginal: for the average is pulled down by considerable numbers of small, old mills, mostly non-integrated and many using obsolete technologies. A 1971 survey by Arthur D. Little rated 46 percent of all U.S. paper and paperboard mills economically marginal; but as these were generally small units, they represented only 18 percent of total U.S. capacity. Most of these economically marginal mills were located in the old center of the industry—New England and the Middle Atlantic and East North Central regions.

The trends in the industry towards integration and increasing size have been combined with other types of modernization. According to Standard and Poor's 1974 basic analysis of the paper industry, computerization of mills has been a major contributor to a 20 percent increase in worker productivity over the past 5 years. This increase has helped offset the 31 percent increase in labor costs over the same period. From 1972 to 1973 there was a 3 percent increase in the number of persons employed in the paper and allied products industry, making the total 718,000 for 1973. The total paper industry payroll reached a record $6.6 billion (an increase of 8.3 percent over the previous year). The cost of labor comprises about 30 percent of total costs. The average hourly earning is $4.19, and recent wage settlements have been in the 8–10 percent range annually and are settled on a mill or plant basis. The major area of labor concern now is in the harvesting of forest products, but mechanization is occurring rapidly and will help hold down labor costs and alleviate manpower shortages.

C. NEWSPRINT—A SPECIAL CASE

In considering the U.S. paper industry, newsprint is a special case, for it is the only paper product the U.S. imports in substantial quantities—nearly 70 percent of domestic consumption comes from Canada. However, U.S. and Canadian newsprint production are closely tied, with U.S. firms owning 33 percent of Canadian newsprint capacity while Canadian firms participate with investments in 26 percent of U.S. newsprint capacity.

III. RAW MATERIALS SUPPLY

The availability of the fibrous raw materials, other necessary chemicals, and energy required to produce paper are important considerations in evaluating possible paper shortages. The most critical raw material is of course woodpulp, but projected levels of demand for fibrous materials shows increasing reliance on recycling. (See Fig. III–1.)

A. SUPPLIES OF FIBERS

1. *Woodpulp.* In the U.S. woodpulp is at present the source of about 75 percent of the cellulose fibers used in paper products, with waste paper supplying about 23 percent and miscellaneous fibers 2 percent.

The U.S. is virtually self-sufficient in woodpulp: total productive capacity has held at slightly greater than consumption, though actual production has fallen slightly short of consumption most years.[1] In 1973 the U.S. imported just under 4 million tons of woodpulp, while exporting 2.3 million tons, for net imports of 1.7 million tons or 3.4 percent of domestic consumption. At the same time, the U.S. is a net exporter of pulpwood. Much of this import/export activity reflects regional supply variations, with exports particularly significant from the West Coast and imports mainly into the Northeast from Canada.

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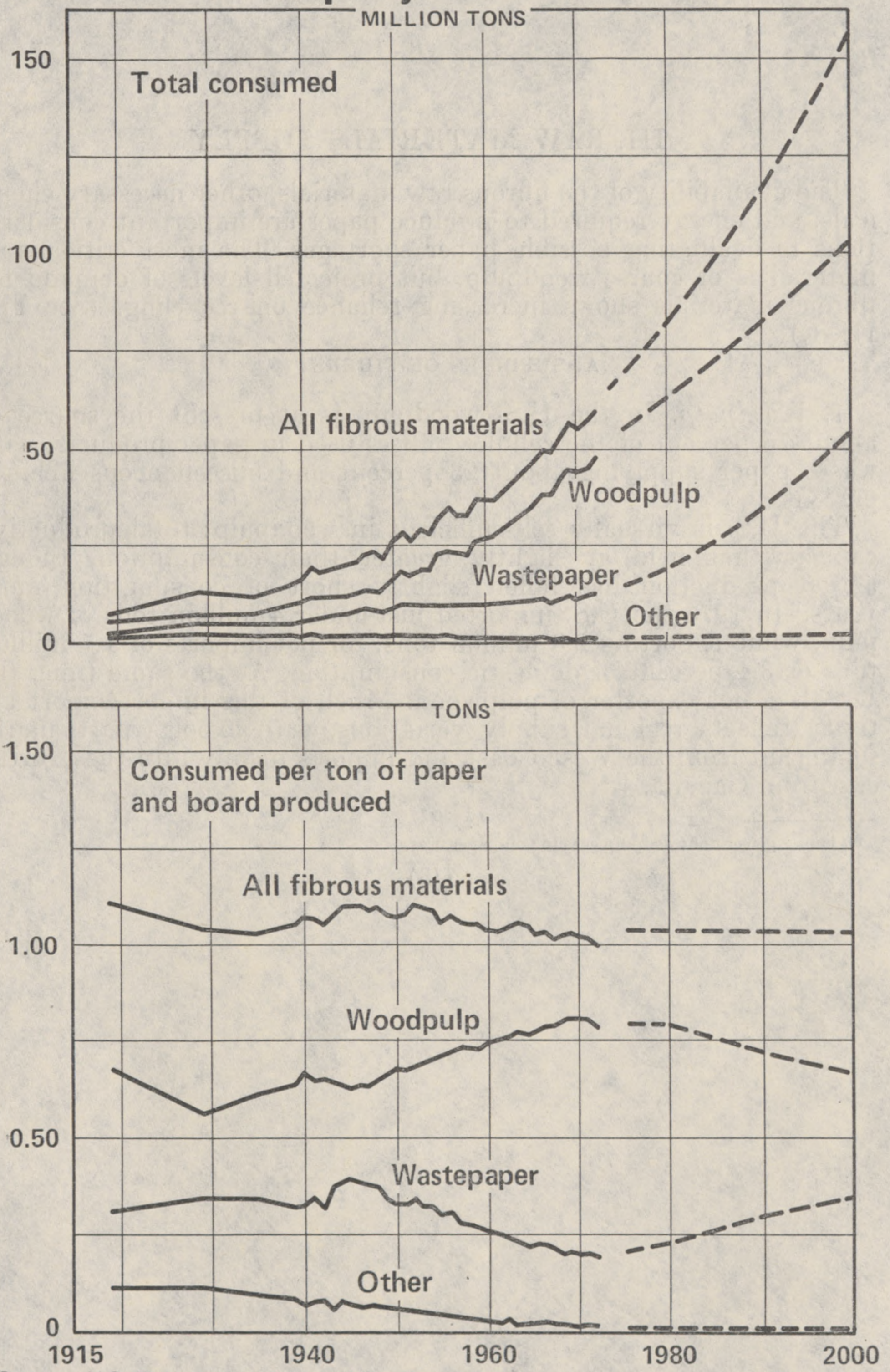
[1] About 2 percent of woodpulp goes to non-paper uses.

