Tripartite meeting on social and labour issues in the pulp and paper industry
Geneva, 1992

Social and labour issues in the pulp and paper industry
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Introduction

This report has been prepared by the International Labour Office as the basis for discussions at the Tripartite Meeting on Social and Labour Issues in the Pulp and Paper Industry to be held in Geneva from 20 to 28 October 1992. This will be the ILO’s first Meeting for the sector and, indeed, the first substantial activity of the Office in this field.

The ILO Sectoral Activities Programme

The scheduling of this Meeting responds to long-standing requests from the industry, the first dating back to the early 1970s. Thanks to a reform of the ILO’s system of industrial committees and other sectoral meetings decided on in 1989, it became possible to accommodate these requests in the ILO programme of work.

The present Meeting is part of the ILO Sectoral Activities Programme. This programme aims to assist governments and employers’ and workers’ organisations to develop their capacities to deal equitably and effectively with the social and labour problems of particular economic sectors. It is also a means of alerting the ILO to specific sectoral social and labour issues. One of the principal ways of doing this is through tripartite meetings which bring together a cross-section of government, employer and worker representatives from countries that are prominent in a given sector. Over 30 industries or sectors are covered in this way, some through established committees that meet periodically and others, including pulp and paper, that are subject to ad-hoc meetings. The main outcome of these meetings is usually the adoption, by consensus, of negotiated texts; though they have no legal force, they do have a certain moral force. These are addressed to governments, highlighting international issues of labour and social policy that deserve attention at national level, and to the ILO, containing guidance for its work programme in this sector.

Topic, scope and selection of countries for the pulp and paper meeting

Since the present Meeting is the first of its kind, the ILO Governing Body decided at its 246th Session (May/June 1990) that the topic should be broad, allowing for an exchange of views on all relevant aspects. It included the Meeting in the ILO programme of work under the title: Tripartite Meeting on Social and Labour Issues in the Pulp and Paper Industry (document GB.246/10/14). The scope of the Meeting and hence of the present report, encompasses the pulp, paper and paperboard manufacturing industry as well as paper and board conversion. Where not specified otherwise, the term pulp and paper industry has been used in this report to cover both manufacturing and converting. While paper packaging is covered, other packaging and printing are not. On the upstream side, raw material procurement, i.e. pulpwod and other fibre harvesting and transport, have been excluded. These activities are dealt with elsewhere in the ILO’s Sectoral Activities Programme, namely the Forestry and Wood Industries Committee, the Committee on Work on Plantations, and the Tripartite Technical Meeting on Employment and Labour Conditions in the Rural Sector.

The 15 countries invited to send Government delegates to the Meeting are Australia, Brazil, Canada, Chile, China, Finland, France, Germany, India, Japan, Kenya, Poland, Sweden, the former Soviet Union and the United States. The 15 representatives of employers’ and of workers’ organisations who will participate in the Meeting have been chosen after consultation with the respective groups in the Governing Body of the ILO. They do not necessarily come from the foregoing 15 countries which include the countries that are major pulp and paper producers and those where the pulp and paper industry is very significant for the national economy, even if the country is not a major producer on a world scale. In addition, all geographical regions are covered. Between them, these 15 countries invited account for more than 80 per cent of world paper output and for about the same percentage of world employment in the industry as can be seen in the first section of this report, which contains economic background data and brief portraits of the 15
countries. At the same time, the countries span a wide range of different raw material sources, product mixes, quality requirements, relative importance of the paper converting industry, technology, domestic market or export orientation, levels of government involvement and labour-management relations.

In spite of being a broadly representative, albeit weighted, sample of the pulp and paper industry, reflecting all the diversity in this sector around the world, the countries exhibit a surprising degree of commonality with respect to the predominant social and labour issues. As part of the fact-finding for the present report, the Office inquired in a number of ways as regards the priority issues to be discussed. These included discussions with government, employer and worker representatives, country profiles commissioned through external collaborators, a literature review and visits to pulp and paper manufacturing and converting mills in several countries.

Organisation of the report

The Office’s inquiry into the sector shows that there are two major concerns. The first is the potential impact of growing public concern worldwide about the environment. The pulp and paper industry has found itself on the front line of the controversy in most countries. The environmental debate has a number of significant repercussions on social and labour concerns.

The second issue is much more complex. Competition in increasingly global markets forces the industry to find ways and means of improving quality and productivity. Rapid and far-reaching technological change has been a major tool in this quest, triggering in turn a cascade of changes to the structure of the industry; employment levels; work organisation; human resources development; careers; and training.

The above findings about priority social and labour issues determined the focus and the organisation of the report. Chapter 1 provides background information on economic development in the sector over the last two decades, the characteristics of the industry in the various regions and, in particular, in the 15 countries invited, and looks at the prospects for development in the medium term.

Chapter 2 identifies the major environmental problems facing the pulp and paper industry, and discusses what is being done to resolve them, as well as the social and labour dimensions of these problems and how can bipartite and tripartite initiatives help to mitigate them.

The many technological changes that have affected the sector over the last ten to 15 years are discussed in Chapter 3. Technology has had a major impact on the various production stages of the industry itself, on pulp and paper making and paper conversion, but also on downstream industries such as printing, and on competing industries. The latter part of Chapter 3 discusses the repercussions of these technological changes for the structure of the industry and analyses the twin trends of growing integration and globalisation.

Both technological and structural change have affected employment in a major way. Chapter 4 provides data about world levels of employment in the sector and analyses trends in employment in the various countries in the light of the changing relationships between industry output and productivity.

As Chapter 5 of the report argues, technological and structural change also have major implications for the nature of employment in the sector. New forms of employment are being promoted in the pulp and paper industry, and many new types of work organisation are being used.

Human resources, as a production factor, are receiving renewed attention. Chapter 6 looks at the reasons, at likely changes in the composition of the workforce, at present and future training needs and at the link between work organisation, training and careers.
Working time and remuneration, as well as occupational safety and health, are very important from a social and labour perspective. They are considered in Chapters 7 and 8. Compared with other issues confronting the pulp and paper industry at the present time, however, these aspects of work appear to be of less immediate concern.

To our knowledge there is no comparable overview of social and labour issues in the pulp and paper industries. Throughout the report, therefore, an effort has been made to provide extensive documentation and to illustrate the developments observed.

A summary highlighting the main points emerging in each chapter is provided at the end. It concludes with a list of suggested points for discussion which constitutes the proposed agenda for the Meeting.

Acknowledgement

Numerous organisations in the industry, trade unions, government offices and individuals have contributed to the preparation of this report. The International Labour Office takes this opportunity to thank all of them for their invaluable inputs and support. Without them it would have been impossible to complete task.
1. Development and status of the pulp and paper industry

1.1. Significance and evolution of the industry

1.1.1. Significance of the industry

The manufacture of pulp and paper and their conversion into useful products rank among the largest of the world's industries. Pulp and paper mills are found in 90 countries; if conversion is included, the figure runs to well over 100. Every country is a consumer. Paper's importance in a national economy is universally regarded as a measure of economic development. (PPI, July 1991).

Worldwide, an estimated 3.5 million persons (see section 4) are directly employed in pulp, paper and paperboard production and conversion. Millions more are engaged to one extent or another in raw material supply, transport, marketing and distribution.

As can be seen in figure 1.1 below, in many countries the sector makes a large contribution to the national economy in terms of its share in both manufacturing output and the trade balance.

In traditional wood-fibre-rich producer countries like Canada, Finland and Sweden, the pulp and paper industry is one of the most important economic sectors, accounting for 2 to 3.5 per cent of GNP, and is the largest net foreign exchange earner.

Even in countries with a more highly diversified economy (e.g. the United States), pulp and paper output account for as much as 1 per cent of GNP.

Pulp and paper production offers great potential for industrialisation in developing countries, enabling them to take advantage of favourable climates for fibre production and

Figure 1.1a. Pulp and paper industry share in industrial output, selected countries, 1989

![Graph showing the pulp and paper industry share in industrial output, selected countries, 1989.](source: United Nations (1991a).)
add value to natural resources like forests. This opportunity was recognised several decades ago; in Brazil and Chile, for example, earlier investments are now reaping large foreign currency earnings. Paper production in developing countries also contributes to the development of other sectors, such as agricultural exports requiring adequate packaging.

**Lastly, the availability of sufficient quantities of paper at affordable prices is crucial for the success of national educational and literacy campaigns. China and India are faced with huge foreign exchange bills for imports to make up for the deficit in domestic production.**

### 1.1.2. Developments over the past two decades

The 1970s and 1980s were excellent decades for the sector. The economic climate favoured unprecedented levels of investment in all regions and in all types of pulp and paper production and conversion. In the industrialised nations expansion was virtually continuous. From 1975 to 1989 world output of pulp, paper and board rose from 238.5 to 397 million tonnes, at an average annual rate of 3.5 per cent (see figure 1.2).

Owing to environmental and other constraints, the availability of suitable mill-sites contracted. Furthermore, older mills which had served their purpose were closed or modified, as multi-mill companies tended to consolidate their production in fewer but larger operations. New mills were frequently erected in areas where jobs were scarce, often in response to financial inducements offered by state and local governments. Many peripheral jobs were created in forestry, transport and allied operations.

### 1.1.3. Evolution of the paper industry in developing countries

Prior to the Second World War, there was virtually no significant pulp and paper production in the industrially undeveloped areas of the world. A few mills located near big cities produced small tonnages of packaging, and some converting operations filled local...
needs for printing and writing papers, fruit boxes, etc. Little investment took place for several years after the Second World War; it was only in the 1960s that technology began to move from North to South. Quite a few small mills were built in that decade. By today's standards, employment in such plants was sizeable owing to the lack of automation and the extensive reliance on manual labour.

Some of the mills installed in the developing countries were not immediately successful because of the following constraints: (i) lack of managerial experience in the industrial practices; (ii) inadequate infrastructure, outages of power supply, interrupted raw material supply; bad distribution of mill products; (iii) government interference, in particular as regards the import of spare parts, ceilings on prices, imposed range of products; (iv) inadequate financing and lack of marketing expertise.

Generally, mills employed technical experts from the North in key positions; local engineers and managers received specialised training in Northern mills and in suppliers' engineering shops. Opportunities abounded for young people with ambition.

Some 50 new mills were built in the 1960s and 1970s with the aim of supplying local markets and, if possible, of exporting surplus tonnage to other countries in the region. In most cases, however, exports failed to materialise because established trading lines, notably from Western Europe and North America, were too competitive.

The decades of the 1970s and 1980s were milestones in the development of the Third World's pulp and paper industry. Armed with small corps of experienced papermakers and greater forest industry expertise in government ministries, the developing countries were ready to join with the international financial community in building huge new integrated, as well as non-integrated, pulp and paper mill projects patterned on successful European and North American models.

By the end of the 1980s, the Third World's pulp and paper industry had become a major and growing sector. In those countries where domestic demand was small, exports were the key to survival. Export-oriented mills were built in Brazil, Chile, Indonesia, Republic of Korea, Malaysia, Mexico, Philippines, Thailand, Turkey and throughout West Africa. In these countries and others a large new workforce found meaningful work, not
only in the mills, but also in harvesting, logging transport, forestry management and local support activities. Export-orientated mills were also built in New Zealand, South Africa and the former Soviet Union.

1.1.4. World trade in pulp and paper products

Pulp and paper products are transported on a global scale. These products cross national boundaries or whole oceans on their way to the eventual consumers. But they must be well packed, as pulp and paper are highly water-absorbent and can therefore be ruined very easily. Paper is a highly refined item of trade with a relatively high value; thus, the extra cost for transport per unit of measure of most papers is not too critical. These factors are vital to the future of the industry because they permit pulp and paper to be made in remote locations such as Chile, New Zealand, Northern Finland or interior Canada, and to be shipped profitably to markets thousands of kilometers away.

The routes traversed by pulp and paper form a veritable labyrinth. The major sources of pulp have historically been Northern Europe and North America. The 1970s and 1980s saw a huge surge in the exports of pulp from Brazil, Chile, New Zealand, South Africa, South-East Asia and the Iberian Peninsular, much of it based on fast-growing plantations. Paper marketing is truly global; it is carried on by independent trading companies of all sizes as well as by the marketing arms of the mills themselves.

There is also increasing international trade of converted paper products. However, because of unfavourable volume and weight to value relations, transport distances for converted products such as packaging materials do not usually exceed a few hundred kilometers. Converting plants are usually situated close to their customers in agriculture, food processing or manufacturing.

Historically, the pulp and paper industry has not suffered much from trade barriers, but the forging of new trade blocs (European Economic Area, North American Free Trade Zone, and Association of Southeast Asian Nations) may generate impediments to trade if the present GATT Uruguay Round fails to reach an agreement.

1.1.5. Consumption of paper

In spite of advances in the developing countries, the major industrialised nations continue to be the largest per capita consumers of paper (see figure 1.3).

1.2. Status of the pulp and paper industry in the major regions and brief portraits of 15 selected producer countries

This section provides an overview of the pulp and paper industry in the major geographic regions of the world and sketches brief portraits of the 15 member countries invited to the Meeting.

The pie charts in figure 1.4 illustrate the relative shares of regions and of major producer countries in world output. North America, Northern and Western Europe and Japan still account for the lion's share.

Africa

Africa plays a limited role in the industry. Its total output of paper and board is matched by that of a mere handful of the larger Northern paper industry concerns. There is little intra-Africa trade in pulp or paper. Accounting for 90 per cent of the pulp and paper made on the continent, the Republic of South Africa has a European/North American structure: large, integrated pulp and paper mills based on plantation pulpwood; smaller specialty paper and board mills using domestically produced pulp; and a strong recycled paper and board sector. South Africa has grown into a formidable exporter of market pulp.
and bulk grades of paper and board, with annual shipments of 500,000 tonnes of paper and board and over 400,000 tonnes of pulp. Production is concentrated in the hands of three or four main groups. In recent years the two largest groups have branched out with acquisitions in the European paper industry (namely in Austria and the United Kingdom), and more can be expected. There is unpublicised trade with other nations of southern Africa, mainly in printing papers.

Figure 1.3. Per capita consumption of paper products, selected countries, 1990

![Bar chart showing per capita consumption of paper products in selected countries, 1990.]

Source: PPI (July 1991).

Figure 1.4a. Share in world pulp production by region or major producer country, 1989 (in thousands of tonnes)

![Pie chart showing share in world pulp production by region or major producer country, 1989.]

The only other appreciable paper producers in Africa are Swaziland (for its market pulp only, rated at 183,000 tonnes per year capacity; in 1990 it produced 130,000 tonnes), Egypt, Kenya, Morocco, United Republic of Tanzania, Tunisia and Zimbabwe. Production in the remaining African countries comes from scattered small mills using waste paper or low-grade imported pulp for printing, writing and packaging, and averages no more than 5,000 tonnes per year.

Kenya

Kenya can in many ways be considered as a microcosm of developing countries' pulp and paper industries. Today, there are five mills in the country; one of these (Panafrican Paper Mills, E.A., Ltd.), partly owned by a paper group in India, produces 70 per cent of Kenya's total output. It was only in the 1950s that Kenya got its first mill. With international assistance, coupled with local and government support, capacity was built which now stands at about 90,000 tonnes per year. Planned additions will increase capacity to 125,400 tonnes per year (no timetable as yet). Output is insufficient to meet the local demand, in part because of a lack of domestic fibre sources. Thus, considerable imports of paper, board and pulp are required, and there is little export.

Despite excellent growth rates in paper output in the 1980s, the situation has deteriorated of late. Investment now is seen as too capital-intensive for Kenya. The smaller mills are using some local sisal and waste materials, and bagasse is a possible fibre for the future. Imported pulp for small mills is costly; only the dominant mill mentioned above enjoys duty-free imports.

Some recycling exists but it is small in scale. There is some pulpwood harvesting, but lack of reforestation is a serious environmental problem, along with pollution from mill effluents.

Panafrican Paper Mills has installed de-inking equipment for waste paper reclamation. It has also instituted a forest-planting programme and is considering rice stalks as a fibre source.

There is an active converting sector with over 40 enterprises turning out paper and board articles of various kinds.

Employment has grown steadily in the pulp, paper and converting sectors, and stood at 5,403 in 1987. A major constraint in industry development is the lack of skilled workers (Ikiara, 1991).
Asia

This is by far the fastest-growing and most dynamic region for the 1990s, with innumerable expansion projects to meet the region's expected growth in demand. Japan has been a world-class producer for more than 25 years, having surpassed Canada, formerly the second largest producer of paper and board, a number of years ago. Japan is now second only to the United States. China ranks second in paper and board in Asia and third worldwide. Other prominent Asian paper producers include Hong Kong, China (for its converting sector), India, Indonesia, Republic of Korea and Taiwan, China. Hong Kong, China, India and Republic of Korea are high-volume, high-tech manufacturers and exporters of industrial goods of all types; these activities require both product and transport packaging, and this has contributed to the rapid expansion of their paper and board and converting industries in the 1970s and the 1980s.

The most promising Asian producer nations for the 1990s are Indonesia, Malaysia and Thailand, with much new capacity under construction to serve large populations which need products as the standard of living and per capita consumption rise. This expansion is illustrated by a pulp and paper complex in Sumatra, Indonesia, which is one of the largest in the region; pulp output in excess of 1 million tonnes per year is the aim; paper capacity is already over 300,000 tonnes per year. It is all based on native hardwoods and extensive plantations.

The difference between the two groups of Asian nations mentioned above, however, is that the Republic of Korea, Taiwan, China, and even Japan have had to rely heavily on imported pulp, waste paper and logs/chips for expanding their fibre bases, while the countries in the second group have significant cellulose resources of their own (see figure 1.5).

Figure 1.5. Pulp and paper production, selected Asian countries, 1990

Source: PPI (July 1991).

Australia

Australia has a woodpulp capacity of 1.2 million tonnes per year, and paper and board capacity of approximately 2.2 million tonnes per year; the fibre deficit is made up by imports, mainly from New Zealand. Australia's paper and board industry and converting
sector are relatively sophisticated. What it does not produce is readily available from the
Pacific Rim countries. It has good distribution and adequate rail facilities for transit
packaging. It also needs good packaging to sustain exports of meat, wool, wine, etc. The
State of Tasmania is an important producer of pulp and bulk-grade papers such as
newsprint and printings.

Paper and board production is quite well-balanced between the major kinds: tissue,
packaging, printing and writing, etc. With a growing population, expansion is forecast to
take place steadily through this decade. Australia's pulp and paper technology is equal to
that of Europe and North America and is especially noted for advances in chemical
pulping. There is an indigenous supplier sector with extensive cross-licensing from
Northern firms. Industry development has been slow; the biggest need for the future has
been identified as new legislation which will ensure stability in wood resources for
development. Employment in 1987/88 was estimated at 22,500 persons.

China

This country has had and will have significant growth in the main sectors of its pulp
and paper industry. It is not rich in forests; in fact, China's forest resources have not yet
fully recovered from years of war and neglect. Thus, the emphasis is on the establishment
of commercial timber species and the culture and expansion of its non-wood fibre sources
such as straw, bagasse, bamboo (as in India) and jute, and fast-growing woody plants such
as kenaf. Under a newly announced plan, China hopes to double its bamboo resource. Pulp
output in 1990 totalled 9.5 million tonnes. There is roughly five times as much pulp made
from non-wood fibres as from wood, and much of the latter is imported. The country's
industry also has major pollution problems (PPI, June 1991).

China's paper capacity ranks about equal to that of Canada, or more than 13 million
tones per year. Newsprint and printing and writing grades make up one-third of total
capacity; wrapping and packaging papers and board (required for the growing volume of
consumer and export goods) account for another third. The rest is shared among all other
grades.

In the 1970s and 1980s China received much technical assistance from the West for
new mills. A $300 million, 170,000-tonne-per-year bleached kraft mill is on the drawing
board as a joint Chinese-foreign venture. A complete machine for making 133,000 tonnes
per year of high-quality packaging board from Finland is in project phase; it is the second
of its type (PPI, July 1991). Despite such examples, most Chinese mills are small by
Western standards. Employment is very high, with manual labour still strongly in the
picture. In 1990 the workforce numbered an estimated 807,300.

China has entered into a joint venture with a Finnish machine builder to produce
small and medium-size paper machines (up to 5 m wide) for domestic and South-East
Asian mills and to share leading-edge technology.

India

The nation's woodpulp output is very modest, equal to about one large market pulp
mill. However, India is a major producer of pulp from non-wood fibres such as bamboo,
bagasse and straw, with a capacity of 2 million tonnes per year. The paper side is well
developed, but the average capacity of its more than 300 mills is comparatively low. Many
mills are old and need modernisation. Total output of all types of paper and board is 2.3
million tonnes per year, with the major grades being newsprint, printing and writing,
wrapping and packaging. Per capita consumption of paper and board is one of the world's
lowest, at 3.1 kg per year (1 per cent of that of the United States).

Waste paper has great potential. Collection and usage are now low. If recycling
could be increased to 25 per cent of raw material needs, thousands of jobs could be created.

With demand steadily increasing, there is great need to increase production. The
dilemma is that the lack of domestic fibre will increase the need for imports of wood, pulp
and paper to bridge the growing gap between supply and demand. A forestry programme is
desperately needed to get "wasteland" into timber production.
Employment in the pulp and paper industry is 300,000, of which 220,000 in production.

Japan

Although it has extensive forests which contribute to the nation's fibre supply, Japan is a major consumer of market woodpulp from around the world. Output in 1990 was 11.3 million tonnes of pulp and 28 million tonnes of paper and board.

The industry spreads over many sections of the home islands. Hokkaido has many large-capacity mills which derive much of their wood from the island. These mills produce mainly bulky products, such as newsprint, linerboard, pulp, packaging materials, etc. The mills in the Tokyo-Osaka-Kyoto corridor are of all sizes and produce the full range of printing, tissue, business papers and specialties, plus packaging of all types; they are very modern and efficient. The technical level is world-class and product quality is excellent. Converting is of the highest quality, particularly in coated papers and boards, and is based on the finest equipment available (PPI, February 1991). Japan is one of the outstanding leaders in recycling.

Japanese paper competes on world markets; its fax and thermal papers are sold worldwide in increasing tonnage. Many mills have technical exchanges with North American and European firms. A well-developed machine industry, much of it allied with United States, German and Nordic suppliers, is a key part of the paper scene. New paper capacity which has recently come on stream has created some market problems, particularly in overcapacity of coated printings. Japan is dealing successfully with its environmental problems.

Employment is high; in 1988 an estimated 278,000 persons derived their livelihood from the paper field, and thousands more benefited from peripheral businesses.

Europe

Although Europe adopted paper more than 1,000 years after its invention in China, it can nevertheless be considered the cradle of pulp and paper making as we know it today, since it contributed most of the significant early inventions such as chemical and mechanical pulping and the fourdrinier paper machine.

Europe is the world's second largest pulp and paper-producing region, after North America. Output of pulp in 1990 was 44 million tonnes and that of paper and board 77 million tonnes. Over 1,600 mills make paper and board while 400 plants produce pulp. These figures include the former USSR (PPI, July 1991). The region is greatly diversified, with mills of all sizes making the complete mix of pulp, paper and board products.

Finland

Fifteen per cent of the world's paper and board exports are claimed by Finland, with 28 per cent of world trade in printing and writing papers. Only Canada is a bigger paper exporter. Finland ranks fourth worldwide in pulp exports. Market pulp is declining as more fibre is going into the higher-value-added paper and board grades. There are 21 pulp mills of all types, and four de-inking mills for recycled fibre.

Finland has 29 paper mills with printing and writing grades predominating, notably in mechanical printings and coater grades. The average paper machine is much wider and faster than 20 years ago.

Finland is a leader in paper mill automation and computerisation. There are 15 board mills making packaging materials for various end-uses in many industries. The converting industry is small compared to the large pulp and paper industry because it is largely confined to domestic markets; converted products are not as readily exportable as pulp and paper. Finland's goal is to produce high-quality, high-value paper and to improve environmental protection in every instance.
Following a major restructuring of the industry, the bulk of capacity is now controlled by four major groups. Nine firms together own or control around 40 foreign production installations in Europe and North America (Finnish Trade Review, 1990).

In 1990 the labour force numbered 45,410. Production figures for the same year were 9 million tonnes of paper and board, and 9 million tonnes of pulp. Finland exports 86 per cent of its paper production (PPI, July 1991).

France

Along with Germany, France has the highest annual production of pulp in the EC: 2.2 million tonnes. In paper and board, it turns out 7 million tonnes per year, second in the EC (after Germany) (PPI, July 1991). France is a technical leader and is strong in many areas of pulp and paper production, notably in print and writing grades, corrugated materials, tissue and technical specialties. Its 150 mills are of all sizes and ages. There has been a continuing modernisation and expansion programme in recent years, much of it as a result of foreign companies investing to strengthen their EC bases. About 30 per cent of output is exported. Approximately half of all mills are small and have capacities under 25,000 tonnes per year. These 75 or so mills produce a large spectrum of high-value specialties; many family-owned operations turn out traditional items. Even with its very creditable paper output, France imports 3.5 million tonnes per year. Per capita consumption is well under that of its EC partners; there is much room for growth ahead. Waste paper is growing in importance as a raw material.

The industry workforce of 90,000 (1990) may be augmented by new capacity installations scheduled to come on line by 1994-95. Twelve new paper machines are to start up, boosting pulp capacity by 1 million and paper capacity by 3 million tonnes per year (Beloit, 1992). Much of the expansion in recent years was fuelled by foreign investment, especially from Northern Europe.

Germany

Germany is Europe's largest paper producer. With the addition of five new federal States in 1990, the newly unified nation now has a capacity of 12.6 million tonnes per year in paper and board.

Printing and writing papers make up nearly 50 per cent of the total, while corrugating materials, with nearly 2 million tonnes per year, are very important in meeting the transport packaging needs of Germany's manufacturing exports. The nation leads Europe in tissue production (750,000 tonnes per year) and produces 1.7 million tonnes of boards of all types. The specialty paper and converting sectors, comprising more than 1,700 enterprises, are among the most varied and sophisticated in the world. In the fibre branch, Germany makes only about 40 per cent of its needs. The country lacks kraft mills (excepting some capacity in the former GDR) and has concentrated on sulphite and refiner and other mechanical grades (TMP, CTMP). Recycled fibre is immensely important, making up 39 per cent of the total paper-making fibre needs. There are 32 mills making pulp and 175 making paper and board. There are 1,472 converting plants. Germany is also one of the world's leading manufacturers of paper machines and converting equipment (PPI, July 1991).

The future will see an active transfer of funds and technology (not only West to East but also from abroad) linked to the commercial development of non-polluting chemical pulp mills to compensate for the West's lack of kraft pulp mills. A 1992 development illustrates this movement: a Finnish paper-maker announced plans to build a 280,000-tonnes-per-year newsprint mill near Leipzig at a cost of $175 million for 1994 start-up using mainly waste paper (Finnfacts, 1992).

Poland

Poland is the third largest pulp, paper and board producer of the ex-Comecon nations after the former USSR and Czechoslovakia. Poland's annual pulp capacity is still about double actual output. Poland has wood resources which can support additional capacity, but even so is aiming at more pulpwood exports. It needs more foreign participation to advance at a rate which would provide all its domestic needs and still leave
a surplus for lucrative exports. The largest pulp type is unbleached kraft from softwoods, which is converted into linerboard, sacks, wrappings and some other grades. Bleached kraft/soda pulp output is sizeable in tonnage and comes mainly from hardwood raw material.

The nation historically has had a sizeable paper and board industry (42 paper and board mills and 17 pulp mills in 1990). In the 1970s and 1980s considerable investment was made in Nordic technology for pulping and paper machinery. The industry needs to be restructured and modernised extensively, but privatisation has been too slow to attract much outside investment. Now Poland has to compete with the newly independent Baltic States for foreign capital from the West. Converting is also in need of upgrading.

Employment was roughly 45,800 persons in 1989. Output in 1990 for paper and board was 522,000 tonnes, and 1 million tonnes for pulp.

Sweden

Number one in Europe and number four in the world in pulp production (9.9 million tonnes in 1990), Sweden is the second largest European paper and board producer (8.4 million tonnes in 1990) and eighth largest worldwide. The nation leads Europe in pulp exports. It exports less paper and board than Finland because it needs more of these products at home for its 8.5 million inhabitants, compared to Finland's 5 million. Paper manufacturing is quite well balanced between cultural and industrial papers; the country is a sizeable producer of tissue, specialty papers and boards. Sweden ranks fourth globally (after Canada, United States and Japan) in newsprint production, of which it exports 1.7 million tonnes per year. Mills are widely distributed throughout the whole nation, which is heavily forested. Its large southern area is better suited to more rapid tree growth than any other part of the Nordic region.

Sweden is renowned for its leadership in pulping technology, and its processes and pulping hardware have been exported to every corner of the globe.

Sweden is dominated by a number of very large integrated forest products companies which have undergone intensive restructuring in recent years. There were 39,500 workers in 1990 in the Swedish pulp and paper labour force, plus a substantial number of persons employed in the converting branch. Sweden was one of the birthplaces of chemical pulping, which revolutionised the industry. It is engaged in many joint ventures in Southern and Eastern Europe and lately in Poland, the Baltic States and the former GDR.

Because of the high cost of operations and declining profits, Swedish pulp and paper companies are engaged in an intense drive to reduce the workforce by many thousands of employees through mill closures and restructuring. For example, one of the largest integrated pulp and paper producers with turnover exceeding $3 billion per year saw its 1991 profits drop by 82 per cent; it is trimming 2,000 jobs between 1989 and 1993 (Wall Street Journal, 1992). Another major Swedish producer ($12 billion in sales and a world-class pulp and paper producer) extended its already substantial continental assets with the acquisition of mills in three EC member nations and Canada.

USSR

The data presented here refer to the former Soviet Union, as up-to-date information on the new Commonwealth of Independent States or its constituent units is not yet available.

Pulp and paper output grew steadily in the former Soviet Union between 1975 and 1989, but fell by 10-15 per cent in 1990, to 10,100,000 tonnes and 8,380,000 tonnes respectively.

The pulp produced in 1989 was in the main chemical woodpulp categories. Paper was about one-third newsprint and printing grades and about two-thirds packaging, wrapping and industrial products. Tissue, specialties and business papers appear to have been produced at only low rates. The workforce in 1990 numbered 177,618.
Paper production and consumption are expected to decrease at least in the short term owing to the transition in the economy, the lack of foreign currency to obtain needed machinery and chemicals and less paper available to publishers owing to hard currency shortfall. There is now the problem of which ministries will have responsibility and authority for the mills scattered over a vast territory stretching all the way to Siberia.

There is an urgent need now for foreign help in the way of marketing agreements, credits for machinery, supplies and chemical purchases and modern technology. Environmental problems have grown quite serious, and the green movement is powerful enough to force mill closures in the cases where pollution is most rampant. Waste paper utilisation has grown steadily over the last two decades, but the latest data show a large potential to increase it to levels found in Western Europe. Most waste presently goes into boxboard; only 20 per cent goes to paper.

Latin America

This region has a large, varied and growing pulp and paper sector, and a considerable value and volume of intra-regional and world export trade. The dominant players are Argentina, Brazil, Colombia, Mexico, Peru and Venezuela, and to some extent Cuba. The rest of the region's countries (including the Caribbean Basin) produce very little pulp or paper. However, the conversion of linerboard and corrugating medium (fluting) into corrugated cases for transport packaging of agricultural products is widespread throughout the region and employs a large workforce. There is a brisk, well-developed trade in all kinds of paper to and from countries in Latin America. Much of the machinery and equipment embodies excellent technology from Europe and North America.

Of great importance to the region is the market pulp industry of Brazil and Chile. A key feature in the raw material sector is the utilisation of bagasse, the left-over from sugar-cane processing. Bagasse pulping is found in nine Latin American nations, notably Argentina, Cuba, Mexico and Peru: this pulp is converted into a wide range of excellent products: tissue, packaging, printing and writing paper, etc.

Brazil

The nation ranks approximately eleventh in the world in paper and board output (4.8 million tonnes in 1990) and eighth in woodpulp production (4.5 million tonnes in 1990). Because of its large population (over 150 million) and the relative sophistication of end-use requirements, Brazil has built a world-class industry in terms of volume, value and quality of product. It is recognised the world over for its market pulp industry, started from zero in the 1960s and now producing some 2 million tonnes per year, mainly from plantation eucalyptus, in mills embodying the best technology from Europe, Japan and North America.

Employment has also risen to a high level; the latest count (1989) shows a mill workforce of 80,600 in pulp and paper manufacture.

Just as remarkable as the pulp growth is the accompanying paper and board explosion. Using home-grown wood, Brazil's papermakers have been able to make very high-quality papers from short-fibre eucalyptus. This know-how was exported to the North where it has been followed by paper mills' purchases of eucalyptus market pulp from Brazil. The severe economic slowdown of 1990-91 is forecast to end this year, if it does so, Brazil is poised to double present capacity by the year 2000.

Brazil has also exploited world-class technology in building its own pulp and paper machinery, much of which is now exported to world markets, including the United States.

Chile

Chile has also developed a world-class market pulp export industry of its own. It is a modest paper-making nation, with an annual capacity of only about 500,000 tonnes, but it has installed capacity of 1 million tonnes per year of bleached market kraft pulp, all based on plantation radiata pine and eucalyptus. The high technological level of its new pulp mills is equal to that of Europe, and great emphasis is placed on environmentally sound pulping processes.
There has been much foreign investment. Japan has invested heavily in facilities for chip exports and has a pulp and paper mill in the planning stage. Swiss interests have a new market pulp mill on the drawing-board for early/mid-1990s start-up.

Chile's market pulp industry (1990 output: 805,000 tonnes) has created 1,500 new jobs in just the last two years in areas where there was poverty and little in the way of job possibilities. Its paper and board industry (ten mills) is highly regarded for the range of grades, which are consumed to a large degree by Chileans. Waste paper has become a vital raw material, and new high-tech capacity is being installed steadily.

The total workforce in the Chilean pulp and paper industry exceeds 9,200 and there is a large number of add-on workers in the forestry and raw material supply sectors.

North America

Canada

The nation is the world's second largest producer of pulp; it produces more than enough virgin fibre for its paper-making needs and exports the rest (about 8 million tonnes per year) throughout the world, making it the world's leading market pulp exporter. Total pulp output is over 22 million tonnes, but when the present recession is over, Canada will be able to move towards its capacity of 27 million installed tonnes per year (1990). Pulp and paper exports were valued at $14.3 billion in 1990. Paper and board production is over 16 million tonnes (1990); capacity is approximately 19 million tonnes per year. In 1990 the industry employed 131,000 workers.

Canada produces all the main grades of paper and board, but its historic specialities are newsprint (it ranks first in the world in exports) and printing papers based on mechanical pulp, or more lately on TMP and CTMP. Woodpulp exports, mainly bleached kraft, go to world markets, notably the United States, Japan and Western Europe. Softwood is the dominant raw material.

Canada, which in the past concentrated on bulk, commodity-type products, now may seek to move ahead with higher-value products and to take a more global stance with foreign joint ventures, especially in the Pacific Rim (MacMillan Bloedel Ltd., 1991).

Interior British Columbia and the Prairie provinces saw much new capacity added in the 1980s and early 1990s, particularly in export market pulp and bulk paper and board grades, utilising the vast interior softwood species resource. Eastern Canadian mills are more diversified, but many are old and too small to be competitive. This is forcing millowners to look to the United States for investment potential. An investment surge in the 1990s has already added capacity in mechanical pulp.

United States

By far the world's largest producers of pulp and paper (57.2 million tonnes and 71.5 million tonnes respectively in 1990), American mills turn out the widest variety of products to be found in any nation. The most important grades in terms of tonnage are newsprint and printing and writing papers, household and hygienic papers (tissue, etc.), wrapping and packaging paper and board, including linterboard and corrugating medium and folding boxboard.

Integrated mills tend to have high capacity, particularly those in the south and west, the heavily forested regions. Mid-west and north-eastern mills are more specialised and of more modest capacity. Market pulp mills, usually on or near the ocean coasts, are also of immense size, enjoying economies of scale. Ownership is predominantly by large corporations. A dozen of these corporations produce well over a million tonnes of paper and board each. The largest among them have a higher output than the entire industry in most countries. The recycling sector is large and growing, consuming millions of tonnes of all types of waste paper and board yearly. In 1991 some 57 per cent of all corrugated boxes
used in the United States were recovered from the solid waste stream. Last year newspaper recycling amounted to 6.6 million tonnes, a record (API, 1992). The industry's total workforce in 1990 was just under 700,000.

Per capita consumption is 311 kg of paper and board per year, by far the world's highest for any nation.

1.3. Outlook

Paper demand rises and falls along with the general economic trends. The resulting cycle of boom and temporary depression is much reinforced by the pronounced investment peaks typical of the sector and the recurrent overcapacity built up as a result.

When overcapacity meets with sluggish demand at the end of a business cycle which typically lasts four to five years, paper is a victim of its production scale. It is not cost-effective to run giant mills at under 80-85 per cent of capacity, according to most industry economists and observers. Furthermore, the financial burden of not being able to pay off investments through cash flow can be crippling in recessions. Smaller, more specialised mills, especially those in key consumer brackets, such as hygienic and household paper products, are usually less affected. After several prosperous peak profit periods in the 1970s and 1980s, paper finished the decade in Europe and North America in a serious financial malaise; by early 1992 the economic recovery had not yet arrived, and the forecast for all of 1992 was for slow recovery to begin, maybe, by the year end. Other regions, with the exception of Asia, can only await such recovery with its resultant spin-offs.

The pattern of recessionary effects is well illustrated by the performance (sales) data, presented in figure 1.6 for Canada's largest forest products.

Figure 1.6. Comparative sales by product type of a large Canadian pulp and paper exporter, 1989-91

![Graph showing comparative sales by product type from 1989 to 1991.](image)

Employment is seriously affected in such periods, with mill shut-downs and resultant lay-offs, both temporary and permanent. Converting suffers because of slack demand, and extra shifts are often cancelled. Part of the problem is due to overcapacity, but this applies only on a spot basis in the case of big new mills which come on stream.

Investments are postponed. Even greater attention is paid to cost-cutting measures in every conceivable link in the chain. When the upturn is reached, the philosophy changes and investment and expansion resume; the business cycle is confirmed.

In the late 1980s South-East Asia’s economic growth spurred higher demand for paper and significant investment in new pulp and paper capacity, creating tens of thousands of new jobs, perhaps hundreds of thousands if one counts peripheral occupations such as forestry, transport, chemicals and construction of infrastructure. The development of a consumer society in South-East Asia’s rapidly growing nations, coupled with industrial expansion, has been a major inducement for paper capacity investments. China still as far to go, but its emerging place in world trade may yet have a significant impact on the growth of paper making and paper usage.

Figure 1.7 summarises expected capacity developments through 1995, based on FAO surveys of investment plans and mill projects. The pace of expansion is slowing down in the 1990s compared to 1985-90. There are also major differences in growth rates between regions. While the developing countries and Japan are set to add more than 4 per cent of new capacity per year, growth is unlikely to exceed 2 per cent in North America and may actually prove to be negative in Eastern Europe.

Figure 1.7. Development of pulp and paper capacities by region or major producer country, 1985-95

![Figure 1.7: Development of pulp and paper capacities by region or major producer country, 1985-95](image)

Source: FAO (1986).
2. The pulp and paper industry and the environment

2.1. Introduction

As a major consumer of wood, water, energy and chemicals, the pulp and paper industry is the subject of many environmental controversies. The pressure comes from various sources including environmental groups, national governments and the media. The industry has been criticised not only for its environmental performance, but for allegedly presenting a distorted view of its environmental record.

The debate has had an impact on consumer behaviour and attitudes; in particular, it has stimulated demand for recycled paper and chlorine-free pulp and paper products. For example, New Zealand producers’ share of the Australian market declined as consumer preferences shifted, following a public debate on dioxin residues in pulp and paper products produced there. Such market forces can have a substantial influence on pulp and paper producers. So can legislation. Under the impression of strong public opinion most governments have drastically raised environmental standards applicable to pulp and paper. Paper sold in Germany is required to have been produced from raw materials and processes which are not polluting according to the buying country’s standards; for example, Chilean and Brazilian pulps sold in Germany have to comply with German environmental rules for pulp production (FAO, 1991a). Governments often find themselves sitting between all chairs when trying to reconcile conflicting environmental and public interests with those of the paper industry and its employees. The row over a court injunction against the operation of a brand new US$500 million pulp and paper mill in eastern France, and the criticism of the local government’s handling of the matter, provide a recent example of the dilemma.

ILO constituents have a stake in this debate for several reasons. There are employment effects - positive and negative, short-term and long-term - associated with the industry’s environmental problems and its response to them. Some of the pollutants and hazards involved have effects within and beyond the workplace. Employers’ and workers’ organisations have roles to play in defining the hazards and in designing appropriate responses, including training requirements. Section 2.5 below elaborates on this aspect.

2.2. What are the environmental issues in the pulp and paper industry?

The pulp and paper industry is basically sustainable in the sense that its raw material is renewable and recyclable. From that point of view it is ecologically sound. There are, however, a number of other environmental issues concerning the industry. The main ones are emissions into air and water, energy consumption, the impact on forest ecosystems and biodiversity, and the disposal of waste products.

2.2.1. Pollution of the waterways

The pulp and paper industry’s impact on the environment is perceptible, especially around mill sites where the odour and the effluent discharges into waterways can be clearly noticed. The following description of the main pollutants draws on Palenius (1988) and the Central Association of Finnish Forest Industries (1991).

Harmful emissions into the waterways include:

- **Suspended solids** (SS), which have their origin in bits of bark, pieces of fibre and filling and coating agents. They consume oxygen when decaying and can be carriers of poisonous substances.

- **Organic matter in general**, which uses oxygen from the water. If the oxygen demand is high, it may cause oxygen deficiency in the waterways, which leads to the death of animals which depend on oxygen, such as fish, and to severe damage to the ecosystem. Bodies of water covered with ice or stratified into layers according to
salt content, such as the Baltic Sea, are especially vulnerable. Organic matter in mill effluents falls into two categories:

- Easily decomposable material. This causes fish to die and produces bad smells. The amount of easily decomposed matter in the effluent and thus the amount of oxygen consumed by the effluent over a certain period of time (usually five or seven days) is expressed as "biochemical oxygen demand (BOD)".

- Slowly decomposing material. The "chemical oxygen demand (COD)" indicates the total amount of oxygen needed for the complete chemical oxidation of effluent impurities.

**Nutrients**, mainly phosphorus and nitrogen, often trigger excessive algae bloom with consequences of oxygen deficiency, bad smell and taste, and sliminess.

**Toxic substances** affect organisms directly and accumulate in them. A prominent place among effluents is held by chlorine and chlorine-containing chemicals, which are commonly used to bleach chemical pulp. They tend to form organic chlorine compounds such as dioxins and furans, which are widely regarded as highly toxic. These substances cannot be filtered out. They degrade slowly; the degradation of one gram takes more than 100 years (FTPF, 1991). Because they are so numerous, many of the chlorine toxins have not been fully investigated, but some are considered carcinogenic. The long-term and the synergetic effects are also poorly understood. When taken up by fish and plant life these substances may accumulate through the food chain and cause damage in the second or third generation. The "absorbable organic halogens (AOX)" parameter indicates the amount of chlorine that is bound to organic matter.