FIGURE III–1

Fibrous materials consumed in the manufacture of paper and board, 1920-72 with projections to 2000

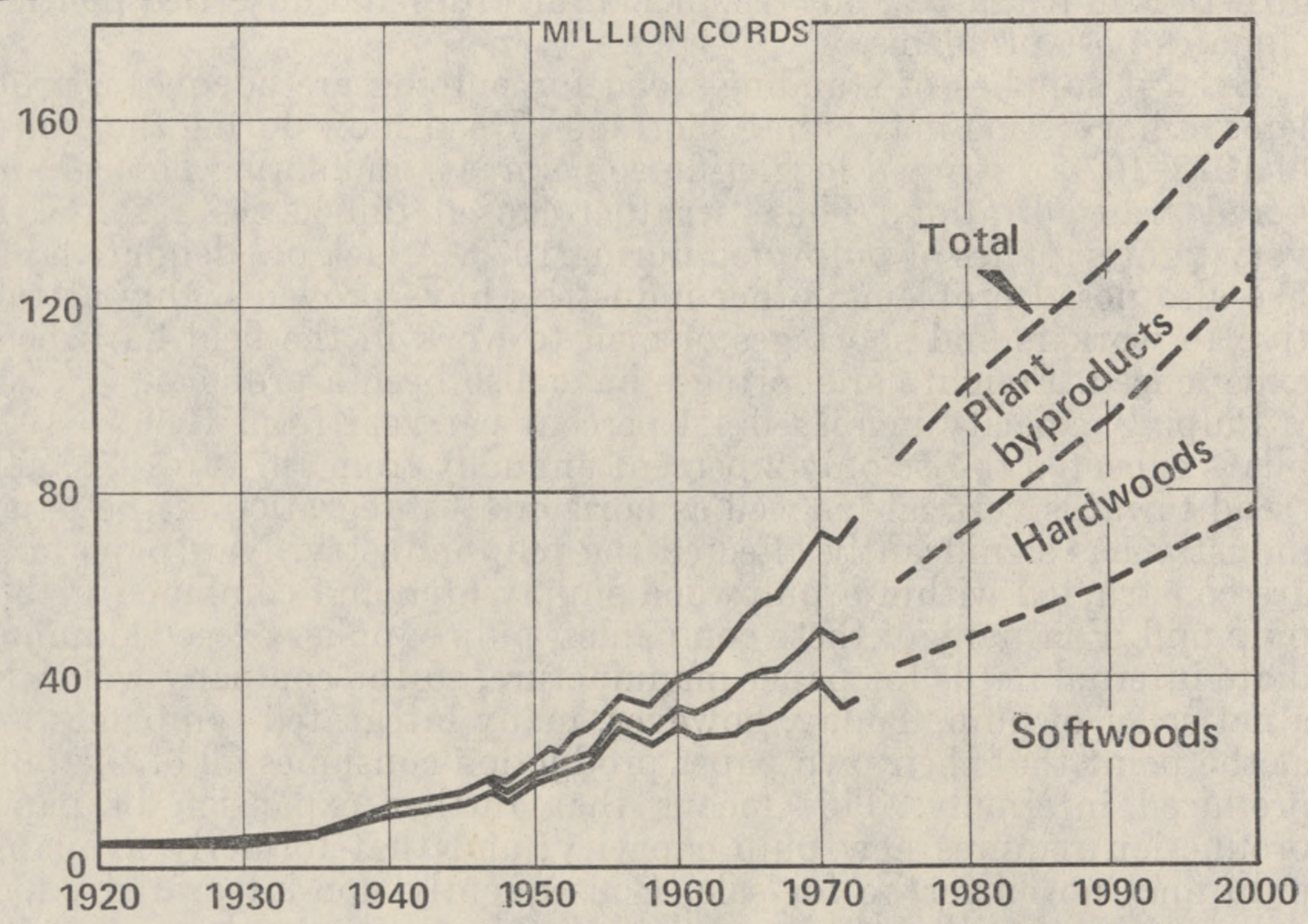


Source: U.S. Department of Agriculture Forest Service

The ability to produce adequate pulp depends on the availability of wood, on the ability to harvest the wood, and on the capacity to pulp it. Because small or damaged trees, wastes, and sawdust can be pulped, the supply picture for pulpwood is fairly bright. (For figures on the paper industry's use of wood see Figure III–2.) In recent

FIGURE III–2

Pulpwood production, by source of material, 1920-72, with projections to 2000



Source: U.S. Department of Agriculture Forest Service

years, much of the increase in pulp has been achieved by expanding utilization of plant byproducts—logging residues, wood scrap, sawdust—in contrast to use of "roundwood" or sections of tree trunks. From 1960 to 1972, the proportion of wood pulp made from plant byproducts rose from 16.3 percent to 34.5 percent. The rate of expansion of this source will probably slow, however, as the most usable sources of byproducts have been tapped; future increases in pulp production may well outstrip available sources of plant byproducts, forcing greater expansion of roundwood consumption.

As demand for the nation's (as well as the world's) timber supplies is rising rapidly and as all wood users compete to some extent—particularly for roundwood—sources of wood loom as a possible constraint on future growth of the paper industry, and certainly as a factor in higher costs (pulp chips represent about 30 percent of the manufacturing costs of a bleached sulphate pulp mill [1970]).

Each company's future costs of pulpwood will be significantly affected by its ability to supply its own requirements internally. Companies with large timber holdings and advanced timber management practices will be relatively secure. Ownership of timberlands also confers certain tax benefits to companies, as well as providing appreciating values (timberland values have increased tenfold in the past 25 years). Improved management practices together with new techniques for utilizing larger proportions of the tree formerly wasted represent major chances for increasing pulp supply; in some regions good management can double or more the productive capacity of the land. However, costs and the limited extent of untapped sources of domestic timber are leading some companies to expand outside of the U.S. and Canada, mainly to the tropical regions where plant growth is much faster; but technical difficulties and unsettled political climates pose problems.

Even if supplies of standing wood for pulping are adequate, problems of harvesting may create shortages. Deep snow during the winter of 1972–1973 restricted logging in some areas, and spring floods hampered transportation. These weather-caused difficulties resulted in very tight supplies of pulpwood during 1973. A lack of adequate labor has also posed problems; other industries have proved highly attractive to workers and shortages of men to work in the field have been experienced. Freight car shortages have also been a problem.

Pulping capacity increased 4.4 percent per year from 1956 to 1973 but is expected to rise only 2 percent annually from 1974 to 1976. The trend towards vertical (as well as horizontal) integration of the paper industry has significantly affected the pulp industry. New papermills are constructed within a pulpwood supply area and combined with a pulp mill. For many of these companies, pulp supplies exceeded immediate internal needs for paper manufacture, so the company would be a net seller of pulp. Today, however, many integrated companies are at the point that their own paper production consumes all of the pulp produced internally. This means that further expansion of paper production requires new pulp capacity; and that formerly available pulp may no longer be for sale. Consequently non-integrated paper mills are faced with tighter supplies of pulp on the market, and with higher prices: the August 1974 price index was 251.9 (1967=100) for the wood pulp subgroup. (See Table III–1.)

TABLE III–1. — WHOLESALE PRICE INDEXES FOR WOODPULP AND WASTEPAPER

[Index 1967=100]

	1967	1968	1969	1970	1971	1972	1973	1974 January	February	March	April	May	June	July	August
Woodpulp	100	100.0	100.0	109.6	112.0	111.5	128.3	150.0	150.0	177.7	196.8	200.4	205.7	247.2	251.9
Wastepaper	100	130.0	138.7	125.0	111.9	133.6	197.4	314.2	330.4	336.8	328.7	284.9	294.8	270.6	261.2

Source: U.S. Bureau of Labor Statistics, Department of Commerce.

It is expected that enough Canadian pulp will be available to fill out U.S. demand. Until recently however, the U.S. Tariff Commission was standing by a ruling of the Secretary of the Treasury that bleached hardwood kraft pulp imported from Canada would be "dumping." This meant that an extra duty was assessed against importers of the goods. In August, 33 U.S. pulp manufacturers petitioned to have the dumping decision revoked and said that pulp shortages have caused downtime. They also said that Canadian pulp would be needed not only in the short-term, but also for the longer term future. On September 23, the Tariff Commission reversed itself in an unprecedented decision, and no duties will be levied on this type of pulp after September 27.

With respect to wood pulp, then, the outlook is for: higher prices and tighter supplies, with the brunt being felt primarily by the non-integrated mills and secondarily by companies with limited timber land.

2. *Wastepaper.* The market for wastepaper tends to follow the market for pulp. In the United States, paper recycling fell gradually from over 37 percent at the end of World War II to about 18 percent in 1968,[1] when the proportion recycled stabilized for several years. When demand for paper and pulp increased sharply in 1972 and 1973, so too did the demand for wastepaper, with about 22 percent of total pulp consumption derived from wastepaper in 1973. This rise in demand has been international as well, and exports from the U.S. rose from 252.7 thousand tons in 1968 to 683.4 thousand tons in 1973, which was, however, less than 5 percent of total domestic wastepaper supply.

A large proportion of home scrap has always been recycled: it is clean, of uniform quality, and concentrated in one locale; much of the recent growth in recycling has been increased recycling of post-consumption scrap. In the past, it was claimed that the possibility of recycling post-consumption wastes was limited for several critical reasons: that the industry has vertically integrated on a forest products base; that the location of paper mills near forests increased freight distances and costs; that freight rates were discriminatory; that quality was inferior because of mixing and contamination; and that deinking was too expensive. Today, however, demand has pushed many of these problems into the background, and many dealers report they will purchase any waste paper on the market. The National Academy of Sciences in 1970 suggested an industry goal of 35 percent recycling, but a more recent Midwest Research Institute report projected 26 percent recycling by 1985 is more plausible. The future importance of recycling can be seen in Figure III–1. Prices have risen along with demand: the 1973 price index was 197.4 (1967=100) for the waste paper subgroup, and hit 336.8 in March 1974, before declining.

B. OTHER MATERIALS

While no one chemical is crucial to the paper industry in the way pulp is, shortages and cost increases have had an impact. Caustic soda, chlorine and related products, soda ash, and titanium dioxide

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[1] There are some discrepancies between American Paper Institute and Bureau of Census figures for recycling during 1968–1972 years; the API figures are higher by up to 2 percent.

have all been in tight supply and spot shortages have occurred. In rare cases, the lack of specific chemicals has caused some downtime or rescheduling.

C. ENERGY

The pulp and paper industry is one of the largest industrial consumers of energy and currently accounts for more than 6 percent of the nation's industrial demand for energy. So far, the main impact of the "energy crisis" has been through prices: fuel comprises 6–8 percent of a mills' operating costs, and fuel costs are expected to double.

Mills in the various regions tend to depend on different fuels. Northeast mills are heavy users of fuel oil, much of which is imported, but no serious shortages have been experienced. Southern mills—where two-thirds of pulp capacity is located—depend heavily on natural gas and some downtime has been incurred. This winter the natural gas shortage is estimated at 10 percent of total demand, a shortfall which will undoubtedly cause more downtime.

Fortunately, the industry supplies over a third of its own energy needs internally, by burning bark (5 percent) and spent pulping liquors (32 percent). The level of internal energy supply varies widely from company to company, however, with a number of large ones achieving over 50 percent self-sufficiency (for example, Weyerhauser supplies 65 percent of its energy needs internally). In addition, it has been estimated that further savings of 7 percent is a reasonable one-year goal, with additional savings reachable.

D. SUMMARY

The pulp and paper industry has been inconvienced by the energy and raw materials shortages of the past year, but these have not yet caused significant disruptions in production. (Strikes against Canadian newsprint mills in 1973 had a much greater impact on supply.) But future natural gas shortages and tight supplies of pulp may cause some downtime and may contribute to conservative decisions on expanding plant capacity. Expansion in the face of tight supplies is made more difficult, too, because the paper industry has become so large that added increments of expansion result in proportionately much greater demands for raw materials than was the case just a few years ago.

It is also possible, however, that significant energy and material shortages may so dampen economic growth as to ease the demand for paper, which tends to be highly correlated with the state of the economy.

IV. CAPACITY FOR MAKING PAPER

A. HISTORICAL TRENDS

Historically, capacity has been the key determinant of the paper industry's economic health, which has been typified by cycles of tight capacity and high profits followed by expansion, overcapacity, and low profits. The U.S. Department of Commerce's "U.S. Industrial Outlook for 1973" summarized the process as follows:

> An industry-wide decision to invest in new plants at the same time brings overcapacity, price cutting, and vanishing profits. Growth of the economy asborbs the new production, then outruns it. Prices rise, profit margins widen, several companies invest in new plant, and the cycle resumes.

Economies of scale in this capital intensive industry have contributed pressure towards cyclic expansion. To be economic, paper machines must be large (500 to 1,000 tons per day, except for specialty papers) and run at near-capacity i.e., 24 hours per day, 7 days a week. At this size, a new paper machine added significantly to total domestic production, often more than growth of demand for a company's share of the market during the period the machine was built and brought on stream. Thus a company either built and tolerated overcapacity for a time—usually at risk of price cutting and diminished profits—or did not build and risked forfeiting the opportunity to control its future share of an expanding market. The significance of this factor is diminishing, however; mill-size has stabilized and the greater total size of the industry means each addition contributes a diminishing proportion of production.