Figure 2.1. The pulp and paper industry and the environment


The impact on the waterways can be dramatic, as for example in recent cases in British Columbia, where the Canadian Federal Government discovered in 1988 and 1989 that some bleached kraft mills were releasing dioxins and furans directly into rivers and the Pacific Ocean. Elevated levels of dioxin were found in shellfish, leading to the closure of
the shellfishery in at least nine different areas. As a result of a survey of freshwater areas adjacent to British Columbia's interior mills, the Government issued a health advisory regarding the consumption of certain fresh water species. Significant dioxin concentrations have also been found in the tissue of fish in the vicinity of pulp factories in Sweden. Research on birds has revealed a build-up of toxic chemicals from eating fish and marine animals (Baumgarten and Grossmann, 1989). The potentially negative impact on tourism, especially in the case of sport fishing, is obvious.

2.2.2. Pollution of the air and the soil

The main air pollution problem is that of acidifying gases generated at the mills, e.g. sulphur dioxide and nitrogen oxides. This leads to acid rain which causes soil degeneration and is a suspected cause of the deterioration of forests. In the paper and conversion industry, sulphur dioxide emissions have their origin in energy production. In the case of pulp production, sulphur-containing chemicals are used, leading to emissions in the form of sulphur dioxide and, for sulphate pulp mills using the sulphate process, in the form of reduced sulphur compounds. The odorous reduced sulphur compounds oxidise in the air, forming sulphur dioxide.

The biggest volumes of production-related waste consist of sludge and ash. A growing problem is the sludge from the de-inking of recycled paper. This sludge often contains petroleum-based ink and de-inking chemicals and must be incinerated or treated and disposed of in sanitary landfill sites.

2.2.3. Use of waste paper

Waste paper is by far the largest single component of domestic waste, constituting 35-40 per cent of the volume of municipal solid waste in the United Kingdom and the United States. According to a study published by Jaakko Pöyry, the use of waste paper in the world is expected to increase from 75 to 130 million tonnes by the year 2001. This would result in an increase in the worldwide utilisation rate (portion of waste paper that is recycled) from 33 to 41 per cent over a decade (Karlsson, 1992).

Some countries already have very high recovery rates (see figures 2.2 and 2.3), and recycled paper can account for as much as two-thirds of fibre inputs. Countries with low population densities (hence low and dispersed paper consumption) but rich inventories of wood fibre - such as Finland, Sweden, and Canada - are at a disadvantage when it comes to recycling.

The world trade in recovered paper amounted to 12 million tonnes in 1989. Sixty per cent of this came from the United States and represented almost one-third of the waste paper volume recovered in that country. The United States' waste paper exports have grown by 14.7 per cent per year during the 1985-89 period. Developing countries (mainly Mexico, China and the Republic of Korea) import over 6 million tonnes (Wardle, 1992).

Despite the increased use of wastepaper, the volume of paper entering the waste stream is currently growing at the rate of 30 million tonnes per year (Paper, 1991), whereas the use of waste paper will, according to Jaakko Pöyry, increase by only 3 million tonnes per year. Therefore, despite notable efforts to improve waste recovery, the absolute volume of unrecycled waste paper is still growing, at the impressive level of 27 million tonnes per year.

2.2.4. Energy consumption

Energy consumption in pulp-making depends on the method used. In chemical pulping processes only about half the wood is recovered. Most of the rest ends up with the cooking liquor in energy production during chemical recovery. So much energy is produced during chemical pulp-making (by burning black liquor and bark) that the pulpmill does not require any outside electricity and can in fact supply electricity and heat to, for example, an adjoining paper mill.
Figure 2.2. Percentage of fibre input attributable to recovered paper, 1989


Figure 2.3. Apparent percentage of paper recovered for reuse, 1989

The high-yield mechanical methods require two to four times more energy per tonne of pulp produced than the chemical methods and have a wood recovery rate of 95-97 per cent. Energy has then to be supplied from outside the process. One advantage of waste paper usage is the lower power input per tonne of pulp. The power needed to de-ink and to repulp old newspapers and magazines is in the order of 400 kWh/tonne against some 1,500-2,200 kWh per tonne for groundwood (Jirvall et al., 1990).

The energy consumption of the industry is substantial. In Finland the electricity demand of the wood-processing industry (of which 90 per cent is used by the pulp and paper industry) amounts to nearly one-third of Finland’s total electricity production. One-third of the electricity required is generated (as described above) by the pulp mills. In the United States 56 per cent of the energy used by the pulp, paper and paperboard industry was self-generated in 1990. In that country the sector consumes 3 per cent of all energy.

2.2.5. Forest conservation

The alleged negative impact of the pulp and paper industry, and of all forest-based industries for that matter, on forest conservation falls into two categories: overcutting, with a resulting loss in volume and forest area available to future generations; and destruction of animal and plant habitats entailing a loss of biological diversity.

In the industrial world pulpwod accounts for as much as one-third of the wood harvest, while in the developing world pulpwod accounts for only 3 per cent. In spite of the substantial quantities involved, forest inventories and areas are not being depleted. For most industrialised countries the opposite is true. Throughout the last decades growing stock volumes, and in many cases forest areas, have been increasing.

In developing countries, by contrast, forests are being depleted and pulpwod demand may be one of several factors draining forest resources. The industry has been harshly criticised in this respect in the media in India, for example (Gosh, 1987). Although South America is the largest regional user of pulpwod in the developing world (7.7 per cent of the total regional wood harvest), a high proportion of the pulpwod comes from plantations rather than natural forest in this region (Paper, 1991).

The biodiversity charge is more difficult to refute. It goes beyond growing stock and forest areas to considerations of the "quality" of forests as ecosystems. This includes aspects like the tree species composition, and management and harvesting regimes. While plantations of a simple, fast-growing tree species are perfectly sustainable sources of raw material in terms of volume and area, they are clearly no match for the biodiversity of indigenous forests. Similarly, large-scale clear-cutting, if part of a planned rotation, does not undermine the timber resource base in terms of volume, but dramatically modifies habitat-threatening species that are dependent on old-growth conditions.

This debate has flared up in industrialised and developing countries alike. Witness the spotted-owl conflict in the United States, the campaign of European environmentalists against forestry practices in Canada or the controversy about eucalyptus plantations in India and Thailand. In the last-named country, employees of a company which plans to set up the largest pulp mill in Asia have been arrested on charges of invading and cutting wood in the national reserved forest in order to clear land for eucalyptus plantations. After this incident the Government bowed to public opinion by suspending any large-scale plantations of eucalyptus. The wholesale harvest and chipping of natural tropical and mangrove forest for pulp has also contributed to giving the sector a bad reputation in some countries.

The debate about the proper balance between the needs of the forestry industry, including its employment opportunities, and the protection of endangered species is once again coming into focus. In Sweden, for example, the Government has committed itself, in accordance with the Second World Conservation Strategy, to protect biodiversity. The World Conservation Strategy estimated that this meant protection of about 10 per cent of the productive forest area. Researchers and environmentalists in Sweden claim that about 15 per cent of the productive forest has to be protected to reach that goal. For years money and political will were not available. In the fall of 1991, however, a remarkable change
took place. All the big Swedish companies announced their intention to stop logging in the Swedish mountain forest, which had been one of the major bones of contention in the Swedish environmental debate. The decision was partly due to economic considerations but also shows a willingness from the industry to cooperate with environmental groups and to adapt to public opinion.

The key questions are and will always be of a moral nature. To what extent does mankind have the right to change the ecosystems and what will the long-term economic impact be? The outcome of the United Nations Conference on Environment and Development in Brazil may provide international guidelines on these issues.

2.3. What is being done?

2.3.1. Technology

Technological development in this field has been rapid. Technical solutions have reduced effluent per tonne of paper produced on a scale considered impossible by the industry some years ago. At present there are economically realistic clean production options available for wood pulp manufacture regarding the emission of organic matter in general. The situation is, however, still not satisfactory regarding discharges of chlorinated organic compounds.

Most chemical pulp mills around the world are in the process of reducing or eliminating elemental chlorine in bleaching, but almost all mills continue to rely on chlorine dioxide to maintain high level of brightness (Paper, 1991). None the less a number of new processes with the principal objective of reducing the level of chloro-organics are under development. These are mainly prenox, biotechnology, solvent lignox and ozone. Because of the long time-scales involved for radical changes in technology it is unlikely that any of these processes will have an impact on the overall pollution load over the next five years.

Around 20 chemical market pulp mills worldwide are offering chlorine-free grades (excluding also the use of chlorine dioxide). Most of these are in Europe and use the sulphite process, incorporating a combination of oxygen and peroxide bleaching. Only two kraft pulp mills were producing chlorine-free grades on a commercial scale in 1991 (Paper, 1991).

2.3.2. Investments

Considerable investment is being made to create a cleaner industry. In Sweden about 20 per cent of the industry's capital expenditure from 1989 to 1991 was scheduled for environmental projects. At existing mills in Canada environmental projects accounted for a quarter of total capital expenditure completed in 1990 and scheduled for completion thereafter. In the mid-1980s it accounted only for around 10-15 per cent and at the beginning of the 1980s for 5 per cent. In Canada 75 per cent of the investment planned for 1990 and beyond concerned emissions to waterways, 22 per cent the emission to the air and only 3 per cent the treatment of solid waste (Roberts, 1991). Two government analyses show that the pulp and paper industry in Quebec alone will have to invest almost C$1 billion before 1994 to comply with the new Canadian legislation (FTPF, 1991).

In the former Soviet Union 2.2 billion roubles had been allocated for 1988-95 to a programme aimed at the total elimination of waste water discharges and an abatement of air pollution by pulp and paper mills by the year 1995 (Korylov, 1991).

In the United States capital expenditure for environmental projects in 1990 and beyond was only 11 per cent. This reflects partly the fact that the United States industry had already made significant investments in secondary treatment facilities in the 1970s. Of the investment planned for 1990, 53 per cent concerned the reduction of emissions into water, 31 per cent dealt with discharges into the air, and 14 per cent with the solid waste disposal from the manufacturing industry.
One serious economic barrier to a cleaner industry in some developing countries is the heavy duty levied on imported equipment. In India the import duty on paper machinery is 40 per cent; there are similar restrictions in Brazil. Import duties and the shortage of convertible currency are limiting factors since most modern clean production technologies have to be imported from Europe, North America or Japan (Fellegi & Judt, 1991).

2.3.3. Legislation

Many countries are in the process of establishing new environmental regulations for their pulp and paper mills. The following table shows current environmental regulations regarding pulp mills in various countries. In most cases the higher limits apply to existing mills and the lower limits apply to new mills. The North American standards for organic matter in effluents [Biological Oxygen Demand (BOD)] are more stringent than the Scandinavian ones. Over 90 per cent of American mills have secondary biological treatment, compared with 50-60 per cent in Sweden and Finland. However, Scandinavian standards for Total Suspended Solids (TSS) are more stringent than in North America.

Table 2.1. International effluent discharge limits for chemical pulp mills, 1991

<table>
<thead>
<tr>
<th>Country</th>
<th>Limit value (kg/ADT unless otherwise stated)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Biological oxygen demand (BOD)</td>
</tr>
<tr>
<td></td>
<td>Kraft</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Germany</td>
<td>8-17</td>
</tr>
<tr>
<td>Sweden</td>
<td>5-10</td>
</tr>
<tr>
<td>Canada</td>
<td>4-8</td>
</tr>
<tr>
<td>United States</td>
<td>3-30</td>
</tr>
<tr>
<td>Brazil</td>
<td>20-120 ppm</td>
</tr>
<tr>
<td>Range</td>
<td>2.5-40</td>
</tr>
</tbody>
</table>


Table 2.2. International effluent discharge limits for chemical pulp mills - proposed absorbable organic halogens (AOX) limits, 1991

<table>
<thead>
<tr>
<th>Country, province or state</th>
<th>Limit value (kg/ADT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alberta</td>
<td>1.4</td>
</tr>
<tr>
<td>British Columbia</td>
<td></td>
</tr>
<tr>
<td>Quebec</td>
<td></td>
</tr>
<tr>
<td>Ontario</td>
<td></td>
</tr>
<tr>
<td>Germany Sulphite</td>
<td></td>
</tr>
<tr>
<td>Japan Kraft</td>
<td></td>
</tr>
<tr>
<td>Sweden Sulphite</td>
<td></td>
</tr>
<tr>
<td>Oregon</td>
<td></td>
</tr>
<tr>
<td>Washington</td>
<td></td>
</tr>
</tbody>
</table>

While most regions are within reasonable range of each other regarding effluent limits, there are major differences in the coverage (Roberts, 1991). In Canada, for example, the regulations of the Fisheries Act apply only to mills built after 1971. That means that only 7 per cent of Canada’s pulp and paper plants are now subject to existing environmental rules; the remaining 93 per cent, or 154 plants, set their own standards (Norrena, 1990).

Table 2.3 shows the level of selected pollutants discharged by pulp and paper companies in Canada, and the limits the Government is proposing for each pollutant. To determine acutely lethal effluent, 30 small fish are placed into a container of 100 per cent pulp and paper effluent and the survival is checked after 96 hours. If more than 50 per cent of the fish die the effluent is classified as acutely lethal. Over 80 mills currently discharge an acutely lethal effluent.

Table 2.3. Effluents in the pulp and paper industry in Canada, current average and proposed legal limits, 1990

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Toxicity</th>
<th>Current Average</th>
<th>Proposed limit 1994</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Fisheries Act)</td>
</tr>
<tr>
<td>BOD5</td>
<td>Acutely lethal</td>
<td>30 kg/ton</td>
<td>Non-lethal</td>
</tr>
<tr>
<td>TSS</td>
<td>12 kg/ton</td>
<td></td>
<td>6.0 kg/ton*</td>
</tr>
<tr>
<td>TCDDb</td>
<td>Acutely lethal</td>
<td>60-200 ug/ton</td>
<td>Non-lethal</td>
</tr>
<tr>
<td>TCDFb</td>
<td>below detect</td>
<td>200-1,400 ug/ton</td>
<td>below detect</td>
</tr>
<tr>
<td>AOX</td>
<td>not available</td>
<td>5 kg/ton</td>
<td></td>
</tr>
</tbody>
</table>

TCDD (2378 tetrachlorodioxin), TCDF (2378-tetraclorofuran)

* Applies to mills with chlorine bleach.

b Regulatory limits: daily and monthly maxima.


In some countries, e.g. the United States and Germany, legislation is being drawn up to reduce excessive levels of packaging waste (Paper, 1991). In the United States eight states and one municipality have passed regulations which specify a minimum recycled content for newsprint being sold in their jurisdiction (Roberts, 1991). This causes problems for the industry far away from the sources of waste paper (e.g. the Nordic countries and Canada), since the cost associated with the transport of the material increases production costs. The Swedish Pulp and Paper Association, among others, disapproves of such legislation and does not consider it acceptable that regulations are introduced in various countries which require waste paper to be mixed into certain grades of paper and board in order to solve the garbage problem. They believe that the market should regulate this matter (Karlsson, 1992).

2.4. What remains to be done?

The pulp and paper industry in most countries has made great strides in reducing pollution and is investing higher proportions of new capital in environmental protection than most other industries. The reduction of emission per unit pulp or paper produced must, however, be seen in connection with the volume produced. Paper production will in the
year 2000 reach 300 million tonnes if present trends continue. Emission per tonne of pulp and paper will have to be reduced by 25 per cent by the year 2000 just to keep the total emission at today's level (Paper, 1991). Some countries with high admissible thresholds at present are likely to cut levels by more than that. Those already having strict limits, however, may find it difficult to reduce further in keeping with rising output. In many developing countries and in Eastern Europe economic constraints will continue to limit funds available for clean-ups.

The growth of world population and consumption generates an increasing stream of pollutants. In Germany, for example, the average per capita paper consumption was 32 kg in 1950, and 210 kg in 1989. The waste and pollutants have to be absorbed or transformed. The absorption capacity varies greatly according to the size of the recipient, the climate and the nature of the particular ecosystem. Chemical processes used have successfully been improved, but from an environmental standpoint, the problem is getting more and more severe.

2.4.1. New problems

New methods cause new problems. For example, critics of the new bleaching method LIGNOX, generally considered as environmentally friendly, fear that it may release heavy metals into the environment.

The increase in waste paper utilisation will require more de-inking plants, which have their own environmental problems. They produce effluent which is more concentrated and toxic than that from pulp mills. Inks and minerals removed from printed waste paper create a yield loss of around 15-35 per cent, which takes the form of a wet sludge, equivalent in volume to about 59 per cent of the waste paper arriving at the plant. This sludge, containing many contaminants such as chloro-organics and heavy metals, must be disposed of (Paper, 1991).

The burden on the environment deriving from paper conversion is growing and the question of disposal of non-recyclable components (printing-ink, plastic, etc.) implies significant difficulty (Annus & Juhasz, 1991).

2.4.2. Small-scale mills in developing countries

Environmental protection in many developing countries is lagging behind due to the large number of small, old and second-hand mills operating without proper waste-water treatment, with low chemical recovery rates and poor air pollution control facilities. Small mills tend to lack the resources and expertise to deal with these problems. The technology developed has been to a large extent geared for bigger units. There is also often a shortage of personnel in the government control body to monitor the performance of numerous small mills.

In pulping based on agricultural residues (straw, bagasse), options for clean operation are more limited due to the specific properties of these raw materials. Consequently it will not, in the immediate future, be possible to reduce discharges as much as with wood pulping.

China, for example, has over 5,300 pulp and paper mills, most of them small or very small. These have an estimated annual effluent discharge of about 15 per cent of the total industrial discharge, and one-third of the total BOD5 discharge. The use of non-wood fibres for 60 per cent of the raw material complicates and limits the recovery of chemicals (Kuang, 1991). Remedial efforts and progress are, however, being made. In China recovery furnaces have been developed for medium-size pulp mills and annually recovered caustic soda increased by 30 per cent between 1982 and 1987. Hindustan Newsprint in Kerala (India) is testing, on a commercial scale, destillation developed jointly by the Central Pulp and Paper Research Institute, India, and UNIDO/ SIDA (Fellegi & Judt, 1991).

In Mexico the technical association of the industry (Asociación Mexicana de Técnicos de la Celulosa y del Papel) have taken the enterprises' lack of resources into
consideration and plan to set up a laboratory for the smaller mills which cannot afford the more sophisticated testing equipment.

In the United States the spotted owl has become a symbol of a much broader debate over the economic impact of state and federal regulations designed to protect the environment and at the same time restricting industrial activity. In 1991 the United States Fish and Wildlife Service, an agency of the United States Interior Department, had initially designated 11.6 thousand acres of federal forest land as critical habitat for the owl. The figure was later revised down to 6.9 thousand acres. The protected forest encompasses federal lands in the states of Washington, Oregon and California, in which logging would be curtailed or severely restricted. By reducing the size of the habitat, the federal Government claims that it will save about 1,000 jobs. The agency estimates that the overall efforts to save the owl were likely to eliminate about 33,000 jobs, but also said that many of these jobs might be lost anyway, because of recession. The Western Council of Industrial Workers, a labour union representing timber industry workers, stated however that the Government was "grossly underestimating" the impact of protecting the owl's habitat. The union claims that more than 100,000 jobs will be lost if the plan is implemented. According to the Wilderness Society, an environmental group, the reduction in protected acreage will lead to a loss of half of the owl's population and destruction of irreplaceable ancient forest (Kehoe, 1992).

2.5. Social and labour dimensions

2.5.1. Employment

Environmental sustainability is a precondition for long-term prosperity and hence job security in the industry. In the short term, market forces and/or legislation can have disastrous effects, particularly where they coincide with many years of neglect regarding environmental performance.

In the former German Democratic Republic, for example, the pulp industry has practically collapsed since reunification, with five out of the seven mills closed down and the two remaining ones fighting for survival (FAO, 1991b). High emissions played a major role in the shut-down. In the former Soviet Union the state bodies responsible for ecological protection, supported by trade union organisations, in 1986 suspended production at the pulp mill in Priozersk on environmental grounds (Korylov, 1991). Small mills in the vicinity of Mexico City may also be forced to close because they cannot cope with the investments for pollution abatement (Pappens, 1990). In other cases anticipated impact on employment is less severe. In Canada envisaged regulations requiring no measurable discharges of dioxin or furan from any pulp or paper mill under the Environmental Protection Act have been estimated to cause a decrease of employment of less than 1 per cent on average (Roberts, 1991).

There is a risk that the cost of cleaning up the effluents, which can be a burden for the industry, may be used unfairly as a pretext for closing mills and decreasing employment opportunities when the real causes are automation and economic recession. Energy-saving measures and waste paper recycling initially forced by environmental requirements often proved in hindsight to be very sensible investments in purely business terms. New business opportunities emerge for the companies involved in producing environmental services, equipment and materials for pollution abatement and control. This market has been identified as one of the fastest growing business sectors for the decade. A growth rate of 5-6 per cent per year is forecast (Paper, 1991). Possible employment effects are also felt in the pulp and paper and associated industries as recycling becomes a major activity and recycled fibre a basis for industrial development in regions with insufficient fresh fibre resources. Established and efficient recycling procedures may also give the paper products a significant edge over competing materials such as plastics.

The risk for environmental dumping, where the mills will be situated in countries with low norms regarding working conditions and environmental concerns is obvious (Garthon, 1990), although international investors may be dissuaded from such practices by various considerations, among them potential damage to their business in other markets. Increasing consumer awareness will make it more difficult to export products if
clean techniques are not being used. Furthermore, pollution abatement costs in newer facilities are a small fraction of the total capital and operating cost. It is much less expensive to build clean technologies in new mills than to modify polluting technologies in older mills. Monitoring of pulp and paper mills is relatively easy and inexpensive. As a result, there should not be as great a concern with the general lack of resources devoted to monitoring in the lesser developed countries (Roberts, 1991). Another problem is the view of some trade organisations that consider environmental legislation as non-tariff trade barriers (Kroesa, 1991).

2.5.2. Working environment

As in a number of other industries the general and the working environment in the pulp and paper sector are two sides of the same coin. Chemicals causing many of the problems for the general environment are also major hazards in the working environment.

Large quantities of chemicals are consumed by the pulp and paper industry. In Sweden alone the industry consumes 2 million tonnes per year, divided over altogether 5,000 different products (PiA, 1990).