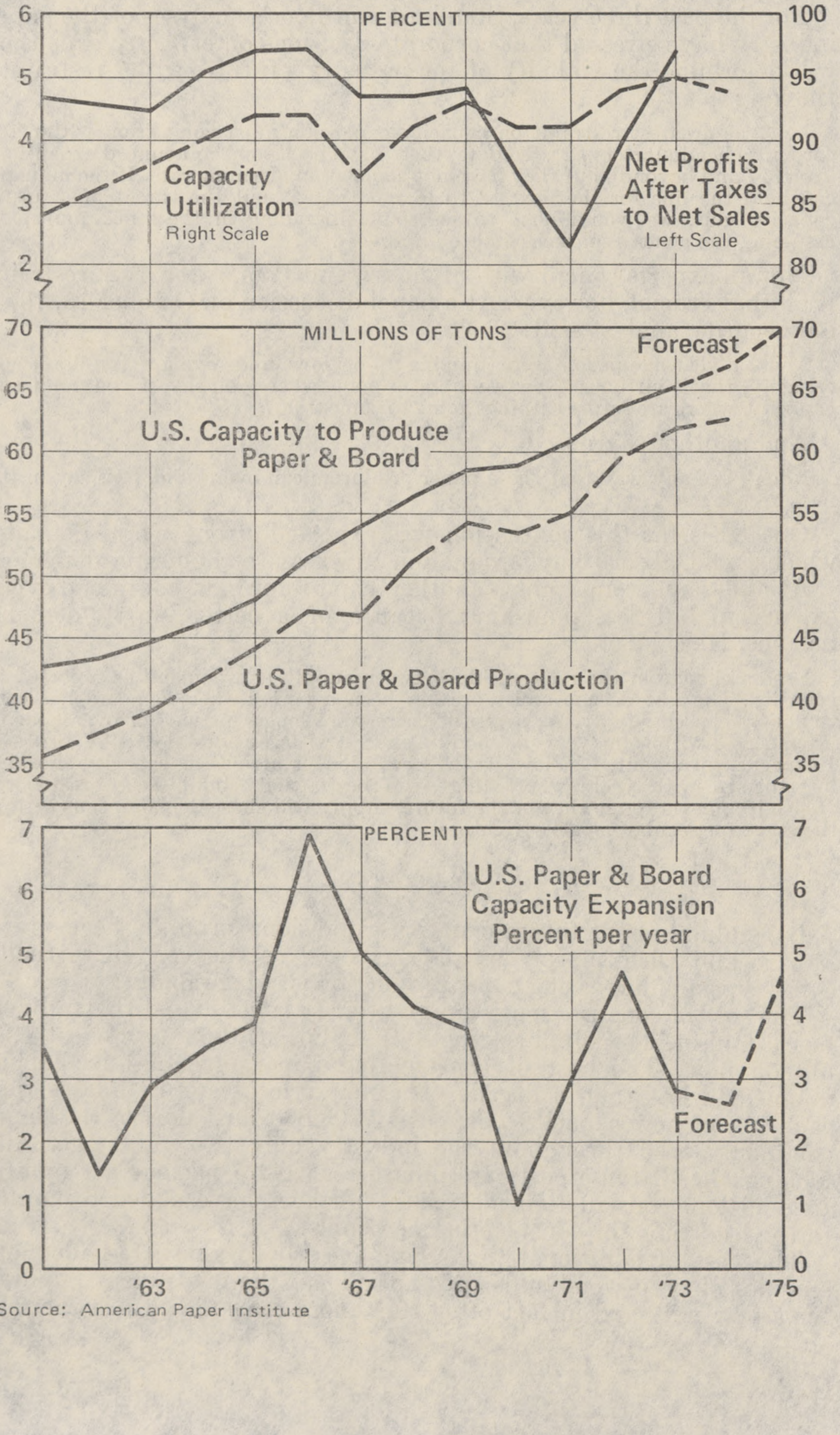
The problem of cyclic expansion has been particularly significant the last several years. The economic slowdown during 1970 and 1971 brought with it reduced demand for paper: capacity utilization slipped, prices softened, and profits dropped substantially (see Figure IV–1). A number of marginal mills shut down. As a result, investment in new capacity dropped markedly, which reduced expansion in 1973 and 1974. The drop was particularly sharp for paper (expanding only 1.4 percent in 1973). less for paperboard (expanding 2.5 percent in 1973).

But this slowed rate of expansion occurred just when a heated economy sent demand up rapidly, and for some product lines supply could not keep pace with demand. Delivery times were extended; for paperboard, for example, the days required to complete unfilled orders rose from a normal 10.8 days in 1971 to 15.2 days in 1972 and 20.9 days in 1973. Spot shortages occurred, the most significant shortage being of newsprint during the winter and spring of 1974. The immediate causes of the newsprint shortage, however, were labor strikes in Canada (which supplies 65–70 percent of U.S. consumption), first against the railroads and then against newsprint mills.

In addition, the imposition of price controls caught the industry's prices at the low levels of the 1970–1971 slowdown and held them down during the 1973 boom in demand, when costs were rising rapidly and when higher profits might have justified more investment in expansion for 1975. Since the end of price controls, prices—and profits—have increased substantially (see Figure IV–1), improving the attractiveness of future expansion.

FIGURE IV–1

U.S. Paper & Board: Capacity, Expansion, Production, Profits



Source: American Paper Institute

But the industry's roller coaster ride of the past several years has contributed to a shift in management thinking: whereas in years gone by managers in the paper industry generally concentrated on expanding capacity and production to hold or increase market shares, the key to profit is now seen as controlling capacity to ensure maintenance of higher prices.

For the past three years, Standard and Poor's analyses of the paper industry have stressed that corporate decisions on capacity expansion will determine the viability of the industry's future, with "restraint" the key:

> . . . the greatest restraint on capacity expansion must come from within the corporate headquarters . . . To date, there have been some announced expansions [for 1977 and beyond], but they have not come at an alarming rate. If the industry can hold the line for the next 12 to 18 months without the threat of a future capacity glut, we would hope to see some upgrading in the stock multiples, assuming the general market climate improves . . .

Not all experts concur with Standard and Poor's view that restraint is all that crucial, however. At a panel discussion on October 15, 1973, one security analyst said:

> About a year ago people were jumping up or down and saying if you don't add capacity, that's virtuous. Now we are at a point where you say, if you don't add capacity, where are future earnings going to come from?

And another said:

> I don't see any way that these paper producers can over build, let's say in the next decade.

One basis for this contention was expected strong world demand, which could absorb any production in excess of domestic demand.

At the same roundtable, another expert foresaw continued cyclic expansion, but less punishing because of a better supply/demand balance. He said:

> I see a change in the relationship between supply and demand as reflected in capacity. The last decade and more has been a period where demand has continuously chased supply. As a result, there were longer periods of overcapacity interspersed with some years of good balance. As I foresee the decade of 1975–85, I expect a turnabout. I believe we will have longer periods of capacity shortage interspersed with years where there will be capacity bubbles—overcapacity. Hence it appears to me that in the future, supply will chase demand, thus setting the stage for secular capacity tightness.

B. COSTS

In thinking about future capacity expansion, corporate heads must also reckon with sharply escalating costs, as the cost of virtually every aspect of increasing paper production is rising rapidly:

The cost of construction is up greatly. It is estimated that a linerboard mill in Mississippi costing $116 million in 1968 would cost $180 million now. The cost of constructing paper machines has about doubled in less than a decade. The newsprint sector estimates that each ton of new capacity now costs $200,000, just double the figure commonly used throughout the industry only two years ago. And looking ahead, these costs are inflating at 1–1.5 percent per month. In addition, construction materials shortages have added 6 months to the lead time for constructing new mills.

The cost of additional timberland needed to guarantee adequate supplies of pulp wood adds substantially to the investment required for a new mill, and in fact often runs more than the cost of the mill

itself. Generally speaking, $200 million of timberland is needed to assure an adequate amount of wood for an average $100 million mill. The price for an acre of timberland is now running between $300 and $400, up from $150 in 1965. Moreover, the availability of land in many areas is limited; and new mills would have to depend on privately owned woodlots for pulp wood.

The costs of Federal regulations are escalating rapidly, as environmental and occupational safety and health requirements must be met. Pollution control costs in particular are absorbing increasing proportions of the industry's investment capital (see Table IV–1). For 1974, environmental controls will account for about 23 percent of the industry's $2.5 billion capital expenditures. As one of the nation's largest users and polluters of water, the paper industry invested over $1 billion in water pollution controls through 1973; and new statutory requirements dictate the need for even greater levels of abatement in the future, at an estimated capital cost of over $2 billion [1972 dollars] for the industry for the 1974–1977 period. In addition, these pollution abatement programs involve heightened operating costs.

TABLE IV–1.—PULP AND PAPER INDUSTRY ENVIRONMENTAL PROTECTION CAPITAL EXPENDITURES THROUGH 1973 AND PLANNED THROUGH 1976

[In millions of dollars]

	Water	Air	Solid waste disposal from manufacturing	Total
Through 1966	213	129	10	352
1967	44	[1] 31	[1] 1	76
1968	49	[1] 43	[1] 1	93
1969	74	[1] 52	[1] 2	128
1970	120	[1] 65	[1] 2	187
1971	134	66	2.5	203
1972	205	129	5.0	339
1973	179	162	10.0	351
Total Through 1973	1,074	677	33.5	1,785
Planned 1974	237	274	12	523
Planned 1975	232	246	14	492
Planned 1976	169	133	11	313

[1] Estimated distribution. Estimate based on partial information from companies with approximately 50 percent of capacity.

Source: National Council of the Paper Industry for Air and Stream Improvement, Inc.

However, it should be noted that some of these expenditures are for requisite sanitation measures that would have to be taken in any case; moreover, about a quarter of these expenditures are for sulfite liquor recovery systems and thus represent investments in process improvements. Tax exempt bonds were employed to finance approximately one half the capital expenditures for environmental protection; also, part of the expenditures were eligible for some form of sales tax or property tax relief. Overall, for 1973 the average costs—including fixed, operating, administrative, and research costs—for environmental protection per ton of paper and paperboard produced in the industry was $6.35 (up from $3.94 reported for 1972); depending on the grade of paper, this represents from 1 or 2 percent to 7 or 8 percent of the value of the paper product.

The costs of money have been at an all-time high; and although interest rates may begin to decline soon, many companies seem unwilling to permit the proportion of their long-term debt to total capital to climb higher than the present 1 to 3 ratio.

The costs of normal operation and of equipment repair and replacement are inflating rapidly, upsetting planned outlays and depleting reserves.

Today, then, the question is, will management commit itself to investing in new capacity at a rate sufficient to keep up with expanding demand? The answer will determine how tight supplies of paper products will be over the next few years. Announced additions to domestic capacity for 1974 are 4.6 percent, somewhat above the 3 percent annual average growth in demand, but low in light of the small additions to capacity for 1972 and 1973. So far, restraint has been the keyword, both at home and in Canada.

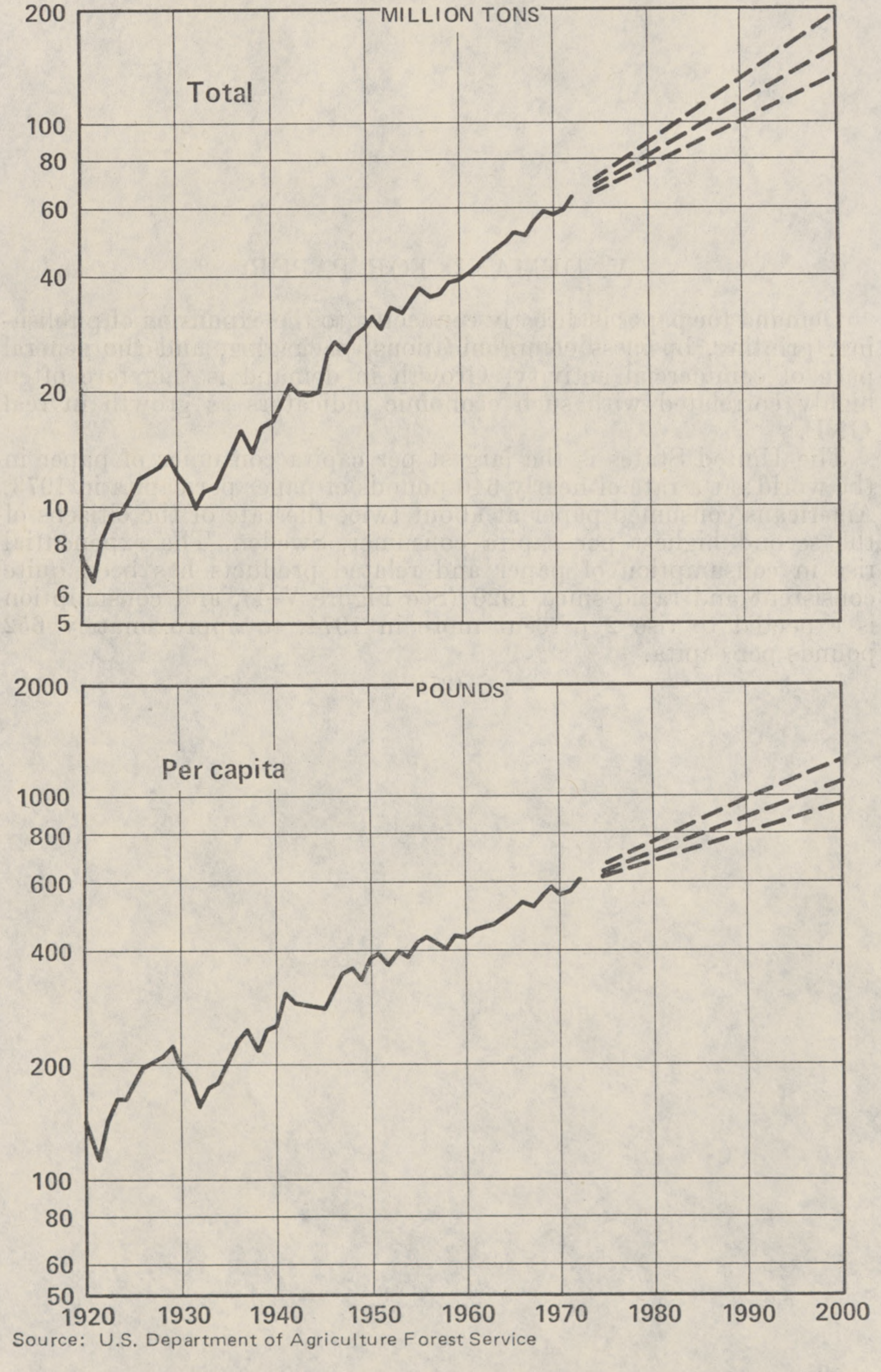
V. DEMAND FOR PAPER

Demand for paper is directly connected to the expansion of publishing, printing, business communications, packaging, and the general pace of commercial activity. Growth in demand is therefore often highly correlated with such economic indicators as growth in real GNP.

The United States is the largest per capita consumer of paper in the world: at a rate of nearly 640 pounds of paper per capita in 1973, Americans consumed paper at about twice the rate of the citizens of the second highest per capita consumer, Sweden. The exponential rise in consumption of paper and related products has been quite consistent and rapid since 1920 (See Figure V–1), and consumption is expected to rise 2 percent more in 1974, to approximately 652 pounds per capita.

FIGURE V–1

Paper and board consumption, 1920-71, with projections to 2000



Source: U.S. Department of Agriculture Forest Service

A. PROJECTING DEMAND

Expected demand is a critical factor in planning expansion of capacity, for it takes 2 to 3 years to bring a new paper mill on line. Each new mill is a very substantial investment, represents a sizable increase in total productive capacity, and must be run at near capacity to be profitable. Today's projections of demand are therefore crucial components of decisions to build new mills to supply paper in the future, and shortages will result if future demand is underestimated and expansions are inadequate; conversely, overestimates will result in gluts and diminished profits.

In simplistic terms demand was in the past commonly projected by extrapolating population increases (about 1–1.5 percent annually) and per capita consumption increases (about 3 percent annually, depending on the grade of paper and the market). And while demand fluctuated with economic conditions, long-term trends showed this to be a reasonably consistent basis for prediction. Today, however, several factors are confusing predictions of future demand. A main one is uncertainty about the economic future (even during the newsprint shortage, a few mothballed Canadian newsprint machines were not activated because of the unsettled economy and fears that a downturn would soon shut off demand).