A study carried out by the British Columbia Cancer Research Institute - which compared the incidence of cancer among lumberjacks, mineworkers, sawmill workers and workers in the pulp industry between 1950 and 1984 - established that the mortality rate among pulp workers was three times higher than among the workers in the other sectors. Also, in Finland it has been proven that high incidences of several types of cancer appear among workers in paper and pulp mills. Other studies, however, did not find clear evidence for higher mortality rates among pulp and paper workers than in the population at large. A more comprehensive discussion of occupational health problems associated with chemicals is provided in the section on occupational safety and health in this report.

2.5.3. Liability

In some countries there is some evidence that the enforcement of relevant regulations has been tightened. In the United States, the Environmental Protection Agency is very active in monitoring pollution and following up with enforcement measures. In the last eight years there have been 500 convictions with over US$30 million in fines. In Australia directors or employees who are proven to have been negligent will be personally liable, under proposed legislation, for fines of up to US$400,000 and face imprisonment of up to seven years (Paper, 1991).

The possibility of individuals being held personally liable for environmental infractions constitutes a new link between the general and the working environment, and has prompted trade unions in some countries to address these problems. Among others, the Finnish trade union has since the 1980s started to consider issues of environmental protection. In the "Environmental policy report to the congress of the paperworkers' union" in 1985 it stated that "increasing workers' influence is necessitated by the mere fact that in the case of serious environmental offences responsibility is indivisible. Workers can be made legally responsible for environmental offences".

2.6. Scope for tripartite/bipartite action

Environmental problems have traditionally been viewed as a threat by industry, as labour and management often joined forces to fend off demands and regulations. Increasingly, however, it is being understood that the problem is here to stay and that a defensive attitude of the social partners may in the long run be a disservice to the sector and an opportunity wasted. More thought is being given now to the question of how environmental issues can be viewed in a more favourable light, taking advantage of the fact that the sector is based on a fully renewable raw material and that most of its products can easily be recycled.
The areas of mutual interest in the field of the environment for governments, employees and workers are numerous. The scope for tripartite and bipartite cooperation should be obvious. The proposals for bipartite and tripartite action with respect to the pulp and paper industry and the environment and some of the initiatives launched, concern information, technology development, hazard control and training.

2.6.1. Public relations

In many countries and among many groups the pulp and paper industry has a bad public image, whether deserved or not. It also has a problem of credibility. To change this image, information policy is needed which is open and factually based. Already now the environmental record of the industry is far better than its reputation in many cases.

Cooperation between employers and unions in transmitting information to the public might be one way to improve the image and to enhance credibility. This is particularly true in the local communities where pulp and paper mills are based. Employees typically constitute a significant share of the population in those localities and can be very effective communicators. Active involvement of the social partners in developing communication and conflict-resolving mechanisms such as the round tables established in British Columbia could be an even more effective tool (ILO, 1990).

2.6.2. Environmental committees

It should be noted that environmental problems are not only caused by emissions and discharges inherent in the processes and the technology used. According to some studies, "accidental emissions and discharges" sometimes make up as much as 70 per cent of the total (Anonymous, 1985). Accidental emissions and discharges are caused by equipment failure, faulty process control and other disturbances due to human errors. They can be prevented to a considerable extent if the workers have sufficient knowledge and the power to make pertinent decisions.

The creation of environmental committees composed of workers and management could improve the situation. The committees could carry out regular inspections of processes and equipment with a view to identifying and planning the reduction of risks. They could be responsible for the creation and updating of an emergency plan, and could encourage the construction and maintenance of adequate technical facilities for emergency situations.

At the last congress of the Swedish Pulp and Paper Workers Union a motion was advanced requesting the union to work for the right of the local occupational safety representative to stop work in case of heightened risks for emissions and environmental damage. This would have been similar to an existing right for the representative to stop work in case of a threat to safety and health. The motion was ultimately rejected on the grounds that the responsibility would be too burdensome for the local occupational safety representative (Sia, 1990).

2.6.3. Training

In 1988 the Central Organisation of Finnish Forest Industries, the Employers' Organisation of Finnish Forest Industries and the Finnish Paperworkers' Union concluded an agreement on the promotion of communications, training and cooperation concerning environmental protection at the workplace. For employees to become effective communicators and partners in reducing environmental problems emanating from the pulp and paper industry appropriate training is a precondition.

Topics recommended to be included in the programme of local training sessions are: (1) environmental protection for the forest industry in Finland and international comparisons; (2) environmental permits at the employee's own mill and the emission situation; (3) actions taken in disturbance situations and the question of responsibility;
(4) communication regarding environmental issues (ICEF, 1989). The agreement identifies the local occupational safety organisations as the cooperation organisations for environmental protection. The scope of tasks handled by this organisation will thus be expanded beyond its previous restriction to safety issues inside the mill area.

The Finnish Paperworkers' Union has produced a workbook on environmental protection, to be used in local study groups to promote environmental protection. Twenty thousand people, or about half of the workforce, have already participated in the training.

2.6.4. Technology - development and change

Even greater benefits from bipartite and tripartite cooperation could arise in the area of technology development. In many developing countries the installation and development of environmentally compatible technology is urgent, especially for small and medium-size mills. The industries in the major pulp and paper-producing countries which have acquired a large research capacity and knowledge would be able to deal effectively with these issues. There appears to be ample opportunity for cooperation between the industry in industrialised countries and in developing countries as well as with governments and international organisations in the development of economically viable cleaner technologies for small mills as well as in the transmission of knowledge. The India/SIDA/UNIDO project referred to earlier is a promising example.

Trade unions have also urged that they should be more involved in technology development and application in industrialised countries. The 52nd Congress of the Paper and Forest Workers' Federation (FTPF) in Canada emphasised the importance of including the union in the industrial planning of technical and environmental strategies. Furthermore, it stressed the need to reduce chlorine utilisation and emissions of organic chloride compounds and to promote the redeployment of workers into the recycling and de-inking sectors to make up for job losses in the core industry (FTPT, 1991).

Improved environmental performance often comes with improved overall efficiency. Yield-and-waste committees operating in mills in the United States, for example, came up with a number of modifications in technology and processes that reduce energy requirements and chemical inputs, and thus negative environmental impact. Substantial savings have been achieved in the process. Even more might be possible if such committees were specifically to target environmental problems.

2.6.5. Outlook

From the above it appears that there are many ways in which bipartite and tripartite structures could help the sector solve its environmental problems. The pulp and paper industry seems only to have started to explore the ways in which such mechanisms could be put to work. Some companies have taken the bull by the horns. They go as far as consulting environmental groups when developing a new grade of paper.

Given the significance its environmental track record has for the future of the industry and the people it employs, one may expect this to remain a key issue in bipartite and tripartite negotiations and cooperation for years to come. Tripartite structures may well become the motor of an active environmental strategy in the pulp and paper industry, safeguarding the future for all concerned and sparing it more of the sometimes traumatic change that environmental requirements have forced on the sector in the past.
3. Technological and structural change

3.1. Technological change

The last two decades were a bridge that saw traditional methods of pulp and paper production evolve into the "high-tech" era. This progress is evident at all stages of the production chain, from handling of incoming raw materials at the mill, through fibre preparation and the sequences of manufacturing, to the robotised operations of packing, storage and preparation for shipment of finished products. Less visible but equally pervasive changes have taken place in the converting industry. In some countries, such as Australia, converting technology actually evolved more rapidly than that used in manufacturing (ABIE, 1988).

Technological change was manifested both in a range of new or greatly improved products and in new or substantially more efficient processes for making conventional products.

3.1.1. New products

One of the most sweeping developments was the improvement in recycling and de-inking to yield fibres suitable for a wide range of uses in printing and writing, business and household/hygiene papers. Earlier recycled fibre had been mostly restricted to less demanding grades, largely used for packaging.

Since the 1960s there has also been a continuing process of differentiation in printing and writing papers, leading to a wide array of coated and fine paper grades (Ranta et al., 1991). This trend has continued and been further enhanced by technological developments in communications and publishing. The spread of photocopiers, computer printers, desk-top publishing, facsimile machines and other new products created a demand for new specialised papers such as fax-paper and carbonless.

Advances in printing technology and a move to self-service retail outlets for consumer products enhanced the advertising effect of packaging. New adhesive and labelling papers as well as an increase in the demand for packaging paper and board were the result.

New technologies to combine materials, particularly for packaging purposes, turned materials that formerly were rivals of paper for these uses into allies. Composite materials made of paper, aluminium and plastic gained a major share in the packaging market.

Numerous new products have been pioneered locally like ultra-lightweight tissues for pottery post packaging in Japan. Australian converters have developed some innovative packaging concepts which have proved both useful and profitable.

3.1.2. New/improved processes

Most technological change in pulp and paper manufacturing and converting processes has been incremental. Rather than taking radical departures, processes were modified whose underlying principles had been established already in the first half of this century. Change has also been mostly incremental in its implementation. While it is true that a considerable number of greenfield mills have been built, on the whole the modernisation and partial rebuilding of existing equipment, which tends to be less expensive, has been more common (OECD, 1989). The gradual mode of change notwithstanding, the sum of all the steps yielded substantially modified processes with far-reaching implications for the structure of the industry, for the level and the nature of employment, for work organisation, working conditions, human resources and training.
3.1.2.1. Raw material handling and pulp-making

The handling of raw materials such as logs, chips, bark, chemicals, fuel, etc. has been automated to a high degree. High-capacity equipment is available. For example, a new automated wood-handling system installed at a French pulp mill for start-up in late 1992 will be able to process over one million cubic metres of solid wood per year (Paper and Timber, 1991).

In pulp-making the capacity of individual chemical pulp lines and entire mills has grown still bigger (FSAC, 1990a). Daily mill capacities are very high, double or triple the original volumes of the 1960s. An output of 1,000 tonnes per day is not unusual.

Batch digesters are seeing something of a come-back following the development of the "Super Batch" process in Northern Europe. Volumes can be up to 2,000 tonnes/day. Super batch mill projects are presently on the drawing board in Karelia, Russia, and Northern Thailand (Sunds, 1992).

Chemical pulp mills are easily the most capital-intensive link in the production chain. At the same time, however, wholly or partly mechanical pulping methods have been much improved for better quality higher fibre recovery and a wider range of uses. Most of the new pulp capacity in the European Community is from pressurised groundwood (PGW), thermo-mechanical pulp (TMP) and chemo-thermo-mechanical pulp (CTMP) (EEC, 1991). Forty projects worldwide for new mechanical pulp capacity were either under construction or planned for the period 1990-94, 11 of them in Canada (PPI, June 1991).

3.1.2.2. Paper and board-making

The overriding technological changes in paper-making have been those contributing to a major increase of output per paper machine. Many developments were involved, including improved process control and stronger steels able to support wider rolls. Machine speeds have increased to as much as 1,500 m per minute (90 km/h) and roll trim to 10 m; modern paper machines with these specifications can produce 300,000 tonnes per year and more. In Australia the average output size of a paper machine doubled between 1975 and 1985 (ABIE, 1988). The increases in average newsprint machine capacity in Canada, Finland, Sweden and the United States are shown in figure 3.1 below.

There have also been many quality-oriented improvements, including the installation of a top wire on older single-wire machines.

Major advances in process control have been essential in achieving these improvements in productivity and in quality. The automation involved did not start from zero; a paper machine is intrinsically automated at least in the sense that it is a continuous operation. Even today's simplest and cheapest paper machinery has a reasonably advanced level of automatic controls of hands-off operation.

More recent developments in automation of the paper machine take several forms. First is the physical operation of all parts of the machine on a push-button basis for starting and running (mechanical, hydraulic, electrical components). Second is the closed-loop system where sensors monitor variables within certain prescribed limits and make automatic corrections when limits are exceeded. Third is complete computer control ("programmable logic control (PLC)") whereby all operations are linked up in a mill-wide local area network with video monitors and terminals in a central operational headquarters room. Any parameter within the system can be instantly located on colour graphic schematics, covering such items as pressures, speed, time, caliper, moisture, fibre distribution, sheet formation, etc. at given points of the process. Even the production of "X" tonnes of paper of a specific grade can be programmed to meet individual customer requirements. Not yet widely applied, but coming, are computer/sensor networks that will stretch beyond the production process proper to encompass maintenance, marketing and input purchases (Ranta et al., 1991).
Functions that are downstream from the paper machine - including the winding of paper rolls, rewinding, super calendering, coating, sheeting and packaging - have also been equipped with electronic quality control systems. Among the above, on-line/off-line coating techniques have been an area of active technological development.

While there are many specialised technical points in board-making, the above comments on paper-making by and large apply to board as well.

3.1.2.3. Paper converting technology

The two most significant changes in the converting sector concern equipment speed and the integration of former sequential steps and machines into single, multiple-function lines.

The speed of converting equipment has risen by an estimated 10-15 per cent on average over the past 15 years, resulting in increases in machine output. These increases in the speed of the converting line have been achieved without sacrificing quality and consistency of product. The use of automation and computers has increased machine reliability, enabled products to be changed more rapidly, provided closer control over material waste, improved inventory, allowed quick order fills to be calculated, and generally allowed the introduction of "just-in-time" deliveries. Quality control has also been automated.

More significant for labour productivity has been the closure of the "technology gap" between the sophisticated production technologies and those used in packaging. In addition, many product-specific changes took place. Some of these led to substantial reductions of required labour input. Examples are the automation of die-making in box production, cold-dry gluing in corrugated box making, automatic palletting in carton manufacture, and CAD-CAM applications in folding box design and manufacture.
3.1.3. Factors driving technological change

Technological change in the pulp and paper industry is driven by a set of interrelated factors including customer requirements, competition, cost and quality considerations, consumer preferences and legislation. All of the above apply to practically all industrial sectors. There is, however, a pulp-and-paper-specific turn to many of them.

Consumer preferences and legislation are having a major impact on technology development and application with respect to environmental protection and waste avoidance/recycling. These aspects are discussed in Chapter 2 of this report.

Customer requirements have become very stringent particularly with respect to consistent product quality, but also as regards flexibility in the range and delivery schedules of custom-made products. Many of these requirements are themselves a result of technological change in the printing, converting and packaging industries.

Paper and board face stiff competition from other materials, but there is also very intense competition between the producers within the sector. Pulp, paper, board and converted products are internationally traded products. The world market dictates prices for most commodity paper products (OECD, 1989). Even for converted products, where unfavourable volume/weight-to-value ratios limit shipping distances, international competition is intensifying. In the European Community, for example, mass products in conversion for which the price is the only selling point are increasingly imported from outside (EEC, 1991). In the face of this competition, new technology has often been seen as the best way to cut cost and improve process yield and efficiency.

Many industry observers expect that "quality" will become the buzz-word of the 1990s in the pulp and paper industry (Pearson 1991). The reasons for that are not only consumer requirements, as mentioned above, but also attempts to move into higher value-added products, where quality brings distinction and price premiums.

An added dimension affecting many of the factors mentioned above is that pulp, paper and board-making, and some converting processes, are subject to big economies of scale. For initial investments in equipment, unit cost of output falls as the capacity of the installations rises. This fact has provided much of the incentive for the huge size and capacity in most new machines and mills. The cost of operation and maintenance in relation to output also declines as capacity increases, since it depends more on the number of parts in a pulp line or paper machine than on the overall size and capacity.

Most of the technology for this sector is produced by a fairly small number of machine manufacturers operating globally. Moreover, most of the technical and economic advice at the planning and design stages is provided by a handful of international consulting and engineering firms. State-of-the-art technology is, therefore, available to anybody able to put up the money.

3.2. Structural change and globalisation

The structure of the sector has changed rapidly over the last ten years in most parts of the world. Three trends are discernible: integration, concentration and globalisation.

3.2.1. Integration

Largely driven by value-added strategies, but also by attempts to extend raw material supplies and market shares, both upstream and downstream integration have been taking place. Upstream moves have occurred as paper producers moved to acquire forest resources in Australia, Canada, Finland and elsewhere. In many cases this involved the take-over of saw mills, but the main motive was access to the forest lands/concessions, hence the fibre belonging to them, rather than the wood processing activity.
Paper producers have also made upstream acquisitions in order to assure their sources of pulp for newsprint, graphic and hygienic papers (OECD, 1989; IG Medien, 1985). A good example of integration of pulp and paper mills driven by value-added strategies is provided by Sweden and illustrated in figure 3.2. By 1990 virtually all pulp capacity was absorbed by domestic paper manufacturers.

Figure 3.2. Sweden: Pulp and paperboard production, 1960-90

In the United States and Canada 76 and 66 per cent respectively of all pulp capacity was in integrated mills at the end of the 1980s (OECD, 1989). Further investments in this direction are likely in order to secure supplies of recycled paper as it becomes an ever more important raw material. Some paper and board mills exist to supply specialised self-owned (captive) converting operations, e.g. corrugated-case-making plants.

Downstream integration occurred as producers acquired holdings in converting, printing and especially distribution. Some newsprint mills are owned by national newspapers (such as in the United Kingdom), which handle the converting and printing functions totally in-house. In some cases it is hard to distinguish between conversion and primary manufacture. In the United States about 75 per cent of corrugated-case-making is captively owned by paperboard mills, although not necessarily on the same site, which makes a comparison with other-product mills difficult. Folding box production involves a substantial and growing printing component.

Paper and board mills are generally not increasing their in-mill converting operation, beyond the need to produce a suitable primary or semi-finished product for onward sale. However, there has been an increase in primary coating and in sheeting in mills supplying communication-grade papers. This activity has clawed back much of the business which was previously handled by independent sheeters who would buy bulk reels and locally sheet for regional distribution. One reason for this action by mills, typically Finnish and Swedish, has been their acquisition of distributor outlets (merchants and stockist distributors in the fine printing sector, e.g. photocopier supplies). A similar trend is observed among Italian paper producers (OECD, 1989). As a result of these developments the dividing lines between paper making, converting and printing are increasingly blurred.
3.2.2. Concentration

The trend towards concentration, i.e. the horizontal expansion of companies, notably through take-overs of companies operating in the same part of the production chain, has been stronger than that towards integration. The driving forces here are intimately linked to the economies of scale inherent in much of the new technology, to the enormous financial burden investments in such technology represent and to an implied need for access to global markets.

High-capacity mills and machines are most efficient on long production runs turning out large quantities of only a few grades of paper. The demand by customers for a whole range of products is then accommodated by a division of labour among several very large machines and mills all belonging to the same company and all benefiting from economies of scale.

The trend in this direction has been very clear. In the European Community, for example the share of large paper mills in total output has been rising dramatically (e.g. by 6 per cent in 1989). The 100 or so mills with an annual capacity of more than 100,000 tonnes now represent some 10 per cent of the production units, but between them account for 40-45 per cent of European Community production. With the share of large mills expanding, there were 947 paper and board mills left in 1989, down 22 per cent from 1980 (EEC, 1991). In Japan more than one-third of the pulp and paper mills disappeared between 1963 and 1990 (Japan Paper Association, 1991). The trend was similar in paper conversion, involving much larger numbers of smaller mills.

Parallel to the reduction in the number of mills, the number of companies declined in many countries at a faster rate than the number of mills. As a result, concentration rose significantly. Figure 3.3 shows trends in the share of total output controlled by the top five and top ten producers of pulp, paper and board in Japan. In the United States one in five pulp, paper and board companies disappeared between 1975 and 1989 (OECD, 1989). The ten largest producers of containerboard in North America accounted for three-quarters of output in 1987 (Kalish, 1990). In Australia eight companies produce virtually all pulp and paper and the overwhelming portion is accounted for by only three of these (OECD 1989).

Concentration was perhaps most spectacular in Northern Europe. In Finland and Sweden mergers and acquisitions left only four world-class companies in each country. In practically all cases total output of the merged units rose sharply through the 1980s. Most of the investment for the expansion came from companies that were large already.

As shown in figure 3.4 for the United States the average establishment employs only 100 people. The average converting establishment has a workforce of about 80. In manufacturing there are 230-430 employees per establishment on average. None the less, employment is already concentrated in the larger units. Most paper makers are in mills with more than 1,000 employees.

Pulp, paper and board manufacturing industries have been much more prone to concentration than the converting industry, especially in the European Community and Northern Europe.

Concentration is in some cases higher than the number of companies would suggest, because large enterprises may be structured as a network of legally independent firms. This is the case, for example, in the converting sector in Germany, which at first glance appears to be characterised by small average firm size (IG Medien, 1985).

Concentration levels can also be high in developing countries because the sector is relatively small, and one or a few mills may provide the bulk of production, as in Kenya (Ikiara, 1992). This concentrated structure has often been perpetuated even where the sector has expanded in recent years, as in Brazil or Chile. In yet other countries concentration evolved over time. In Mexico, for example, three to four companies account for 75-80 per cent of output in printing and writing papers (Pappens, 1990).
Figure 3.3. Japan. Share of total output of pulp, paper and board by the top five and top ten paper companies, 1990


Figure 3.4. United States. Average number of employees per establishment in paper and allied industries, 1989

The economic effects of high levels of concentration in national markets depend on the extent to which those markets are open to international competition. This is related to the third observable structural trend, globalisation.

3.2.3. Globalisation

The 1980s have not only seen accelerated concentration on a national scale. More and more, the intense merger and acquisition activity in the sector has involved transactions across national borders and continents. The search for access to foreign markets as well as to cheap fibre provided the major push in this direction. Pulp producers have moved south (southern United States, South America and tropical Asia) to take advantage of abundant, low-cost fibre produced in fast-growing plantations. Bio-engineering and intensive management boosted the already significant growth advantage in southern regions even further.

The desire for access to foreign markets, or the fear of being denied such access as a result of emerging trade blocs, played a much bigger role. It has been particularly visible in the European Community ever since a Swedish pulp and paper maker bought a large British company in 1980. In the years that followed all large Northern European pulp and paper makers acquired strong footholds in the EC to ready themselves for whatever “Europe 1992” might mean for foreign trading partners. The most spectacular take-over was that of the German Feldmühle Nobel, the largest paper maker in the European Community by Stora, a Swedish multinational. There have also been investments in the EC coming from outside Europe, for example, from New Zealand and particularly from the United States (EEC, 1991). The market for hygienic papers, for example, is now dominated by a few United States and Northern Europe-based corporations.