A second unsettling factor is recognition that consumption trends cannot rise interminably and must level off some day. In July 1972, after two years when U.S. per capita consumption remained below the highest level of 1969, an editor for the trade journal *Pulp and Paper* suggested that per capita consumption had peaked, a suggestion that if true implied grave risks for extensive expansion—and in fact 1971–1972 decisions to expand were very conservative, as can be seen by the low levels of expansion in 1973 and 1974 when those decisions became effective. Nevertheless, most experts predicted the growth rate to continue. And in fact the upward trend of consumption has been resumed, and the U.S. Department of Agriculture's "The Outlook for Timber in the United States," prepared by the Forest Service and dated October 1973, projects demand to continue to rise through the year 2000, though at a somewhat slowing rate of increase. The Forest Service's high projection is that consumption in 2000 will be 1,263 pounds per capita, the medium projection is 1,114 pounds, and the low projection is 981 pounds. (See Figure V–1.)

Also adding to the difficulty of projecting future demand is rising prices. Demand for some paper products is highly inelastic for example, newsprint, toilet paper; but less so for others—wrapping papers can be partially substituted for by plastics (although supplies of plastic are tight now), packaging for some products might be reduced. It is not certain whether, or to what extent, rising prices may dampen future growth of demand, but it is another force for making conservative estimates.

On the other hand, world demand has been expected to rise at an increasing rate, which some experts maintain will solve any future problems of domestic over-capacity, as they expect production in excess of domestic demand to be absorbed on world markets. Deterioration of the world economy may render these expectations invalid, however.

An additional difficulty lies in the fact that although demand is rising for virtually all paper products, demand for some grades is rising much faster than for others. The extent to which production can be shifted among grades is limited, so the question of supply/demand relationships needs to be considered for various categories of paper products.

B. DEMAND BY PAPER GRADES

The following projections, most of them to 1980, are taken from Standard and Poor's August 15, 1974 basic analysis of the paper industry.

1. Paper

a. *Newsprint.* Almost all newsprint is consumed in newspapers, except for the small percentage used in comic books, handbills, and community newsletters. The demand for newsprint is directly tied to the number and size of newspapers, which expands and contracts with the amount of advertising. Advertising in turn is directly tied to the condition of the economy; and therefore newsprint demand increases in response to a rising economy and has reflected the sag in 1970 followed by a boom in 1973. Consumption of newsprint in 1973 was slightly under 11 million tons, and an expansion to 12 million tons is being predicted for 1975, although demand has been soft this year, with usage off 2-3 percent from 1973. By 1980 consumption is expected to rise to 14 million tons, as the number of households and education levels increase.

Demand for newsprint is presumed to be highly inelastic for there are no ready substitutes. But prices are rising very fast: the price of newsprint has gone from $160 per ton in 1972 to a posted price of $259.65 a ton beginning January 1, 1975. As a result newspaper prices have gone up. At what point circulation levels might drop is not known.

b. *Writing, printing, and communications papers.* Reading and writing activities lie behind the demand for these types of paper. Although the annual growth rate in this sector averaged just under 5 percent during the last decade, future growth is expected to slow; nevertheless, production is predicted to reach approximately 16.5 million tons by 1980, up 24 percent from 1973.

Less directly tied to the state of the economy, demand for these types of paper tends to lag behind that for the industry as a whole during recovery periods. The present expansion of demand began in late 1972 (about 6 months after initial expansion of more volatile segments), extended through 1973, and has continued in 1974.

Demand has slipped for printing and writing papers because of the failure of several major magazines. With the recent increases in postal rates, tonnage growth has also shifted from heavier to lighter grades of paper. Demand for coated paper has remained strong, with the publication of more than 2,000 trade papers by the business press. Coated paper production is expected to increase 4.4 percent per year during the remainder of the decade.

While the uncoated book paper segment of the industry has benefited from the growth in book publishing over the past 10 years, demand should rise at a slower rate the next few years because of

decreasing school enrollments. Also, foreign competition is starting to erode the U.S. market export situation. By 1980, production is expected to total 3.8 million tons, a 31 percent increase over 1972.

Writing and related papers includes those used for writing, typing, photocopying, graph paper, and mimeographing, and are of a very fine quality grade. A major increase in office copying (more than 60 billion copies a year) and other factors have resulted in an above average growth rate in recent years for this category. Growth in production is expected to be 3 percent annually, reaching 4.6 million tons by 1980, up 21 percent from 1972.

Demand for uncoated groundwood paper, which is low quality paper used in catalogs, paperbacks, and telephone directories, is slowing down but will maintain a growth rate of approximately 3.7 percent during the remaining 1970s.

The final sector in this category is bleached bristols, which are high quality cardboards used in such products as postcards, index cards and manila envelopes. Future growth is anticipated to continue at about the current 3 percent growth rate annually with production reaching 1.4 million tons by 1980.

c. *Packaging and industrial papers.* This sector of the industry, which includes bag and sack, shipping sack, special industrial paper, and others, is one of the slower-growing areas, with an annual growth rate of about 2.5 percent annually. A major reason for this slow growth has been the penetration of plastics into the market. The demand for wrapping paper and heavy duty bags was particularly hard hit. While demand is up somewhat this year and paper will become more competitive as plastic prices rise, this sector is expected to continue to have one of the lowest growth rates in the industry.

d. *Tissue and sanitary papers.* This category experienced a slight drop in shipments in 1973 and 1974 due to a shortage of fibers. Sanitary paper products account for 95 percent of this category, with tissue paper accounting for the remainder. This segment of the paper industry is the most competitive, with brand names and promotional campaigns common.

Although capacity growth since 1956 has averaged 5 percent per year, additions through 1976 will average only 2.3 percent, indicating a probable tight supply/demand relationship. Demand from foreign markets is expected to strengthen and possibly increase as standards of living rise.

2. Paperboard

Since paperboard is the most widely used intermediate material in the packaging industry, demand is strongly linked to the state of the economy. Demand rose swiftly during the economic surge of 1972, and spot shortages of wood pulp and production curtailments combined with limited capacity additions to create a tight supply/demand relationship in this sector in 1973. Total production for 1973 increased only 4.2 percent over 1972, below the average of 5 percent annual increases for the past decade; but there was considerable variation among subcategories; domestic use of containerboard was up 6.3 percent, boxboard up 5.5 percent, and other paperboard items down 2.8 percent.

a. *Containerboard,* used to produce corrugated boxes, is the fastest growing sector of the paper industry—in part because of very strong export demand. However, recent tariff reductions among European countries may depress the U.S. export market. The stability of demand for containerboard is indicated by rising prices: 42-lb. domestic linerboard rose from $145 a ton at the end of 1973 to $195 a ton after July 1, 1974; and international prices are $50–$70 a ton higher still.

Although corrugated box shipments in 1974 are expected to be only 1–2 percent above the 1973 level because of the flat economy, observers predict future growth in demand for containerboard may still run 5–6 percent annually. Even if this rate is not achieved, this sector should be among the leaders for the industry.

b. *Boxboard,* used in the form of folding cartons, is the primary component of consumer packaging. Competition from plastics has been strong and this plus market saturation has held growth rates to 1–2 percent annually in recent years. In response, the industry has attempted to improve its product by developing higher quality board that is more attractive but stronger. Competition from plastics may decrease somewhat in the future, as petrochemical shortages and price increases reduce the attractiveness of substitution, if one assumes paper prices will rise proportionately less.