As a result, more than 20 per cent of the capacity of Finnish-owned pulp and paper makers is now located outside Finland. In France, the United Kingdom and Canada, over 30 per cent of the companies are foreign owned. Between the Australian and New Zealand industries there are numerous ties through cross-holdings. Finally, Japanese pulp and paper manufacturers have recently acquired mills on the North American continent (OECD, 1989).

Many of these international mergers and acquisitions involved companies that were already among the largest in the sector. Fully one-third of the 100 biggest pulp and paper companies in 1974 no longer existed or had merged with others by 1990 (Kalish, 1990).

Between 1986 and 1990 the top 150 producers worldwide saw their sales increase by 60 percent and the value of their assets more than double. As can be seen in figure 3.5, the share of world paper and board output of the top 150 producers rose to 64 per cent in 1990, that of the top ten producers alone to 28 per cent. Significantly, their share in world employment is much lower (about one-third in 1990 for the top 150, 12 per cent for the top ten) and, in absolute terms, actually fell in 1989-90.

The intensity of restructuring in Europe is reflected in a listing of the top 150 by the ascent of three European companies into the top ten, previously exclusively made up of North American corporations. Another significant feature is the appearance and upward movement on the list of Far Eastern and South American companies in recent years (Matussek and Pearson, 1991).

As can be seen in the listing of the top 20 pulp and paper companies below (table 3.1), the largest produce more than the entire industry in most countries, including those with a good size industry.

The above trends look likely to continue and perhaps even accelerate as growth temporarily slows down. Particularly in Europe, where family-owned businesses are still numerous, more consolidation is to be expected. More American and European producers are likely to move commodity production into low-cost-fibre, low wage-cost countries in the south. The opening up of Eastern Europe may widen the range of geographical options (Matussek and Pearson, 1990, 1991).
Figure 3.5. World share in total paper and board output by top ten and top 150 companies, and employment in the top 150 companies, 1991

Table 3.1. The million-tonners' club (top 20), 1991

<table>
<thead>
<tr>
<th>Company name</th>
<th>Headquarters (country)</th>
<th>Paper/board output (1,000 tons)</th>
<th>Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. International Paper</td>
<td>United States</td>
<td>9 253</td>
<td>69 000</td>
</tr>
<tr>
<td>2. Stone Container</td>
<td>United States</td>
<td>6 756</td>
<td>32 300</td>
</tr>
<tr>
<td>3. Georgia-Pacific</td>
<td>United States</td>
<td>6 259</td>
<td>63 000</td>
</tr>
<tr>
<td>4. Stora</td>
<td>Sweden</td>
<td>4 520</td>
<td>69 700</td>
</tr>
<tr>
<td>5. Champion International</td>
<td>United States</td>
<td>3 861</td>
<td>28 500</td>
</tr>
<tr>
<td>6. Weyerhæuser</td>
<td>United States</td>
<td>3 441</td>
<td>40 621</td>
</tr>
<tr>
<td>7. James River</td>
<td>United States</td>
<td>3 400</td>
<td>38 000</td>
</tr>
<tr>
<td>8. Boise Cascade</td>
<td>United States</td>
<td>3 270</td>
<td>19 810</td>
</tr>
<tr>
<td>9. Joju Paper</td>
<td>Japan</td>
<td>3 035</td>
<td>7 341</td>
</tr>
<tr>
<td>10. Jefferson Smurfit Corp.</td>
<td>United States</td>
<td>3 000</td>
<td>-</td>
</tr>
<tr>
<td>11. Oij Paper</td>
<td>Japan</td>
<td>2 872</td>
<td>6 074</td>
</tr>
<tr>
<td>12. Daishowa Paper</td>
<td>Japan</td>
<td>2 728</td>
<td>5 029</td>
</tr>
<tr>
<td>13. Scott Paper</td>
<td>United States</td>
<td>2 700</td>
<td>30 800</td>
</tr>
<tr>
<td>14. Fletcher Challenge</td>
<td>New Zealand</td>
<td>2 568</td>
<td>40 000</td>
</tr>
<tr>
<td>15. Enzo-Gutzeit</td>
<td>Finland</td>
<td>2 550</td>
<td>15 974</td>
</tr>
<tr>
<td>16. Temple-Inland</td>
<td>United States</td>
<td>2 519</td>
<td>-</td>
</tr>
<tr>
<td>17. Kymmene</td>
<td>Finland</td>
<td>2 511</td>
<td>17 567</td>
</tr>
<tr>
<td>18. Jefferson Smurfit Group</td>
<td>Ireland</td>
<td>2 480</td>
<td>32 611</td>
</tr>
<tr>
<td>19. Svenska Cellulosa</td>
<td>Sweden</td>
<td>2 470</td>
<td>30 139</td>
</tr>
<tr>
<td>20. Noranda Forest</td>
<td>Canada</td>
<td>2 325</td>
<td>24 000</td>
</tr>
</tbody>
</table>

3.2.4. Social and labour implications of structural change

These structural changes, particularly the trend towards globalisation, already do or may well in the future affect labour in at least three respects: employment, working conditions and labour's bargaining position.

Restructuring is to a significant extent the result of technological change, but in turn it accelerates the introduction of modern and very large production facilities. The repercussions on employment levels are discussed in detail in Chapter 4 of this report. A further effect is to loosen the ties between corporations and individual mill sites or even entire branches of production. In many cases mergers and acquisitions are followed by "streamlining" and concentration on "core business". Mills and plants outside the core change hands once more or are closed down. In yet other cases mills peripheral to a corporation's interest are starved for investment and are shut down after some time when they are no longer competitive. The commitment to individual establishments is reduced further by the fact that many of the major international corporations are diversified concerns in which paper is only one, albeit usually the most important, field of activity (Matussek and Pearson, 1991).

While employment security is often reduced, career prospects for individual workers may be brighter in large and expanding firms. Greenfield mills and new machines are often manned with experienced workers from older mills in the same corporation, providing opportunities for fast-track promotion.

Internationalisation also means a certain transplanting of management cultures and styles of labour-management relations. There does not seem to be a clear trend. Some companies with strong commitment to union participation at home try to avoid unions abroad if they can. Others pursue the same policy of union involvement as at home, even if unions do not play a major role in the host country.

On the whole, the mounting size of many corporations would seem to weaken labour's bargaining position. The information gap, already substantial in many medium-sized companies, widens enormously in the case of multinationals with dozens of mill sites spread over several continents. The possibility afforded to management of obtaining concessions from labour in return for investments in a particular site, or even the (possibly implicit) threat of social dumping, i.e. relocation of production to countries with lower wages and social security charges, may put union negotiators in a difficult position.
4. Employment and productivity

4.1. World employment in the sector and its relative importance

Worldwide the sector employs some 3.5 million people. This estimate is on the low side since for many countries no figures on the numerous small-scale converting establishments are available. The figure also does not include upstream employment in forestry or other fibre production industries. Employment in raw material production can be substantial, particularly in countries with modest rates of mechanisation in forestry. In Brazil, for example, pulp and paper-related forestry employs an additional two workers for every three in the pulp and paper industry proper.

The sector also generates considerable employment spin-off in the economy at large. In Canada there were 2.2 jobs outside the sector for every job in the pulp and paper industry in the late 1970s. This was one of the highest spin-off factors in Canadian industry (Employment and Immigration Canada, 1987).

Employment is heavily concentrated in a few countries. China and the United States alone account for just under half of estimated world employment in the sector (see figure 4.1).

Figure 4.1. The number of employees in the paper and allied industries, selected countries, late 1980s

Sources: ILO Year Book of Labour Statistics, 1991, for manufacturing and total employment; and various sources listed in the bibliography.

Between them the industries in the 15 countries represented at the meeting employ about 2.88 million persons, i.e. some 80 per cent of world pulp and paper employment.

As can be seen in table 4.1, the relative importance of the sector is highest in three countries with a relatively modest pulp and paper workforce. In Canada, Finland and Sweden the pulp and paper industry accounts for between 6.6 to 8.7 per cent of
manufacturing employment and 1 to 1.8 per cent of all employment, underpinning the significance of the sector for the economy in these countries.

In the major industrialised countries with diversified economies such as France, Germany, Japan and the United States it is still a substantial employer. The "diluting" effect of the many other sectors notwithstanding, pulp and paper in these countries provides between 1.9 and 3.3 per cent of manufacturing employment, and between 0.4 and 0.6 per cent of all employment.

Table 4.1. Employment in pulp and paper manufacturing and conversion and share of total employment, 1991

<table>
<thead>
<tr>
<th>Country</th>
<th>Employment in pulp and paper</th>
<th>Year</th>
<th>Share of pulp and paper as a percentage of:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Manufacturing employment</td>
</tr>
<tr>
<td>Australia</td>
<td>22 500</td>
<td>1987/88</td>
<td>1.9</td>
</tr>
<tr>
<td>Brazil</td>
<td>80 600</td>
<td>1989</td>
<td>0.9</td>
</tr>
<tr>
<td>Canada</td>
<td>131 000</td>
<td>1990</td>
<td>6.6</td>
</tr>
<tr>
<td>Chile</td>
<td>7 540</td>
<td>1990</td>
<td>7.1</td>
</tr>
<tr>
<td>China</td>
<td>807 300</td>
<td>1990</td>
<td>2.4</td>
</tr>
<tr>
<td>Finland</td>
<td>45 410</td>
<td>1990</td>
<td>8.7</td>
</tr>
<tr>
<td>France</td>
<td>90 300</td>
<td>1989</td>
<td>2.0</td>
</tr>
<tr>
<td>Germany</td>
<td>161 686</td>
<td>1990</td>
<td>2.2</td>
</tr>
<tr>
<td>India¹</td>
<td>290 000</td>
<td>mid-1980s</td>
<td>4.7</td>
</tr>
<tr>
<td>Japan</td>
<td>278 000</td>
<td>1988</td>
<td>1.9</td>
</tr>
<tr>
<td>Kenya</td>
<td>5 403</td>
<td>1987</td>
<td>3.2</td>
</tr>
<tr>
<td>Poland</td>
<td>45 800</td>
<td>1989</td>
<td>1.0</td>
</tr>
<tr>
<td>Sweden</td>
<td>39 500</td>
<td>1990</td>
<td>8.0</td>
</tr>
<tr>
<td>USSR</td>
<td>177 618</td>
<td>1990</td>
<td>0.5</td>
</tr>
<tr>
<td>United States</td>
<td>699 300</td>
<td>1990</td>
<td>3.3</td>
</tr>
</tbody>
</table>

Total 2 882 000 (15 countries)

World total 3 500 000 (1987-90 estimate)

¹ Pulp and paper manufacture only.

Sources: ILO Year Book of Labour Statistics, 1991, for manufacturing and total employment; and various sources listed in the bibliography.

In the countries with less homogeneous industrial and employment structures the sector has a significant share in manufacturing employment: India (4.7 per cent), Kenya (3.2 per cent), China (2.4 per cent) and Australia (1.9 per cent). Only in Brazil and the former Soviet Union does the sector account for less than 1 per cent of manufacturing employment.

4.1.1. Manufacture and conversion

In countries that are both big producers and big consumers of pulp and paper products, conversion typically provides twice the number of jobs found in pulp and paper manufacture, as shown in figure 4.2. In Japan the ratio is three to one. In countries where exports are high compared to domestic consumption, the relation tends to be reversed, because converted products are sensitive to transport cost and therefore represent a small fraction of total production. Canada, with 73 per cent of employment in pulp, paper and board manufacture (see figure 4.2), is a case in point.
Looking more closely at the two subsectors in diversified pulp and paper countries like the United States and Japan it appears that box makers and paper mills are the two largest employers, accounting between them for about two-thirds of employment. Most other converting employment is spread over a variety of different industries (see figure 4.3).

While pulp and paper manufacture typically is a capital-intensive activity, this is less true for conversion. Production values per employee and year in Japan in 1988, for example, were 37 million yen in manufacturing against only 21 million yen in the converting industries (Japan Paper Association, 1991). Similarly, in the European Community in 1988 the production value of pulp, paper and board manufacture was 148,000 Ecu/employee/year against 108,000 Ecu/employee/year in conversion (EEC, 1991). Within the converting sector there are major differences too. In terms of technology and machine size, corrugated board mills can be very similar to paper mills, while makers of highly customised products operate much smaller facilities involving lower capital investment per unit of output and per employee.

Both pulp and paper manufacture and conversion tend to be more capital intensive than manufacturing industries on average. In Japan, for example, value added per employee is more than 10 per cent higher in pulp and paper than in the average for all manufacturing (Japan Paper Association, 1991).

4.2. Technological change and employment in the pulp and paper industry

Table 4.2 suggests that there is no general trend in the development of employment levels in the sector. There has been hardly any change at all in the international totals. For some individual countries and regions, however, changes have been dramatic. On the positive side there appear to have been major expansions in employment volumes in China (+44 per cent) and Kenya (+50 per cent) over the last decade, at annual rates of 3.7 and 4.1 per cent respectively. In some countries, such as the United States, Mexico and Germany,
changes were modest. In eight of the 12 countries, however, substantial reductions in employment took place over the last five to ten years, ranging from -5.7 per cent in Sweden to almost -18 per cent in France, corresponding to annual losses of 0.5 to 2.0 per cent. In the member countries of the European Community 125,000 jobs disappeared over the last decade.

The two subsectors of manufacture and conversion have not been affected equally. The brunt of the losses was taken by the pulp, paper and board manufacturing mills in most of the countries for which data are available. In France (like in the European Community as a whole) fully a quarter of all manufacturing employment vanished. The full significance of these numbers only becomes clear when one recalls that the reference period during which these losses were incurred was one of unprecedented boom years for the sector, with a sustained increase in output and new, record levels of production year after year (see Chapter 1).

Figures 4.4a, 4.4b and 4.4c illustrate the two inversed trends for production and employment for three countries affected to varying extents. In the United States total employment levels fluctuated but, on the whole, did not fall.
Table 4.2. Changes in employment ('000) in the pulp and paper industry for selected countries, 1978-90

<table>
<thead>
<tr>
<th>Country</th>
<th>Period</th>
<th>Pulp, paper and board manufacture</th>
<th>Paper and board conversion</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>('000)</td>
<td>('000)</td>
<td>('000)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>Total</td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2-1)</td>
<td>(2-1)</td>
<td>(2-1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
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<tr>
<td>Australia</td>
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<td>1987/88</td>
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<td></td>
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<td>24.6</td>
<td>22.5</td>
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<tr>
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<td>1978-90</td>
<td>97.0</td>
<td>96.0</td>
<td>-1.0</td>
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<td>China</td>
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<td>807.3</td>
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<td>1980-89</td>
<td>225.9</td>
<td>173.0</td>
<td>-23.4</td>
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<td>Finland</td>
<td>1985-90</td>
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<td>48.3</td>
<td>45.4</td>
<td>-6.0</td>
</tr>
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<td>1980-89</td>
<td>36.4</td>
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</tr>
<tr>
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<td>1980-90</td>
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<tr>
<td>Japan</td>
<td>1978-88</td>
<td>85.8</td>
<td>66.1</td>
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<tr>
<td>Kenya</td>
<td>1978-87</td>
<td>3.6</td>
<td>5.4</td>
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<tr>
<td></td>
<td>(1989)</td>
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<tr>
<td>Mexico</td>
<td>1981-90</td>
<td>33.5</td>
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<td>United States</td>
<td>1978-90</td>
<td>267.4</td>
<td>245.3</td>
<td>-8.3</td>
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(1) = Employment at beginning of period in thousands ('000).
(2) = Employment at end of period in thousands ('000).
(2-1) = Change in employment from beginning to end period in per cent.
(2-1/4) = Annual rate of change (2-1) in per cent.
Figure 4.4a. Sweden: Employment versus production in the pulp and paper industry, 1985-90


Figure 4.4b. United States: Employment versus production in the pulp and paper industry, 1980-90

Source: United States, Dept. of Commerce, Bureau of Economic Analysis.
4.2.1. Productivity versus output

It is clear that in most countries productivity gains outpaced even the swift growth in output the sector experienced during the 1980s. (Most of the data presented in this section are in terms of physical productivity per work-year rather than per work-hour. For want of data it was not possible to single out the effect of reduced working hours per employee in most countries.)

Countries with particularly high increases in productivity include France (+6 per cent per year in paper and board mills, +7 per cent in pulp mills, 1980-89) and Finland (+10 per cent per year, 1982-89). Productivity increases in Finland in recent years are up sharply from those in earlier years. During the period 1974-82 productivity only rose 30 per cent, i.e. about 3 per cent per year. Sweden, Germany and Japan recorded smaller, but still substantial productivity gains of 3.2, 4.4 and 5 per cent per annum respectively. For the United States productivity increases in the sector from 1980-90 averaged 2.2 per cent annually (United States, 1991). More modest rates were found in China (+1.6 per cent per year, 1980-90).

All other things remaining equal, output changes minus productivity change per employee equals the change in the number of employees as illustrated for the German pulp, paper and board manufacturing industry, 1981-90 in figure 4.5 below.

Generalisations across subsectors and products are difficult to make. While in France productivity in pulp outgrew that in paper and board, the reverse was true for Japan. In that country board manufacture had higher productivity growth (6.8 per cent per year, 1980-90) than for pulp (4.1 per cent) and paper production (4.9 per cent) over the same period.

Such trends are not necessarily durable for any given subsector as can be seen in figure 4.6 for the United States. Productivity growth was highest for box manufacture in 1973-79, while this subsector recorded much lower rates in 1979-90, when pulp, paper and board mills were experiencing accelerated productivity gains.
Productivity changes are not a continuous process either, as the longer-term averages may lead us to believe, but subject to rather strong fluctuations. The German pulp and paper manufacturers, for example, experienced productivity growth of only 1.5 per cent in 1985 after an 11.6 per cent jump in 1984. Increases tend to be most pronounced as production rises during the upswing of the business cycle and a reduced workforce coincides with high capacity utilisation rates of modernised equipment. A continuous process of productivity improvement through underlying technological change is thus masked by a superimposed pattern of demand fluctuation. Employment levels quickly drop as output stagnates or falls and follow with a certain time lag as demand picks up again. During the ensuing boom period all of the increased production capacity can be operated profitably and new capacity is added. As demand falls below capacity, a shake-out takes place during which older and less cost-effective facilities are shut down.

Figure 4.5. Germany: Productivity, output and employment in pulp, paper and board manufacturing, 1981-90
Productivity development in the converting industries was brought about by less visible, but equally profound, technological change. Both in the United States and in Germany productivity gains were very significant in late 1970s and early 1980s. Annual output per working hour in the United States box-making, for example, grew by 3.7 per cent a year, outpacing manufacturing (United States, 1991). In Germany average increases were in the order of 5 per cent per employee-hour in 1975-84.
In more recent years, however, gains have slowed down in the conversion industry in both countries. In the United States productivity growth dropped to 0.6 per cent for fibre boxes. German converting productivity grew by about 4.0 per cent in 1985-91. On a per-employee basis German paper converting productivity increased by only 4.6 per cent from 1975 to 1984, and by 2.4 per cent from 1985 to 1990.

The latter figure illustrates the buffer function of working hour reductions as far as the direct impact of productivity development on the number of employees is concerned. As pointed out by the German paper conversion trade unions, the number of employees rose from 114,200 to 119,600 between 1980 and 1990, while the number of working hours fell from 195 to 186 million per year over the same period. Without reductions in working hours per employee, productivity gains over and above output expansion would have translated into employment losses (I.G. Medien, 1992). Like rapid demand growth for the subsector’s products, working time reductions have been an important cushion, helping to absorb the impact of productivity leaps.

4.2.2. A micro-perspective on productivity and employment

Looking at the longer-term macroeconomic indicators for productivity and its impact on employment, the development appears fast in some cases, but on the whole not dramatic. The full scope of technological change only becomes apparent when new facilities are directly compared to old ones. In many cases new mills or older ones that have been rebuilt require only half the workforce of the older ones.

An integrated mechanical newsprint mill commissioned in France in 1991 produces about 700 tonnes of pulp and paper per employee-year. The average for the industry in France is 326 tonnes per employee-year. A modern chemical pulp mill in Finland - allegedly the one with the highest labour productivity in the world - requires 1.2 work-hours per tonne of pulp. This translates into 1,600 tonnes of pulp per work-year. The average Finnish pulp mill needs 2.2 working hours to produce a tonne even though the average mill is only a few years older than the one cited above.

It is worth noting that figures in some developing countries are at about the same level. A pulp mill under construction in Chile at the moment is rated to produce 350,000 tonnes of pulp per year with a mere 200 employees, i.e. 1,750 tonnes per work-year. A similar mill only a few years older “only” produces 1,125 tonnes/work-year, i.e. 56 per cent less.

After extensive rebuilds in the late 1980s the most productive linerboard mill in the United States now uses 1.7 work hours per short tonne. The country average is 3 hours, not quite twice as much.

Modern pulp and paper mills are conspicuously devoid of people. The giant halls and installations look pretty much like unmanned factories.

Average employment trends in the sector are not very relevant for the employees of old mills forced to close down by the competition from newer, greenfield facilities or modernised mills. For these employees the change is not gradual, but instantaneous, implying a nearly total loss of local employment opportunities. With mills often spread out and in isolated locations, the impact of a mill closure on the workforce and the local community is dramatic. They are often the only major employer in the area. Chances of redeployment or relocation for the employees are therefore slim.

The case of old mills closing down most clearly illustrates the dilemma for employment in this sector as in most others. The choice facing workers and trade unions is: join in, help to improve productivity and lose some employment, or don’t - and risk losing all.
4.3. The outlook for employment

The short-term outlook for employment is rather gloomy in a number of countries. As output growth in the sector slowed down considerably in 1990 and 1991, and actually declined in some regions and for some products, companies started to shed labour. Market pulp and newsprint producers have been among those hardest hit. With the general economic slowdown affecting more countries, and the recession turning out to be deeper and longer than expected in others, sluggish paper markets and hence further reductions in the workforce are on the cards.

Medium and longer-term prospects are a lot less clear. If previous experience is anything to go by, John Garland’s statement about forecasters may apply: "Those who make predictions about the future will have to eat glass ground from crystal balls".

An example of how far out forecasts can be is a study on employment in the paper conversion industry in Germany commissioned by the Government in the early 1980s. It concluded that by 1990 only 85,000 employees would be left in the industry (IG Medien, 1985). In the event the number was 111,000. It is obviously easy to be clever with hindsight, and all the example does is to illustrate the complexity of the endeavour. Moreover, the German study contained a caveat. It was based on the explicit assumption that there would be no reduction in working hours. In fact, the working week was shortened from 40 to 37.5 hours.

This reduction in itself does not explain the strong deviation from the predicted trend. It does, however, point to an important employment buffer and to the fact that forecasts can be wrong and still be useful and beneficial. Rather than becoming self-fulfilling prophecies, forecasts can demonstrate what will happen if present trends are simply extrapolated. This often prompts the actors to change some of the parameters. It is with this in mind that some of the important parameters are reviewed in the following.

At least four factors will have a direct bearing on future employment levels in the sector: (i) demand for the products; (ii) technological change; (iii) the balance between production factors; and (iv) working time.

All studies of long-term trends concur that demand for, and hence output of, pulp and paper will continue to grow - and so far these predictions have been borne out by the facts (see Chapter 1 of this report). Growth levels in terms of tonnage will, however, be well below historic rates of increases in productivity in many regions, notably the industrialised countries.

An OECD study (1989) expects productivity gains to slow down as well. This is not at all certain. The capacity created by investments during the boom years of the 1980s now coming on stream will probably force a shake-out and push up average productivity.

It is argued that in some areas logistical and technical limits are being reached, for example in paper machine trim and speed. Even if this were so, one must bear in mind that the average installation in the industry is considerably less productive than the state-of-the-art. For many technologies penetration rates are not very high yet. Productivity gains associated with modernisation and rebuilds are not much lower than those in greenfield mills. In countries where the average age of equipment is high the impact can be massive.

The spending spree on new investments during the 1980s has left many of the technological frontrunners laden with debt and in a difficult financial position. There may be less readiness or ability for major capital investments in the future. Even then, productivity increases may continue more or less as in the past. Examples demonstrate what can be achieved by regular and not very costly technological improvements, coupled with organisational learning and more efficient work organisation (see Lilja, 1989).

The cost of capital equipment has risen very slowly in the past (OECD, 1989) and for computers it is actually falling fast. This puts applications within reach of small users such as in the converting sector.
Some of the technological gaps of the past are also being closed. They concerned mostly peripheral activities such as handling, packaging and transport. Automated lines are available now that no longer require manual interventions. For some of the labour-intensive, but also very repetitive operations, robots are being tested (Sifaoui, 1991). Technology is making in-roads into areas like paper testing and administration too. These are areas that have so far been largely spared by rationalisation.

On the other hand there are technological changes and new developments favouring smaller economic unit sizes and thus relatively higher employment intensities. Examples are organo-solvent pulping and, even more so, agricultural residue pulpers (Plan, 1991).

As regards the balance between production factors, it has been pointed out that longevity of equipment is a characteristic of the paper manufacturing industry as well as of the converting industry (ABIE, 1988). Paid-off machines can continue to run profitably for a long time. In many cases the resilience of old machines and of old mills depends on the mill’s ability to identify and occupy a niche in the market where it avoids direct competition with more modern producers.

Under the conditions of niche markets with more specialised and customised products that generate higher value-added than commodity grades, a different operating rationale applies. Flexibility, short lead times from development to marketing of new products, and high quality are more important than rock-bottom unit cost. In such mills labour costs may amount to as much as 30 per cent of total production cost and yet the company may be perfectly competitive. Ironically, in spite of the higher overall manning levels, such mills are much more in line with the notion of lean production than many of the capital-intensive giants. The organisation tends to be flatter - even at the mill level - and decision-making is more decentralised. The additional staff tends to be viewed and used more as a human resource, in support as well as in production functions.

Even for commodity products, rationalisation efforts aiming at a reduction of labour cost may be approaching a point where marginal returns to additional investment are diminishing fast. Wage and salary costs have been falling relative to total turnover, as can be seen in figure 4.7 for paper manufacture and conversion in Germany. In manufacturing, labour costs represented 13.6 per cent of turnover in 1989, down 35 per cent from its 1975 level. In conversion the decline was slower, but here too labour costs amounted to less than 19 per cent of turnover in 1990 (HPV, 1991).

Figure 4.8 shows a similar pattern even for the typical commodity products - market pulp and newsprint paper. In the four countries surveyed, labour represents between 9 and 20 per cent of the cost of pulp and between 12 and 27 per cent of the cost of paper.

There has been a technology and labour-saving bias in the past when it came to rationalisation. Other inefficiencies in the process received a lot less attention. All this would suggest that further cuts in employment have to do as much with management attitudes and orientation as with the economic logic inherent in pulp and production and conversion. This would seem to be an area where the social partners could create a new employment buffer by more actively exploring the alternatives.

In principle, working time reductions have in the past and could in the future buffer the employment effects of productivity gains. This is only possible to a modest extent, however, because time reductions make labour more expensive and reinforce the tendency to focus rationalisation efforts on this area.

Much of the above discussion does not apply or applies only partially to the countries of Central and Eastern Europe in transition to a market economy. They presently have very high manning levels relative to output. Available machine capacity in Poland and the former Soviet Union has also been greatly underutilised because of diseconomies of scope. Central planning forced mills to produce a vast variety of grades resulting in inefficient scheduling and frequent grade changes on the machines (Lilja et al., 1989). This has changed. Through joint ventures more and more mills may be able to remove another major bottleneck too: a shortage of spare parts due to a lack of hard currency. The compounded effect of both changes may well mean a high number of redundancies before export and domestic demand allow capacity expansions large enough to require a bigger workforce.
Figure 4.7. Federal Republic of Germany: Wages and salaries per DM1,000 turnover in paper converting and manufacture, 1978-90


Figure 4.8a. Share of labour costs of total delivered cost for market pulp, selected countries, 1989

Source: FSAC (1990a).
Developing countries may be expected to be a positive exception with respect to employment levels. Their markets are expanding faster than elsewhere. Countries rich in fibre and energy resources are also well placed on export markets. The level of employment that will be generated depends to a much larger extent on technological choices, than is the case in industrialised countries. Small-scale mills producing 150 tonnes of paper per year with a total of over 60 staff are still viable in countries like India. They also generate employment spin-offs because all equipment can be made locally (Forest Development Corporation, 1981). The place assigned to small units in development programmes for the sector will have a significant impact on employment.

On balance, there is reason to be sceptical about predictions advanced by the European Commission, for example that employment losses in the sector will slow down (EEC, 1991).

The process of employment adjustment can and will be influenced in a number of ways by the social partners in the sector and government. This will concern the modalities, such as finding socially acceptable ways of dealing with redundancy and coping with technological change. It will also concern the direction and volume of the loss.

In the eyes of a pulp and paper manager, technological change is a job security problem for the individual worker. It may be expected that the trade-off between job security on the plant floor and work flexibility will be the major collective bargaining issue for the 1990s (Lauzon, 1989).
5. Technological change and flexibility

The impact of technological change reaches far beyond the mere volume of employment. It has consequences also for job content, career opportunities, working conditions and the status of employees; in other words, it affects the very nature of employment in the industry.

5.1. Flexibility

Flexibility has been a buzz-word in management circles ever since it was said to be a must for competitive companies by Atkinson and Meager (1986). As it calls into question some of the fundamental principles and rules which have traditionally governed the status of employees in the industry, it has also been the subject of a heated debate.

To our knowledge, very few studies have attempted to produce empirical evidence on the forms and incidence of flexibility in the pulp and paper industry. One recent investigation (Penn et al., 1991) has a limited coverage of countries and mills (eight paper mills in the United Kingdom and Finland), but has the merit of structuring the debate by distinguishing between the various forms of flexibility.

5.1.1. Forms of flexibility

These are basically four: functional, numerical, financial and distancing. Functional flexibility refers to the manner in which workers are deployed to perform various tasks. It includes things like multi-skilling and the use of job classification schemes containing fewer but more broadly defined jobs, not tailored to a particular workplace. Functional flexibility can also take the form of job rotation or job sharing.

Numerical flexibility is achieved through the use of temporary and part-time workers and flexible working time/shift schedules. Financial flexibility with respect to employment is the result of performance or output-based rather than fixed pay. Finally, distancing refers to the loosening of ties between worker and company. Typically this takes the form of subcontracting part of the work to be performed in the mill.

Based partly on their research in the United Kingdom and in Finland and partly on earlier work (Penn and Scattergood, 1988), Penn and his colleagues conclude that only two of the above forms of flexibility make sense in paper companies: collective incentive bonuses (financial flexibility) and subcontracting of maintenance work (distancing). The other forms are therefore not commonly found in the industry. The reason, the authors argue, is that in capital-intensive manufacturing, quality of output and continuity of production are critical. In this setting a strategy of numerical flexibility would be completely inappropriate. They also point out that functional and numerical flexibility are in serious conflict with each other. Higher levels of skill and proficiency tend to be associated with permanent and full-time work. Even so, the survey finds no evidence for multi-skilling either in maintenance or across the division between maintenance and operations workers.

The only form of flexibility practical on a significant scale, according to this study, is subcontracting. Even this is limited. Farming out a substantial part of the maintenance workload to contractors would mean giving up control over machine down-time, one of the most crucial parameters for mill performance. Most subcontracting is therefore confined to the use of external maintenance workers during periodic shut-downs. This practice has been part of the normal pattern since the start of continuous production and certainly predates the 1980s. Only in one of the eight mills was regular maintenance work carried out by contract labour.
5.1.2. Flexibility - a non-issue in the pulp and paper industry?

Is all the concern about flexible forms of employment in the pulp and paper industry unjustified then? At first glance the logic of the above arguments is compelling. What little evidence there is from industry-wide statistics would also appear to support the view that flexibility is rather a non-issue and certainly not a practice that is likely to spread widely in this sector.

The ratio of part-time and full-time employees to full-time equivalent employment in the United States, for example, has remained virtually unchanged over the last decade, as can be observed in figure 4.4b in the foregoing section. In 1990 a total of 700,000 full and part-time employees translated into an unspectacular 690,000 full-time equivalents.

Similarly, in the paper converting industry in Germany the share of part-time employees remained almost unchanged at about 5 per cent of the total from 1978 to 1987.

The low percentage of maintenance and shipping work that is contracted out in market pulp mills would also seem to corroborate Penn's assertion. According to a survey prepared annually for the Forest Sector Advisory Council of Canada (FSAC, 1990a), contracting accounted for less than 1 per cent of labour costs in pulp mills in Finland and British Columbia; 1.3-1.5 per cent in the southern United States and eastern Canada; and 3-4 per cent in the western United States.

On closer inspection, however, the case appears to be a lot less straightforward. There is more work flexibility practised in the sector than the above numbers suggest. Moreover, the stringent logic of the arguments developed above for the very limited incidence of flexibility, applies to a much lesser extent to small mills and to most converting operations. While empirical, the above study is based on a very restricted sample in terms of number and size of firms, geographical spread and kind of operations. In some countries flexibility is more common than in the two researched. And, lastly, things are changing fast.

5.2. Contract labour

A sizeable integrated mill in southwestern France, for example, has some 1,500 workers employed by 200 different companies working on the premises in the course of a year. At any one time about 150 external workers are in the mill, compared to 615 mill wage earners. In this case contract labour is the equivalent of a fifth of the total workforce at the mill (Richez, 1992).

In the United States, to take a second example, it is not uncommon for contract work to extend to regular maintenance work like the changing of filters, painting, etc., in addition to regular machine maintenance shut-downs or construction work. The external workforce permanently present on the mill site may well number 10-15 per cent of directly employed workers in some cases. The fact that the average is lower and that some mills do not resort to any contracting in maintenance at all is largely due to union resistance. In many mills in the United States contracting is a permanent bone of contention. This would appear to have contributed as much to containing it as the operating logic of large modern mills. The situation in Australia is similar (Penn and Scattergood, 1988).

One area in which pulp and paper mills the world over have massively contracted out work is fresh fibre procurement, i.e. forest harvesting and transport. While employment in forestry is outside the scope of the present report, a brief parenthesis appears in order. Pulp and paper mills are a major client of forestry contractors and the system has been around for a while. The pros and cons of the formula are thus more visible than for contracting inside the mill.

The good news is that contracting in forestry has led to substantial reductions in fibre cost. The bad news, however, is that only part of the gain is due to higher productivity and efficiency. A substantial part of the cost has simply been passed on to the contractors.
This has very negative consequences for their income in spite of long working hours. They record high accident rates and develop serious health problems. To make ends meet they often forego essential social security coverage or resort to irregular practices like moonlighting.

The strategy of systematically contracting out harvesting work may well backfire because it often leads to a drain of human resources and loss of skill. The whole profession gets a poor image and fails to attract new entrants. The bottom line may then be that a qualitatively and quantitatively adequate workforce to harvest the raw material for the industry is simply no longer available. In some countries, such as France, the situation is deteriorating at a rate that may soon pose a serious threat to the raw material supply of an expanding pulp and paper industry. For a full discussion of these trends see ILO (1990).

5.3. Part-time and temporary employment

Part-time work may not be very significant in terms of the overall hours of work or number of employees it represents. For some subgroups in the workforce, however, it can be a major issue because it affects them much more than others and because of the disadvantages and hazards the part-time status sometimes involves. The German converting industry is a case in point. Only 0.3 per cent of male employees, but about one in every three women working in the industry, worked part-time in 1987. Depending on the number of hours a week they work, they may have to forego vital social security coverage. If they work less than 18 hours/week, part-time employees are not insured against unemployment. At less than 15 hours/week they do not participate in health and pension funds, and under 10 hours/week their wage would not continue to be paid in case of sick-leave. Moreover, part-time workers are not entitled to many of the fringe benefits under collective agreements, such as overtime, free shifts, paid leave or annual bonus.

The collective agreement concluded in the paper converting industry in Germany in 1991 for the first time provides for an explicit protection of part-time workers. In addition to taking care of the above problems, it stipulates that open-end contracts with respect to working hours are not admissible nor are contracts for ranges of hours, for example between 20 and 40 hours/week.

Contract and temporary employment pose a number of problems as regards the status of the employees concerned, the terms of their contracts and social security. Those employed by small contracting firms often have lower incomes and considerably less favourable conditions than their counterparts who are directly employed by the mill.

A particularly worrisome aspect of temporary and contract employment is the poor safety record often associated with it. A study carried out by the National Health Insurance in France holds the spread of these forms of employment responsible for much of the increase in accident rates and the greater severity of these accidents in recent years.

Temporary employees provided by labour-leasing firms have twice as many accidents as the average worker. About half of the difference can be attributed to the composition of the temporary workforce and the type of work, but the residual other half is a result of the temporary situation. Information training in safety matters is deficient. Often even the suitability of a worker for a particular post is not checked. To curb these problems employees and trade unions in France concluded a national agreement in 1990 limiting the use of temporary labour to three specific cases: (i) the replacement of absent workers, (ii) a temporary increase in activity, and (iii) traditionally seasonal occupations. Temporary employees also have to undergo the same training in safety and health as regular ones (Travail et Sécurité, 2/1992).

Also in France, the integrated mill cited above accommodating 1,500 external employees a year has made efforts to remedy the safety problems associated with contract labour. In this mill contract labour had more than twice as many accidents as regular personnel. This was put down to a large extent to the unclear status of contract workers. Both their external employers and mill supervisors acted as if they were temporary mill employees. Neither side felt responsible, though, for safety instruction and enforcement. The mill clarified the responsibility of the contracting firm in this respect in a new clause
in the contract. The actual problem, however, was the lack of coordination and supervision on the shop floor on the part of the contractors. This situation was overcome by the creation of a contractors’ association at the initiative of the mill and with the involvement of its safety and health committee. The director of the association (created in 1990) acts as a chief executive for all mill-related work carried out by the contractors. Accident rates among contract workers have since gone down by 50 per cent, but they are still higher than among regular employees (Richez, 1992).

**Differences between wage-earners and salaried employees vanishing?**

With most of the discussion about changes in the status of employees focusing on flexibility - hence on forms of employment other than full-time, direct, permanent jobs - a current going in the opposite direction may go unnoticed. There are indications in various countries that the status of blue-collar workers - de facto and to some extent de jure - is moving closer to that of white-collar employees.

In the United Kingdom pulp and paper workers receive their wages through monthly payments like salaries. In the United States, a large corporation has adopted a common pension plan for both categories of employees. There is a pronounced trend to reduce the level of supervision and to give workers more latitude in deciding how to do their jobs. As a corollary, one of the vestiges of conventional wage employment, the work clock, has started to disappear from some mills.

For Finland, Lilja (1989) observes that working conditions for blue-collar workers in pulp mills are very similar to those of white-collar workers. Specifically he quotes office-like control rooms, pay, leave and information on the company’s performance and strategy.

### 5.4. Working time

In addition to the above, there is more flexibility built into present arrangements than meets the eye. Many collective agreements provide for flexible working hours and/or shift arrangements. Particularly in small mills and converting plants where 24-hour operations are not an economic imperative, this allows constant adjustments to orders in hand. In many countries larger mills can resort to temporary shut-downs of paper machines or pulp and converting lines at relatively short notice and temporarily or permanently lay off the employees concerned. Both afford considerable financial and pay flexibility to take advantage of booms and to contain losses during slumps. Even where firm ceilings on working hours have been put in, there is often the possibility of flexible scheduling. A 37-hour working week, for example, may never actually be done by a given employee, but may instead represent the average over several months.

On balance there would seem to be much more flexibility already than is maintained by some, and more appears set to emerge, particularly in the related areas of work organisation, job classification and skill requirements.

### 5.5. Flexible work organisation

The generalisations by Penn and co-authors about multi-skilling and the stability of job descriptions may also understate the degree of flexibility that is already practised. The impression from recent mill visits in Finland and the United States and from recent reports and literature on other countries is that the situation is currently in flux, and some traditional practices are changing rapidly.

The crew concept, i.e. a flexible distribution of work tasks within a machine crew on a shift, and multi-skilling among maintenance workers have been in use for more than 30 years in some mills in the United States. Over this period the practices have spread, particularly in the greenfield mills built in the southern part of the country over the last 20 years. At least with respect to maintenance this is common practice by now. The change is reflected in collective agreements. While traditional mills maintain job classifications with
over 300 specific job descriptions, a greenfield mill typically will have a few dozen only. A similar trend is observed in Canada (Jensen, 1990).

Technological change as described earlier is likely to bring about much more functional flexibility: broader skills, less specific job descriptions, more autonomous teams with internal job rotation and flatter organisations. Some of these changes are required for an effective use of new technologies, others are made possible by it.

Table 5.1 below presents a most instructive picture of the price of flexibility associated with the move from standard, commodity grades of paper into more customised and more sophisticated ones. A multi-product environment is characterised by a high number of grade changes and a corresponding increase in variable cost. At the same time the risk of breaks increases and raises the cost of losses due to breaks to as much as 50 per cent of the profit margin.

Table 5.1. Cost structure: Price of flexibility, machine size 200,000 tonnes per year, 1991

<table>
<thead>
<tr>
<th></th>
<th>Lost sales</th>
<th>Direct variable costs/TN</th>
<th>Capital costs/TN</th>
<th>Grade changes/year</th>
<th>Time spent for grade changes (minutes)</th>
<th>% of total time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Value/TN</td>
<td>Lost value added (FIM)</td>
<td>% margins</td>
<td>Sensitivity for breaks</td>
<td>Break time</td>
<td>Value breaks</td>
</tr>
<tr>
<td>News, standard</td>
<td>2 000</td>
<td>1 500</td>
<td>300</td>
<td>30</td>
<td>450</td>
<td>0.01</td>
</tr>
<tr>
<td>News, multiproduct</td>
<td>2 500</td>
<td>1 600</td>
<td>330</td>
<td>400</td>
<td>12 000</td>
<td>2.5</td>
</tr>
<tr>
<td>SC, standard</td>
<td>2 800</td>
<td>1 900</td>
<td>350</td>
<td>40</td>
<td>800</td>
<td>0.02</td>
</tr>
<tr>
<td>LWC, multiproduct</td>
<td>3 200</td>
<td>2 000</td>
<td>380</td>
<td>500</td>
<td>15 000</td>
<td>3.0</td>
</tr>
<tr>
<td>Fine, standard</td>
<td>3 500</td>
<td>2 300</td>
<td>400</td>
<td>250</td>
<td>7 500</td>
<td>1.5</td>
</tr>
<tr>
<td>Fine, multiproduct</td>
<td>4 500</td>
<td>2 500</td>
<td>450</td>
<td>700</td>
<td>28 000</td>
<td>5.0</td>
</tr>
</tbody>
</table>

* FIM.

As noted earlier, some of the problems of frequent grade changes are taken care of by structural change. A paper machine belonging to a large corporation can produce more of a smaller number of grades. The whole range of products is provided by the many machines belonging to the corporation. None the less, the scheduling problem remains. For smooth runs and grade changes close vertical collaboration within a mill is needed between marketing, production planning, production management and machine operation.

Smooth runs with a minimum of breaks also require close horizontal cooperation along the machine and into stock preparation. In other words, teamwork is needed along both horizontal and vertical axes (Ranta et al., 1991).
5.5.1. Teams

Many experiments have been made in the sector with team approaches of varying scope and direction. In some instances teams are not permanent, but rather operate like task forces to resolve particular problems with quality, work organisation, workplace arrangements or yield and waste.