Since the use of boxboard is closely tied to the consumption of many consumer products, especially food items, its demand tends to follow the economy. Demand rose strongly on the positive economy of 1973.

C. INTERCHANGEABILITY OF PAPER GRADES

To meet these variations in demand among the various grades of paper, some flexibility by consumers and producers is possible. Because of the characteristics resulting from raw fibers used and the pulping process, pulps are not completely interchangeable among grades of paper and paperboard; likewise, only certain products can be made on one paper machine. But product mixes can be shifted somewhat in response to demand and relative profitability. Often production shifts to more profitable lines results in reductions in the number and availability of some grades of paper. For example, two mills have reportedly diminished production of newsprint—which is in tight supply and experiencing rapidly rising prices—in order to shift production to more profitable grades. In another sector publishers and users of writing papers may have to turn to heavier—and more expensive—grades of printing and writing papers which are more profitable to producers and hence now more available.

D. SUBSTITUTES

Although discussed at various points elsewhere, a brief summary of the possibility of substitution in the event demand exceeds supplies of paper is appropriate here.

1. Woodpulp

As noted in Chapter III, the rising demand for woodpulp is being met more through increasing use of forest byproducts than through increasing harvesting of roundwood. Also, use of recycled post-con-

sumption waste paper is rising again, after years of decline; today, some 23 percent of waste paper is recycled, up from 18 percent a few years ago, and the level is expected to continue to rise to about 25 percent by 1980. The industry is also continuing to research the use of vegetable fibers and of plantation trees which could be harvested on a short rotation; so far, use of alternative fibers is restricted to countries where forests are limited.

2. Paper

The substitutability of many kinds of paper is quite limited, but wrapping and packaging papers are subject to strong competition, particularly from plastics. However, the recent petroleum shortage and large price rises may halt this trend as petroleum based products such as plastics become increasingly expensive.

The use of microfilm and tapes represents a potential replacement for considerable paper used in books and magazines, particularly technical and specialized documents and those intended for storage.

Certain qualities in papers might be substituted for in order to increase productivity. For example, bleaching to achieve present levels of brightness adds to costs and decreases productivity from a given quantity of woodpulp by some 10 percent. While esthetically pleasing, except for certain limited grades and uses of paper, current standards of brightness do not increase utility. If consumers were agreeable, then, production of some grades of paper could be extended by reducing brightness quality.

E. INTERNATIONAL DEMAND

The United States is active in both the import and export of paper products. In 1972 imports of paper rose 3.5 percent to total nearly 8 million tons, while exports remained nearly level at about 3 million tons. For 1973, imports rose further, to nearly 8.5 million tons, while exports held steady. (See Table I–1.) The U.S. is a net importer from Canada, a net exporter to the rest of the world. (See Table V–1.)

TABLE V–1.—U.S. PAPER AND PAPERBOARD TRADE BALANCE—1972

[In tons of 2,000 pounds]

	Trade with Canada			Trade with countries other than Canada		
	Imports	Exports	Trade balance	Imports	Exports	Trade balance
Paper	7,109,948	143,115	−6,966,833	410,124	424,264	+14,140
Newsprint	6,772,159	4,346	−6,767,813	328,377	140,540	−187,837
Printing and writing	217,211	79,340	−137,871	52,991	130,879	+77,888
Coarse	120,463	22,693	−97,770	27,510	95,255	+67,745
Tissue	2	4,062	+4,060	50	15,523	+15,473
Special industrial	113	32,674	+32,561	1,196	42,067	+40,871
Paperboard	7,657	160,816	+153,159	4,838	2,132,711	+2,127,873
Building Paper and Board	166,254	51,011	−115,243	293,681	27,825	−265,856
Total	7,283,859	354,942	−6,928,917	708,643	2,584,800	1,876,157

Source: U.S. Bureau of the Census, Department of Commerce.

Approximately 95 percent of total paper imports takes the form of newsprint imported from Canada (and small amounts of newsprint were also imported from Scandinavia). In 1973, domestic production of newsprint totaled 3.4 million tons while imports totaled 7.4 million.

As a share of total domestic paper and board production, exports declined to 5% in 1973, from 1972's figure of 5.2 percent; but actual paper and board output increased 4.7 percent over 1972 to 61.7 million tons. Total 1973 U.S. exports in pulp, paper and board amounted to $1.4 billion.

Exported paper base stocks which totaled 3.1 million tons, accounted for over half of all paper industry exports in 1973. Most of the 14.3 percent increase in 1973 is attributed to larger shipments of wastepaper which increased 65 percent. Approximately 50 percent of the total 1973 wastepaper export was shipped to Japan, Korea and Taiwan which are using it as a fiber due to the tight supply of wood pulp.

Linerboard accounts for better than 26 percent of total 1973 shipments abroad and is the largest single export item, followed by bleached sulfate pulp, most of which is shipped to the Common Market.

Europe continues as the largest foreign market for the U.S. paper industry, consuming the largest portion of the total pulp, paper and board exports. However, due to the increase in membership of the European Economic Community and accords reached with members of the European Free Trade Association, the U.S. domestic paper industry will be trading at a competitive disadvantage in the European market. These countries have agreed to gradually remove tariff barriers between them while imports from other countries, including the U.S., will be subject to duty rates ranging from 12 percent upward. At this point the degree of impact of this agreement on U.S. paper industry exports is still uncertain.

Most would say that the long term outlook for the international role of the U.S. paper industry appears to be favorable. As the less affluent nations of the world increase their living standards and domestic industrial capacity expands, paper demand will increase. The U.S. and Canada have a large percentage of the usable timber reserves and the needed technology. We can expect that the U.S. role of fulfilling growing world paper demand will increase. It is predicted that by 1980 U.S. paper and board shipments should reach between $15.5—16.0 billion and attain an annual growth rate of approximately 4.6 percent.

VI. OUTLOOK

If consumption of paper is to continue to increase, capacity must be expanded. Reviewing the speculations and forecasts of experts and observers, one finds two basic alternatives being expressed, founded on diverging views about an uncertain economic future.

First, a pessimistic view of the economy, expectations of stagnating demand, and a fear of overcapacity lead to the alternative of *restrained expansion of capacity.*

In the short term, this alternative means conservative expansion of capacity and represents the option of playing safe with existing profit rates, which are high, and not taking risks in the face of a highly unsettled future. In the longer term, expansion of capacity would be based only on very solid expectations of demand. This could lead to cyclic expansion, characterized by periods of balanced supply/demand interspersed with periods of undercapacity, tight supply, and strong prices—in short, a situation analogous to today's except that it would be a seller's market, with supply chasing demand, rather than vice versa as has been the case in the past.

Second, an optimistic view of the economy, expectations of rising demand, and a fear of losing market shares lead to the alternative of *unconstrained expansion.*

This view could imply a return to the cyclic expansions of the past, in which periods of overcapacity are interspersed with periods of balanced supply/demand—in short, a buyer's market, with demand chasing supply. But some observers feel world demand is growing so fast that overcapacity is essentially impossible, for export markets would absorb any domestic oversupply. This suggests the possibility of adequate domestic capacity, with supplies subject to foreign competition and prices tending toward international levels, now higher than domestic ones.