A successful example of an organisation-wide network of teams acting as task forces has recently been described (Ferguson and Roth, 1991). Teams organised by function rather than shift meet regularly to identify, prioritise and tackle problems. Complaints are not accepted unless suggestions for improvement are put forward at the same time. Improvements must pass the test of cost-benefit analysis or substantially raise the quality of working life. The company considers the teams as an important means of increasing employee commitment, which in turn is considered the key to quality improvements.

Labour-management yield and waste committees have also achieved the objective of higher productivity and increased identification of the workforce with these jobs and with the mill.

A combination of both project groups and permanent work teams has been very effective in a pulp mill in Finland. Small project groups take care of improvements of workplaces. For day-to-day operations, maintenance workers are assigned to specific areas of the mill to carry out preventive maintenance. Machine operators are organised in teams without internal hierarchy. The job classification only contains skilled positions. There are no "helpers". All members of the team can perform the tasks assigned to the team. Teamwork and flexible work organisation are credited with the stunning increase of mill output, over and above the rated capacity, as shown in figure 5.1.

Figure 5.1. Average daily production of pulp on a yearly basis by Kaskinen Pulp Mill, 1977-89

![Bar chart showing average daily production of pulp by year](image)

Source: LiJa (1989).
Hundreds of incremental changes and improvements in production process and working methods, rather than big investments in new equipment, boosted annual output to 350,000 tonnes p.a. in 1987, i.e. 100,000 tonnes more than the originally planned capacity (Lilja, 1989).

Guesstimates for productivity increases in North America as a result of team approaches are as high as 30-50 per cent (Spiker, 1988 and Crow and Spiker, 1991).

Additional material rewards can be a very powerful persuader to make new work organisation effective. Some observers comparing Canadian to Northern European mills even maintain that the bonus systems in use for operating crews had more to do with the good performance of European mills than computerisation and sophisticated management.

5.5.2. Flatter organisations

Automated, integrated control systems in mills have paved the way for a kind of management by objectives to be practised not only in the boardroom but also on the shop floor; intervention can be limited to problems or exceptions rather than be routinely practised. Some mills have introduced self-directed work teams which resulted in taking some supervisors off the shift.

In a mill in the southern United States production dipped briefly after the number of supervisors per shift was reduced from eight to six, but picked up soon thereafter.

Labour representatives are fully supportive of self-managed teams as they make workers feel more responsible and give greater job satisfaction. Peer pressure is a good substitute for "breathing down the neck" supervision. As a result of the introduction of the concept, absentee rates dropped to 1.2-1.5 per cent from several times that level earlier. While job rotation and self-directed teams were a universally welcome innovation, the next step envisaged - creating opportunities for process operators to cross over into maintenance - is a sensitive issue.

The pressure to simplify job classification comes by no means only from management. In the German paper converting industry, for example, the trade union considered this one of its major achievements in the early 1980s because it reduced the number of unskilled, poorly paid jobs (IG Druck und Papier, 1983).

In Finland a drive towards these new concepts, and in fact ultimately towards a removal of the division between maintenance workers and operators in paper mills, is coming from the shop floor. These initiatives by operators are greeted with mixed feelings by their maintenance workmates, who fear for their status (Alasoini and Pekkola, 1989).

5.5.3. A debate on flexibility?

Looking at the experience of work flexibility and the debate surrounding it, one is led to suspect that much of the discussion is not about flexibility per se. There are numerous examples where employees have welcomed flexibility because it meant higher pay, better career prospects, more diversity of tasks and higher job satisfaction.

Trade union concern and opposition to a wider introduction of flexible practices can only be understood against the background of general labour-management relations. Job classifications, lines of progression, the principle of seniority in promotion and dismissal, and collective agreements which deal with every aspect of work organisation are historically developed means of enhancing job security, protecting older employees and stabilising working conditions and income.

An example will illustrate the point. Mohawk Paper, a small, family-owned paper mill in the north-eastern United States, employs 315 people. The company has been extremely inventive and came up with half-a-dozen new products over the last decade, giving it an edge over big competitors. The small machines and a lean structure enable the company to develop new grades literally in a matter of days. Chlorine-free paper was put
on the market only weeks after the first trial run. While base machines are old, they have constantly been modernised and are very efficient.

Mohawk is committed to social peace. Agreements are typically reached three months before the due date. The company has never had a strike, not even a case of arbitration. A no-job-loss policy is practised, whereby workers are redeployed where technology makes jobs redundant. The company has good pay rates and one of the best benefit programmes in the industry. Exploding health care costs are for the first time in decades a stumbling block. A joint committee was set up to look into options.

The "Mohawk family" situation - for once not a euphemism - has enabled the company to practise flexible work organisation long before the term was coined and without much ado. Multi-skilling in maintenance was already in place 35 years ago! All employee involvement is informal. The Mohawk experience appears to indicate that such closely-knit companies, dominated by mutual trust, can largely do without formal structures. Many issues are solved in a non-legalistic, case-by-case manner.

In the overwhelming majority of mills, however, stringent agreements serve as safeguards of employee rights. These safeguards increasingly clash with the economies of technological change as well as with aspirations of part of the workforce, notably the younger and better educated ones. It is not until the safeguarding functions of present inflexibility are taken care of by other mechanisms and arrangements that the apparent contradiction between benign and malign flexibility will disappear. Only then will employees feel comfortable with new ways of doing their jobs.

Trade unions are being rediscovered as valuable, almost indispensable partners in building a relationship of mutual trust between management and labour that will allow equitable schemes for work flexibility to be developed and implemented.

The pulp and paper industry in Finland provides an example of how this can be done, even from a starting-point of a very adversarial relationship. Trade unions are in a fairly strong position in Finland in terms of organisation rates and influence on the introduction of new technology. Four trade unions play a role in the sector, catering for the various groups in the workforce. Almost all blue-collar workers in operations and maintenance belong to a single paper workers' union. There are very high levels of unionisation also among clerical workers and technicians. Even three-quarters of supervisors and managers are organised. The unions' leverage in technological change is much enhanced by a so-called "technology clause" introduced into the collective agreement in 1968. It gives the unions the right to renegotiate wages prior to the introduction of new technology in a mill (Koistinen and Lilja, 1988).

The late 1970s were very difficult years for labour and management in Finland. Difficult as it is to believe from the present state of the industry, pulp and paper looked like a "sunset" sector then, unable to compete in the face of high raw material, energy and labour costs. The resulting friction led to numerous strikes. In the peak year, 1979, there were 233 strikes in the sector.

Since then the industry has come a long way. The joining of forces between labour and management has enabled Finnish industry to become one of, if not the most technically advanced and modern in the world, the one having the highest average labour productivity in many subsectors. The industry has also expanded massively abroad, implying among other things that today some 16,000 jobs in the Finnish paper industry (i.e. of Finnish-owned firms), or about a quarter of total employment, are located outside Finland.

The leap forward into massive investment and high-tech equipment and products, would not have been successful without a new style of labour-management cooperation. Industrial relations are characterised by dialogue and co-determination from national to mill levels, the latter being the most significant. Union representatives at all levels are well-informed about the economic situation, prospects and strategy of the company and the sector. Job security and a sharing in the benefits of modernisation and improved productivity and quality are safeguarded through collective agreements.
As a result employees share and identify with company objectives. Modernisation and expansion abroad are seen by labour as a means of improving pay and working conditions at home. Motivation and commitment are high, enabling companies to manage mills and smaller units by objectives set in consultation. If targets are not met, small, joint task forces are set up to remove bottlenecks. Strikes have become rare. Even a cut in purchasing power in 1991 was accepted by the workforce as economically inevitable.

The picture has been quite different in many other countries. The situation in Brazil, Canada and the United States is characterised by more antagonistic relations. According to Lobos (cited in Celulose e Papel, 1990) the industry in Brazil is pursuing a contradictory strategy. It is promoting the use of contract labour, rendering employment less secure and ignoring workers’ demands in the face of dwindling purchasing power. At the same time workers are expected to do what is necessary to raise the quality of output.

In Canada some observers note that a lack of trust between labour and management prevailed throughout the industry in the 1980s. This situation appears to be changing, and there are calls on management to work with the unions in spite of falling union membership (Jensen, 1990).

In the United States, finally, the situation varies from company to company, even from mill to mill. In some places there is a history of strikes, lockouts, permanent striker replacement and concessionary bargaining. There has been much improvement in recent years. Some conflicts, however, persist. A widely publicised case concerns one of the largest paper companies in the world. In an extensive analysis of labour relations in that company Birecree (1991) claims that the company through "aggressive labour relations policies" compensated "for its diminished power in the product market ... by changing the functional distribution of income between capital and labour in its favour, as opposed to the division that might have resulted from capital restructuring alone under unionised production processes". The company has been faced with a negative attitude of its workforce in many mills, leading among other things to sabotage of equipment and production.

The conclusion from the latter negative example and the positive Finnish and United States examples described earlier appears to be rather clear. It is that a partnership, based on dialogue and cooperation, between employers and strong, well-informed trade unions can contribute to higher productivity and quality on an equitable basis, whereas confrontational policies are apt to be self-defeating.
6. Human resources and training

New technologies have for a long time been thought to reduce the role of human beings in the production process. Economic success seemed to depend largely upon the design of sophisticated machines and equipment. Employees, with the exception of engineers and technicians, appeared to play a secondary role. As the previous chapters have shown, this perception is no longer valid, if indeed it ever was, in respect of the latest generation of equipment being installed in mills and converting plants.

A statement made by a prominent electronics and engineering manager about his industry more than a decade ago is increasingly seen to apply to the pulp and paper industry as well: "We have measured the scope of the technical and economic challenges. We know that the intelligence of a handful of technocrats, however brilliant, is no longer enough to take them up with a real chance of success" (K. Matsushita, 1979).

The successful adoption of new technology, high and consistent quality, the elimination of waste and the mobilisation of productivity reserves that do not depend on equipment have focused attention much more than used to be the case on the human resources in the pulp and paper industry. Moreover, technology and global markets are changing faster than ever before. Successes are short-lived and it is the potential for adjustment and innovation embodied in the workforce that determines the future of a mill or a company (Lilja, 1989, Hendry, 1991). It will be crucial to find the right answers to the questions in the human resources field: What kind of workforce will be needed in the future? What will be the proportions of the various echelons? What skills will this workforce need? How can they be imparted? What will be the recruitment base? How can the pulp and paper industry make sure it attracts enough new entrants with good potential?

The following section attempts to provide elements for the answers to these questions by analysing changes in the composition of the workforce and in skill requirements, the impact of these changes on career opportunities, and developments in training for the pulp and paper industry.

6.1. Changes in workforce compositions and profiles

A general trend in the pulp and paper industry over the last 20 years in most industrialised countries has been a decline in the share of blue-collar production workers in the total workforce. In most OECD countries workers accounted for 70-80 per cent of total employment in the sector in the late 1980s, down eight percentage points from the levels in the early 1970s (OECD, 1989). Technical, administrative and management personnel, by contrast, remained by and large constant or actually increased, even in absolute numbers. Figure 6.1 below illustrates the shift towards white-collar positions in Finland. The strongest increase was among academic professionals (24 per cent). A similar trend is reflected in time series on labour inputs in pulp mills in Canada, Finland, Sweden and the United States (FSAC, 1990a).

In some countries and subsectors within the industry, however, the composition of the workforce has changed very little in recent years. This is true for the United States, for example, where on average production workers represented three-quarters of the industry's workforce in 1990, as they did in 1980. Changes in the subsectors are without a clear trend either way (API, 1991).

In the German paper-converting industry blue-collar workers represented 73.5 per cent of the total in 1988. This level had already been reached in 1982 when a slow but steady decline of more than two decades tapered off (HPV, 1991).

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A survey of newsprint mills in Canada, Finland, Sweden and the United States (FSAC, 1990b) shows no dramatic change in workforce composition between 1985 and 1989, except for Sweden where the share of workers fell from 82 to 75 per cent. In the mills with the highest labour productivity, however (Finland and the western United States), the workers' share remained stable or actually increased. Similarly, there has been

Figure 6.1. Finland: The composition of the workforce in the pulp and paper industry, 1985-90

The only valid generalisation would seem to be that the strong decline in the share of workers brought about by early phases of technological change tends to level out once a threshold is reached. Exactly where this point is appears to vary between countries and subsectors as well as between mills (large commodity grade versus small speciality makers, for example).

A drop is forecast in some countries for lower-tier administrative staff such as bookkeepers, accounting clerks and secretaries (for Canada, for example, see Employment and Immigration, Canada, 1987). Comparisons between countries and even between subsectors are complicated by the differences of classification criteria applied. Changes in work organisation and job content may well make such comparisons even more difficult in the future and, what is more, less relevant. Changes in the nature of the jobs in each category and new job descriptions within each group are more relevant for human resources planning than traditional classification patterns.

There is general agreement that these changes affect blue-collar workers as much as white-collar ones.

As has been pointed out in the section on technological change, there is a strong decline in the number of manual and unskilled positions in manufacture and conversion alike. General skill levels will be higher in the future. Both among workers and supervisors/technicians/engines, maintenance functions will continue to increase (Penn and Scattergood, 1988).

In Canada the ratio of technicians and engineers in maintenance has risen steadily from 1:12.2 in 1976 to 1:8.8 in 1988. In Northern Europe it is even higher. The annual output of pulp and paper engineers in Europe increased by 50 per cent over the last five years and there are no signs of saturation (Paper, November 1991).
Increased employment is also expected in specialised production functions like process control and recycling as well as in research and development, administration, marketing and consumer services. In line with this trend, the number of paper-maker apprentices in Germany, for example, has risen by more than 50 per cent from 1980 to 1990 and now stands at 1,000.

Emphasis at the blue-collar level will be less on how to do a job than on why it is done (Caganpan-Stoute, 1990). Workers will have to gain an overview of the entire production process rather than just of their particular work post. A better overall understanding of their roles and functions will also help them to learn to work smarter rather than harder in the leaner and faster mills and converting plants of tomorrow. To match the demand for a more versatile workforce, skills will have to be broader too, particularly in maintenance, but also in operating positions.

For supervisors, managerial skills like coordination and planning will gain in significance, possibly outweighing technical competence in the future.

Supervisors and managers, as well as workers in self-directed work teams, will increasingly have to acquire "people skills" - communication, goal-setting, team-building, conflict resolution. In an industry that is rapidly becoming more international and global, foreign language skills will be crucial for easy access to information and for career opportunities, even for workers (Paper, November 1991).

In some countries a need for a more balanced skill mixture at the management level has been diagnosed. For Northern America, Simons (1991) argues that more technical as well as marketing specialists are needed in top positions. Technology should be taught at business and law schools to avoid the conflicts often arising between a bias towards short-term economic return and long-term technological development and capacity-building. For Finland, Lilja (1989) observes a deficit in the opposite direction. According to him, marketing and business specialists are underrepresented in Finnish paper companies. With Finnish industry rapidly becoming international the traditional focus on engineers was no longer appropriate.

In countries in transition to a market economy a whole set of other skills has to be added to those needed to handle changes in technology and in work organisation. In a study of a large mill in Estonia employing 7,200 people, Lilja and co-authors (1989) conclude that the entire work culture would have to change. A particular problem is preventive maintenance and the build-up of specialised maintenance services able to intervene during machine shutdowns.

On the management side a huge training effort is required to develop cost accounting, the use of decision-support data and the ability to view operations and processes in terms of productive results and markets. A recent analysis of the pulp and paper sector in Poland arrived at similar conclusions.

6.2. Training

Many of the major pulp and paper-producing countries have long-established training traditions that include the paper industry. For example, the first technician course in paper making was offered in Dresden, Germany, as early as 1865 (Paper, November 1991). Over the last two decades, under the pressure to adjust, upgrade and extend skills, training systems have evolved significantly, particularly in Japan and in Europe. Other regions with less of a tradition of vocational training are starting to perceive this as a major shortcoming.
6.2.1. Training in the course of a working life

*New investments*

Regardless of what kind of basic education and training has been provided in a given country, major training efforts are always made in connection with the start-up of greenfield mills and expansions or modernisations in existing mills.

By and large, the industry appears to be doing a good job in this kind of training. All levels of staff typically go through a phased programme based on an assessment of needs and skill profiles. Training is usually a combination of theory and practice, the latter often involving actual participation in the installation works. A variety of trainers share the task, including equipment suppliers, consultants, training centres and, not least, mill personnel.

The duration varies considerably, partly as a function of the scope of the change, but to some extent also as a reflection of the attention paid to human resources development. A new winder may require only a few days of training, a mill-wide control system three months (Spiker, 1988). For a very successful greenfield pulp mill workers were hired one full year prior to start-up (Lilja, 1989).

Two problems arising with training tied to new investments are timing and the depth of the knowledge acquired. There is a tendency to plan for slower learning and a longer start-up phase rather than involving the workforce earlier, taking advantage of the design phase as a training opportunity (Spiker, 1988).

Secondly, an operator may take only four weeks to learn how to use automated controls, but for trainees without prior knowledge in computers this training is often too superficial. They learn how to key in new set points for the process, but do not really understand how the machine functions. As a result such operators often end up battling the system and learning in a costly process of trial and error.

The example points to two important preconditions for successful training: a solid foundation in basic education and vocational training and its constant upgrading in life-long learning.

*Basic education and vocational training*

Trainability will in the future depend more and more on the trainee's familiarity with language, mathematics, sciences, reasoning and basic economics. Most of the above would be expected to be imparted through basic school education. In many developing countries, but also in North America, the industry is faced with a widening gap between its requirements and the results of public education (Fosmire, 1989). A compilation of quotations for the situation in Canada (by Simons, 1991) includes the following: up to 40 per cent of the population has reading difficulties; almost 50 per cent of the workforce does not have 12 years of schooling; about 30 per cent of the workforce cannot meet pulp and paper basic entry requirements.

Vocational training in most European countries attempts to combine basic and pulp-and-paper-specific education and training by moving students from general schools into trade schools for the last two to four years of basic training. In Finland paper machine operators will have spent two years at a local trade school, in Sweden and Germany typically three years. A recently introduced scheme in France stipulates a minimum of two years (IRFIP, undated'a). In all European countries basic subjects such as languages and sciences are given much attention in vocational schools.

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In addition to emphasising knowledge that will be the basis for further training at later stages of working life, initial vocational training in most European countries is broad-based on the technical side. In Germany, for example, paper-making apprentices are expected to cover all parts of the process including basic maintenance (BfB, 1991).

Formal training in most developing countries is top-heavy with well established university level institutions but little or nothing at the technician, let alone the worker level.
A notable exception in this respect is the training centre for hand-made papers in India catering for managers of small business, operators and artisans (Virmani, 1991).

**Life-long learning**

No matter how well they were acquired, most technological and job-specific skills are rendered obsolete at ever-shorter intervals. Moreover, in all likelihood the average age of the workforce will rise in most industrialised countries, reducing the influx of fresh skills and knowledge acquired in basic training.

Further training will thus play an even more prominent role than it has in the past as a key mechanism to deliver skill upgrading and adjustment. Japan has long valued continuous skill development. In Japanese pulp and paper mills one in three workers receives training in any given year (Kamiparengo, 1989). Opportunities for further training have also evolved at amazing speed in Europe. In France, for example, the pulp, paper and converting training organisation offers more than 75 specialised courses lasting from one day to more than a year, covering all aspects of industry and all levels of personnel (IRFIP, undated b).

Some mills in the United States and Europe have begun to take a systematic look at further training. The assessment of present skills and further needs starts with the hiring (in which qualified workers participate) and goes through individual career plans to computerised databases of the individual employee’s training record.

### 6.2.2. Training systems

There are considerable differences in the ways in which training at different times and for different levels ties in with training institutions to form a training system.

Some countries, particularly in North America and the developing world, rely heavily on on-the-job training. New entrants typically start at the bottom of the job classification in unskilled helper jobs. Whenever they are promoted to a new, more highly skilled position they are "set-up" with an experienced worker for a few weeks or months until they are supposed to have picked up the necessary skill. The system has the virtue of being very down-to-earth and application-oriented.

More and more companies, however, are having second thoughts about the merits of on-the-job training. Contrary to widely held assumptions, not much actual skill transfer takes place in the arrangement. The theoretical knowledge of the trainer is limited and so are his pedagogical skills. Moreover, most incumbents do not want others to interfere with "their" machine. A "watch-but-don’t-touch" attitude prevails that makes this form of training rather ineffective.

Complaints are also heard about initial training for maintenance workers in North America. Unlike process workers, maintenance personnel are subject to apprenticeships in the respective crafts. Even here, training is often poorly structured, lacking clear standards for the expected skill and level of competence to be attained. Some mills in North America have attempted to tackle the problem. In the absence of mechanisms for cooperation and of common public or industry vocational training schools, they have to do so on a mill-by-mill basis. One mill which started to take a systematic look at training in 1987 hired a training manager and set up a training centre with two classrooms and a fully equipped workshop on the mill site. A joint management-labour team developed a maintenance training programme that now comprises 100 different courses which are certified through an arrangement with a local trade school.

The latter approach is consistent with trends in Latin America and traditional practices in Japan: structured in-house training by individual companies. In Latin America the industry often had no alternative but to invest massively to compensate for the absence or inadequacy of public training facilities in the remote areas often chosen for greenfield mills (Simons, 1991).
In Japan more than 90 per cent of the companies have in-house training. Public vocational training centres are used for a number of generic courses, but most training is internal. It starts with a course for new entrants and is followed up with one or two years of on-the-job apprenticeship under a qualified instructor. Performance is assessed monthly and is reflected in bonus payments. Company training ties in with government certification (Simons, 1991 and Kamiparengo, 1989).

A higher degree of input from vocational schools characterises the dual system in Germany. During a three-year apprenticeship, papermakers work for nine months per year in a company and attend vocational schools and/or specialised paper-making school for the remaining three months. Only certified companies may take on apprentices. They have to have qualified instructors (master-craftsmen) and the apprenticeship contract must contain a company-level training plan complying with a national standard. At the end of the term apprentices have to pass a practical and theoretical examination according to country-wide specifications. This system is deemed to reconcile industry's need for flexibility and customised training with the country-wide maintenance of comparable qualifications and quality of training (BfB, 1991).