In summary, if demand continues to grow, these views imply generally tight supplies and higher prices—either supplies limited by conservative additions to productive capacity and prices held up; or supplies and prices determined by strong world competition.

Except for those taking a pessimistic view of the future, the present tight supply/demand relationship and high profits would seem to indicate that the time is ripe for expansion. But a number of factors discourage this: tight supplies and high prices of raw materials (Chapter III); costs of capacity expansion and fears of overcapacity (Chapter IV); uncertainty about how fast demand will grow (Chapter V); and questions about the future of the economy and about adequate rates of return on investment. Until recently, low profits (first because of the 1970–1971 slump and then because of price controls) and depressed rate of return have made investment unattractive. Now prices and profits are waxing satisfactorily, but inflated costs and high rates of return on alternative investments diminish the attractiveness of investing in paper producing capacity.

For some time, experts have contended that expansion and less tight supplies awaited only price rises to justify investment. Prices have risen sharply, especially since the end of price controls; and profits are up handsomely. Earnings, up 50 percent in 1973, are expected to climb another 35–40 percent in 1974. Moreover, total capital expenditures, up 35 percent in 1973, are expected to climb another 32 percent, to $2.5 billion, this year; of course, part of the increase in capital expenditures is absorbed by inflation and by pollution controls; furthermore, as the industry grows, each additional mill adds a smaller proportion of total capacity. Nevertheless, despite the high profits and large capital expenditures, investment in new capacity is restrained both in the U.S. and in Canada.

The example of newsprint is instructive. At the end of 1972 newsprint was selling for $163–165 per ton on the East Coast. In 1973 demand rose and two price increases occurred during the year (an unprecedented situation), bringing the price to $175–178 per ton. Shortages during late fall and winter were severe enough to cause some newspapers to miss issues or to cut pages. Industry spokesmen asserted higher prices and increased profits were necessary to justify expansion. In late September a Canadian marketer said $205 per ton was needed:

> We need a pretax profit of $30 a ton. Right now, with newsprint going for $178 a ton, we're at about $8.

By January, industry spokesmen were upping their estimate, saying that prices—then under price controls—would have to rise to $240–250 per ton before rates of return would justify adding new capacity. At the time price controls were lifted, prices were over $200 per ton and headed up; then, in September 1974, several producers announced price increases to nearly $265 per ton effective January 1975. But even though prices have passed the level at which spokesmen just months ago said would justify investment, construction of new capacity is still limited. Now spokesmen say that to justify new construction of capacity, newsprint prices will have to reach at least $300 per ton, and perhaps more in view of inflation. The president of Reed Paper Ltd. in Toronto was recently quoted as saying:

> We still make a smaller profit on newsprint than on any other paper product we produce. Recent price increases are only just keeping up with costs increases. It would take a price of $290 a ton to justify new expansion today. However, it is necessary to look into the future, and it isn't difficult to see a 20 percent cost increase during 1975. That means we could easily require $350 a ton before we could justify new capacity in 1976.

Newsprint is the extreme example, but analogous price increases appear likely for most grades of paper. (See Table VI–1.) Whether consumer demand can hold up in the face of such increases remains to be seen.

TABLE VI-2.—WHOLESALE PRICE INDEXES FOR WOODPULP, PAPER, PAPERBOARD, AND CONVERTED PRODUCTS

[Index 1967=100]

Item	1967	1968	1969	1970	1971	1972	1973	1974							
								January	February	March	April	May	June	July	August
Pulp, paper, and allied products	100	101.1	104.0	108.2	110.1	113.4	122.1	131.8	132.9	137.2	144.4	146.6	147.5	153.3	162.9
Woodpulp	100	100.0	100.0	109.6	112.0	111.5	128.3	150.0	150.0	177.7	196.8	200.4	205.7	247.2	251.9
Wastepaper	100	130.0	138.7	125.0	111.9	133.6	197.4	314.2	330.4	336.8	328.7	284.9	274.8	270.6	261.2
Paper, except newsprint	100	102.2	105.8	112.0	114.7	116.1	121.0	125.0	126.2	130.2	137.8	140.1	141.1	150.2	160.0
Newsprint	100	101.1	104.4	107.6	112.2	116.7	122.2	132.3	132.3	139.9	147.2	147.2	148.6	148.6	160.8
Paperboard	100	95.9	99.1	101.1	102.4	105.5	115.1	127.0	131.0	133.9	145.1	148.0	148.9	158.0	166.4
Construction paper and board	100	100.9	105.5	101.0	103.0	106.4	112.8	121.7	121.8	123.4	123.7	125.4	124.9	124.4	125.1
Converted products (for example, sanitary paper, bags, packaging accessories, etc.)	100	101.0	103.6	107.9	109.7	113.6	121.6	128.6	129.1	130.0	137.0	140.5	141.3	142.8	150.0

Source: U.S. Bureau of Labor Statistics, Department of Commerce.

While expansion of newsprint capacity awaits yet higher prices, return on some grades has apparently achieved a satisfactory level which, combined with anticipated demand, does justify some expansion. Additions to kraft linerboard capacity are leading the way with announced additions for 1974–1978 of 784 thousand tons, or 5.6 percent of 1973 year-end capacity. The attractiveness of investment in this sector is indicated by prices, which for 42-pound domestic linerboard rose from $145 per ton at the end of 1973 to $165 at mid-March 1974 and to $195 after July 1. Even so, domestic prices are running $50–70 per ton below world prices, so there will be strong competition for added supplies of linerboard, which is already a leading export item.

So far, then, announcements of additions to productive capacity indicate a restrained rate of growth. Overall, as of June 1974, just over 1.8 million tons of additional domestic paper productive capacity had been announced; this represents 2.8 percent over 1973 capacity, but spread over 4 years. For the same period, announced additions to domestic pulp capacity are 1.6 million tons, up 3.2 percent over 1973. (See Table VI–2.)

TABLE VI–2.—NET PULP, PAPER, AND PAPERBOARD CAPACITY INCREASES, 1974–78

Major product grade	Announced additions as of June 1974 (Tons)	Percent of addition	Percent added to 1973 capacity
Newsprint	54,000	3	1.5
Printing and writing papers	436,000	24	3.5
Tissue	164,000	9	3.7
Kraft linerboard	784,000	43	5.6
Solid bleached paperboard	167,000	9	4.2
Semichemical corrugating	210,000	12	4.8
Total	1,815,000	100	2.8
Kraft pulp	1,404,000	87	4.1
Semichemical pulp	210,000	13	5.0
Total	1,614,000	100	3.2

Source: American Paper Institute.

If demand continues to rise at rates projected in recent reports and if the number of announcements of further capacity additions does not increase over the next few months, then consumption for many grades of paper during the coming years will probably be limited by supply. But price increases and deteriorating economic signs (oil price increases are holding, unemployment is rising, demand for many goods is softening, talk of recession is reasserting itself) suggest demand for paper may not hold up, thus implying capacity will be adequate. One looks to the decline in demand for paper during 1970–1971 and to the resumption of historic growth rates during 1972–1974 and wonders which is the real portent for the future. The American Paper Institute is at present updating its capacity surveys, and the new figures will provide evidence on whether optimism or pessimism is dominating decisions about the future.

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