The Swedish systems depicted schematically in figure 6.2 assign more of the training to schools and provide less alternation between industry and school.

Figure 6.2. Sweden: Training in the pulp and paper industry, 1991

On the whole, European training systems appear to be much more geared to operator-level training than elsewhere. In Canada and the United States, for example, engineering-level training in pulp and paper, unlike vocational training, is institutionalised.

In Canada, B.Sc. programmes at most universities include one or two pulp and paper courses. There are also two specialised chairs, a masters degree programme in collaboration with the paper research institute and three technician degrees providing a link between operators and engineers. In the United States there are three main pulp and paper universities, but a total of seven offer a B.Sc. in pulp and paper production (Simons, 1991).
At the nine western European institutions awarding degrees in paper production the paper course is complementary to basic studies in process or mechanical engineering (Paper, November 1991).

Two intermediate levels exist in Germany between skilled operators and university graduate engineers (M.Sc. equivalents): a master-craftsman to fill supervisory, production management and training positions, and a technical engineer. The full training system for paper making in Germany, including typical positions filled after training, is shown in figure 6.3. The system (like those in France, Sweden and elsewhere) features one of the desiderata in that there are multiple entry and exit points. There is also a high degree of horizontal as well as upward mobility to move from apprenticeship to engineer.

In an attempt to fill the void in formal operator training the Centre for Professional Advancement and the Technology Association of Pulp and Paper Industries in the United States have developed a wide spectrum of short courses as well as self-learning and educational material (Simons, 1991). In Canada the employers’ organisation has been producing a series of training modules since 1988. Seven modules are available, and a total of 19 are planned. The material is used in basic and further training through three to five-day courses. The modules can be used flexibly and afford substantial savings compared to proprietary, company-designed ones (CPPA, 1991).

Where they exist, central training institutions play a key role in further as well as initial training at all levels. Perhaps even more significant is the fact that they constitute a focal point for exchange, coordination, updating of training programmes and systems and for the forging of coherent training strategies.

6.2.3. Coordination, updating and strategy

Coordination and a training strategy for the sector are vital for coherent, up-to-date and cost-effective training. In the absence of such a strategy serious mismatches can develop between industry requirements and training systems in place.

A good illustration is provided in figure 6.4, which summarises findings from a recent survey of Canadian and international training systems commissioned by the Government. The mismatches identified suggest that the concern in government and industry about human resources for the future is well-founded. The absence of an overall education or training strategy is a disadvantage for all levels of staff. The fact that such an unsatisfactory situation developed in spite of large industry investment in training ($Can 160 million in 1990) illustrates the need for a coherent approach. Another insight this kind of overview provides is that most shortcomings are concentrated in operator training. A similar situation prevails in the United States and in Australia (NFITC, 1991).

The authors of the Canadian study argue that only through joint commitment by government, management and labour can a relevant training strategy be forged. In many European countries, notably in Sweden, Finland and Germany, tripartite cooperation is built into the structures in charge of updating and adjusting training contents and modalities. Government regulations concerning apprenticeships in paper making in Germany, for example, are prepared by a tripartite body of experts (BfB, 1991). A successful example of tripartite cooperation at the mill level from the United States has already been quoted above. Mill level management-labour cooperation in training planning and implementation are common in Europe. In Northern Europe, the French and United Kingdom employers’ associations take a very active interest in training development, sometimes to the extent of masterminding national training programmes for the entire sector.

The number of recent adjustments in pulp and paper training systems in Europe is testimony to the effectiveness of the coordination mechanisms. In Sweden secondary education has been reorganised so as to integrate basic vocational training in the last two years of schooling in response to industry demands (Simons, 1991). Finland has introduced a modular system for further and upgrading training designed for older workers with no previous formal training (FIE, 1991).
Figure 6.3. Germany: Training and career opportunities in the paper industry, 1991

**SECONDARY SCHOOL COMPLETE**
- 3 y apprenticeship of which per year:
  - 9m in industry trg
  - 3m vocational school
  - 13w block release paper maker centre

**HIGHER SECONDARY SCHOOL COMPLETE**
- 3 y apprenticeship of which per year:
  - 9m in industry trg
  - 3m vocational school
  - 13w block release paper maker centre

**UNIVERSITY OR TECHNICIAN SCHOOL ENTRY EXAM**
- with exam directly to technician school
- OR THE PRACTITIONER'S PATHWAY:
  - 2 y apprenticeship then studies to become:

**PAPERMAKER**
- Company Training plus paper maker center or school for paper and packaging technology

**AND THEN**
- Technical engineer
- Engineer (M.Sc.)

**JOBS AND CAREER IN THE INDUSTRY**
- Skilled positions:
  - in stock preparation
  - in operations-, testing-, colour laboratories
  - at the paper machine up to head operator
  - in finising, converting, packaging up to head operator

**TRAINING FOR MASTER CRAFTSMAN**
- Precondition:
  - 3 y practical experience after 8 y practical experience if trained on-the-job
- Vocational school and government examination for industry master craftsman subject area papermaking
- Positions:
  - Deputy mill manager, shift manager, head of maintenance, head of laboratory, mill manager production manager

**COURSES:**
- Papemakers/Master craftsmen/Maintenance
  - Duration: 3 days - 3 weeks

**FURTHER TRAINING**

**MANAGEMENT SEMINARS**
- Master craftsmen, commercial and technical top management and directors

Figure 6.4. Canada: Mismatch between needs and existing training in the pulp and paper industry, 1991

<table>
<thead>
<tr>
<th>What is Needed</th>
<th>PERCEIVED GAP TO WHAT IS IN PLACE</th>
<th>Work force</th>
</tr>
</thead>
<tbody>
<tr>
<td>REF:</td>
<td>Formal education system</td>
<td>External researchers &amp; consultants</td>
</tr>
<tr>
<td>1. High education &amp; training standards</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Connection with industry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. In-house training &amp; continuous education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Fundamental skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5a. Knowledge transfer training standards</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5b. Technology awareness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Immigration of special skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Overall education or training strategy</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Minor gap</th>
<th>Moderate gap</th>
<th>Substantive gap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work force</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>


In France a number of new schemes and certificates have been instituted over the last few years, including a technical diploma in 1987 and a technical baccalaureat in 1990 (IRFIP, undated a). The British Paper and Board Education and Training Council, in cooperation with Government, made great strides toward establishing multi-skill training in crafts, creating a framework for nationally recognised vocational qualifications for all process workers; they also mounted a new scheme leading to qualification as a paper technologist (ETC, 1991).

Perhaps the strongest argument for labour-management as well as tripartite cooperation in training is that for it to be effective training must tie in with job descriptions and work organisation, with national education systems and vocational qualifications patterns, with promotion and reward systems. All of these are shaped by collective agreements or influenced in a major way by tripartite discussion.

### 6.3. Training, careers and the recruitment base of the future

#### 6.3.1. Training and careers

As has been discussed earlier there are moves to base promotion more on competence and less on seniority. There is also pressure to overcome the problem of mill and job seniority, which can deter young, new entrants from pursuing further education before joining the workforce (Simons, 1991).

Organisations are getting flatter, reducing the number of echelons in the career ladder. This leads to a situation already prevalent in many converting plants. Lines of progression are extremely short and hold no career opportunities. Reluctance to take up such jobs, as well as high turnover, are often the consequences. In Canada the pulp and paper sector loses many of its technicians due to this. Failing room for professional advancement, they soon move on to engineering studies (Simons, 1991).

The problem becomes more acute as the workforce in a given mill ages, owing to attrition and early retirement and little or no hiring of young entrants. The trend is
particularly pronounced in greenfield mills starting with young workforces. Figures 6.5a and b show the two types of age distribution - balanced for the average of French industry, which is presently expanding through greenfield mills, and a Finnish pulp mill started up in 1985 that has lost employees due to productivity gains.

Figure 6.5a. France: Age distribution in the pulp and paper industry, 1991


Figure 6.5b. Finland: Age distribution in the Aenekoski Pulp and Paper Mill, 1991

Finally there is the continuous threat of mill closures. Unlike those of most maintenance workers, the skills and credentials of process workers are not transferable (Penn and Scattergood, 1988). In Canada, for example, only 10 per cent of the pulp and paper workforce have generally recognised trade skills (Simons, 1991). Losing employment in "their" mill or wanting to move to another part of the country, process workers often have to start from scratch even in another paper mill or converting plant. Even greater difficulties arise when former paper workers have to seek employment in other industries.

Both to keep pulp, paper and converting jobs attractive with a changing work organisation and to hedge against the consequences of loss of employment, training and career patterns should allow for a maximum of upward and lateral mobility within a mill, within the industry and across sectors. The introduction of standards and accreditation of skills for as many employees and as many stages of a career as possible are prerequisites for such mobility.

To some extent this has been achieved in Northern Europe through general vocational school training prior to employment, and in Germany through apprenticeships. Schemes in the United Kingdom and in Finland take account of the fact that a large proportion of the workforce has acquired skills without or with very little formal training. To avoid curtailing career prospects for this group, programmes are developed that will lead to accreditation under the national vocational qualifications systems. The Finnish scheme is based on modules; some of them are compulsory, while others can be combined as most appropriate for the individual trainee. Depending on the number of modules covered and tests passed, the trainee scores points that lead to the award of one of three successive vocational certificates. Distance learning packages, short courses and seminars provide the necessary structure and theory without making it unduly difficult for employees to participate. Multi-skilling, mastering of the entire process and stepwise increase of skills are emphasised (FIE, 1991).

6.3.2. Recruitment base of the future

There is reason to believe that even more effort will be needed in the future to make pulp, paper and converting jobs attractive to young jobseekers.

In some countries and for some qualifications there are emerging or even acute shortages already. Engineers and technicians are in short supply in the United States and Canada (Employment and Immigration Canada, 1987; and Simons, 1991). In many industrialised countries it is difficult to find enough skilled workers (OECD, 1989). In many developing countries there is an acute shortage of skilled workers and a chronic problem with floor-level technicians (see Virmani, 1991). A survey of nine pulp and paper companies in Mexico found two-thirds of the workers to have minimal qualifications and one-third to have none (Flores-García, 1991). The problem is likely to get worse.

Demographic changes in the industrialised countries will reduce the number of young jobseekers over the next decade. Industry growth in developing countries will outstrip the limited output of present training institutions even more than today. In both cases there will be more competition with other industries for good new recruits. The disadvantages of the industry will become more perceptible then. Mills are often located in remote areas devoid of the amenities of urban centres. Periodic downturns and lay-offs have earned the sector the reputation of an unstable employer. The public image of the pulp and paper industry is often that of smokestacks and environmental damage and pollution. All this would suggest that the traditionally high pay may no longer guarantee enough applications, as it used to in the past.

In some countries the industry is trying to be proactive and approach public schools to educate young people about the sector and to stimulate interest. The British industry, for example, has prepared teaching material on the sector and distributed it at all secondary schools in the country (ETC, 1991).
Useful and necessary as these efforts are, more fundamental changes than image-building may be needed to make the pulp and paper industry attractive. Faced with shortfalls among male recruits, the industry is attempting to turn to more recruitment of women as a solution. The experience of female employment in the sector highlights many of the shortcomings in human resources development that need to be remedied.

6.3.3. Women - an untapped human resource for the pulp and paper industry?

Women have long been a rare sight in the pulp and paper manufacturing industry, particularly on the mill floor. With the exception of China, the share of women in the sector’s workforce is 20 per cent or lower in all countries for which data are available (see figure 6.6a below). The few available time series for female employment show stagnation (Australia, Sweden) or decline (India, Germany).

Figure 6.6a. Share of female employment in the pulp and paper industry, selected countries

![Bar chart showing the percentage of women in the pulp and paper industry in various countries.](chart)

Source: Various sources.

Women are not found in the same proportions in the various levels of personnel. The breakdown for Finland (see figure 6.6b), with a high concentration among clerical staff and a lower than average level in technical and managerial positions, is rather typical.

In all countries and in both manufacture and converting women are concentrated in low-skill, low-reward jobs. There are few female machine operators even in Northern Europe, a region spearheading equality of opportunity in many ways. Typically women production workers are employed in sorting, quality control, handling, packaging and dispatch (see figure 6.6c).

This is also true for India, where there are very few women in manufacturing mills and in large-scale operations (under 5 per cent), but many more in small enterprises, particularly in hand-made paper production and conversion (Virmani, 1991).
Figure 6.6b. Finland: Share of female employment by occupational group in the pulp and paper industry, 1991


Figure 6.6c. Germany: Share of female employment in pulp and paper making and in the paper conversion industry, 1990

In a survey of employment in five mills in the United States, Australia and the United Kingdom, all skilled jobs were found to be exclusively male (Penn and Scattergood, 1988). The same is true for the German and the United States converting industry, where the bottom jobs are de facto women-only jobs (IG Medien, 1985, Glines 1986).

It is these women-specific jobs that were particularly affected by technological change and rationalisation in the 1980s (United States 1982, IG Medien, 1985). As a result, the share of women among production workers fell by 5 per cent from 1978-87 in the German converting industry. While women accounted only for a third of the workforce in 1987, well over half the registered unemployed converting workers in Germany were women (HPV, 1991).

While this state of affairs is bad, it is a slight improvement over the situation prevailing in 1980, when almost two-thirds of the unemployed were women. Some change for the better is also reported from Finland, where women are starting to move into more qualified positions including blue-collar jobs (Alasoini and Pekkola, 1989).

To judge from a survey of women employees in the North American paper industry, a lot remains to be done if the sector is to become an attractive employer for women. Women find it difficult to get ahead in the industry (46 per cent of respondents) or to even get accepted. To get the same recognition 84 per cent of the women feel they have to work harder than their male colleagues.

But the picture is not entirely gloomy. Almost three-quarters of the women interviewed would recommend to other women to start a career in the sector. The same proportion singles out a lack of women-specific recruitment efforts on the part of the industry as one of the major reasons for the presently low share of women.

Women are still treated as a minority problem in the United States. If the industry could give female employees adequate status and opportunity there would seem to be great potential. According to forecasts by the United States Department of Labor, women will make up two-thirds of the increase in the national labour force by the year 2000 (Bottiglieri, 1989). A similar situation is likely to prevail in most industrialised countries.

If the pulp and paper industry is to continue to be a successful example of technological and structural adjustment, a much more coherent strategy for human resources development would appear a priority need in many countries. Not only for women but for the labour force at large, changes in work organisation, job contents and line of progression have to be synchronised with workforce planning, training, promotion and remuneration packages affording both a smooth transition of the company and attractive workplaces, secure employment and career prospects.

To be meaningful, such strategies should cover mill, company and national levels. In most cases they will require close labour-management cooperation and substantial government input and backing to be effective.
7. Working time and remuneration

7.1. Working time

7.1.1. Standard working day and week

In line with the general trend in many industrialised countries, the duration of the average working week in the pulp and paper industry has become shorter over the last decade. Normal working time in the industry now ranges from 37 to 45 hours per week in the countries covered in this report. The most common standard is 40 hours (for selected countries see figure 7.1). The shortest regular working week is found in Germany, the longest in Kenya. The number of working days per year varies from 217 to 252. Long weekly hours and a high number of working days per year are found in many developing countries.

Figure 7.1. Normal weekly working hours, selected countries, 1989

Shift work is very common in the pulp and paper industry. The extent and the form of shift work practised vary according to subsectors and to some extent according to the size of the mill. Daywork and discontinuous shift work for operations running less than 24 hours a day, with no work over the weekend, is a pattern widely used in converting plants.

Semi-continuous shift work, operating 24 hours a day without a daily break, but not over the weekend or on public holidays, is a common practice in larger converting operations and smaller paper mills. In large pulp, paper and board mills as well as in part of the box-making industry, continuous shift work supporting operations 24 hours a day, 168 hours a week and almost 365 days a year is the rule. Most shift schedules are based on eight-hour shifts but 12-hour shifts are also practised, particularly on weekends.

The normal working week in many countries applies only to normal daytime workers, whereas shiftworkers work fewer hours. In Sweden for example, the normal week...
according to the collective agreement is 40 hours. Workers permanently on discontinuous shift or intermittently on continuous shifts, however, work 38 hours, and those permanently on continuous shift 36 hours (Kollektivavtal, 1989). In Finland normal annual working hours are 1,716 for dayworkers and 1,619 for shiftworkers.

In some countries working hour reductions are granted for employees doing particularly arduous work or working at night. For example, boilerworkers in pulp mills and those handling chemicals worked six rather than eight hours a day in the former USSR (Korolyov, 1991). In Mexico nightworkers work seven rather than eight hours a day (Flores-García, 1991).

7.1.3. Actual working hours per year

Overtime, compensatory and other leave often result in considerable deviation of actual working time from standard working time. In Sweden, for example, actual working hours for daytime work are about 17 per cent below the standard; for shift work they are about 13 per cent below the standard (see table 7.1).

Table 7.1. Sweden: Standard and actual working hours per year in daytime and continuous shift work in the pulp and paper industry, 1990

<table>
<thead>
<tr>
<th></th>
<th>Daytime (hrs/y)</th>
<th>Continuous shift (hrs/y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calendar working hours</td>
<td>1,791</td>
<td>1,617</td>
</tr>
<tr>
<td>Overtime</td>
<td>+ 111</td>
<td>+ 102</td>
</tr>
<tr>
<td>Sub-total</td>
<td>1,902</td>
<td>1,719</td>
</tr>
<tr>
<td>Sick-leave</td>
<td>- 201</td>
<td>- 147</td>
</tr>
<tr>
<td>Other leave</td>
<td>- 165</td>
<td>- 151</td>
</tr>
<tr>
<td>Actual working time</td>
<td>1,556</td>
<td>1,424</td>
</tr>
</tbody>
</table>


In some countries actual hours worked exceeded the scheduled ones. In Japan, for example, 1,894 hours were scheduled in 1989 but actual working time totalled 2,101 hours. Average net overtime in Japan was 10-11 per cent for the period 1985-89 (Japan, 1989).

7.1.4. Changes in actual annual working hours

The situation and trend with respect to annual working hours are shown in figure 7.2 for the second half of the 1980s. Swedish workers had the shortest working time, approximately 1,500 hours per year, followed by Canada, Finland, Germany, Italy and Poland with 1,600-1,800 hours. Workers in Japan, Mexico and the United States worked more than 2,000 hours per year (United Nations, 1991a).

7.2. Remuneration

Remuneration is determined in the pulp and paper industry in many countries through national and local agreements, sometimes in a two-stage process, with a national agreement fixing a floor rate subject to topping-up in mill-level agreements. The numerous agreements in force differ in many ways: wage levels, the spread across job classifications,
overtime, weekend and shift bonuses, special allowances, incentives, fringe benefits and others. It is, therefore, very difficult to present a full picture. The following is limited to some basic points.

Figure 7.2. Actual annual working hours of wage-earners in the pulp and paper industry, selected countries, 1985-89

![Graph showing actual annual working hours of wage-earners in the pulp and paper industry, selected countries, 1985-89](image)

**Source:** United Nations (1991a).

### 7.2.1. Annual earnings

As would be expected, annual wage income in the pulp and paper industry spans a wide range across countries, as can be seen in figure 7.3. Kenya records the lowest annual cash earnings for blue-collar workers with $1,320 (Ikiara, 1991), and Japan the highest with $56,640 (Japan Paper Association, 1991). Top annual wage incomes for skilled blue-collar workers in the United States were $70,000 in 1991.

### 7.2.2. Income comparisons

Wages in pulp, paper and board manufacture are considerably higher than those in converting in most countries. In Canada manufacturing workers earned almost 40 per cent more per year than the best paid converting workers. In Japan the gap is smaller but there is still a 15 per cent advantage for manufacturing workers. Hourly wages in paper converting in Germany are about 20 per cent lower than those in manufacturing. The difference in annual earnings is even greater because of a higher share of shift premiums in manufacturing. An exception in this respect is the United Kingdom where, at least in terms of basic hourly wage, workers in packaging made of paperboard fared better than those in paper and board production.

Female employees on average have far lower incomes than their male counterparts in most countries. A detailed comparison for France and Japan is provided in figure 7.4. In France the incomes of women workers are 12-27 per cent lower than those of their male colleagues, depending on the category. In Japan the difference is as high as 45 per cent. This gap is the result of a compounding of factors like part-time or temporary work and the concentration of women in the converting industry and in low-paid jobs.
Figure 7.3. Average annual cash earnings of blue-collar workers, selected countries, 1990-91

US dollars (thousands)

<table>
<thead>
<tr>
<th>Country</th>
<th>Average Earnings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>50</td>
</tr>
<tr>
<td>United States</td>
<td>60</td>
</tr>
<tr>
<td>Finland</td>
<td>45</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>30</td>
</tr>
<tr>
<td>France</td>
<td>25</td>
</tr>
<tr>
<td>Poland*</td>
<td>10</td>
</tr>
<tr>
<td>Kenya</td>
<td>5</td>
</tr>
</tbody>
</table>

- Poland, very substantial fringe benefits

Source: Various national statistics and employers' organisations.

Figure 7.4a. France: Comparison of average incomes of male and female employees, 1989-90

US dollars (thousands)

<table>
<thead>
<tr>
<th>Category</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skilled</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Workers</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Salaried staff</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Skilled workers</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Technicians</td>
<td>6</td>
<td>5</td>
</tr>
</tbody>
</table>

Wages in the pulp and paper industry as a whole compare favourably with those in other sectors. In most countries they are slightly or well above the average for all manufacturing industries. In Finland, for example, pulp and paper workers earn 11 per cent more than the average manufacturing industry worker (FIE, 1991) and in Mexico 7 per cent more (Flores-García, 1991). In Japan the gap is smaller as shown in figure 7.5.

Earnings in the pulp and paper industry have kept up in most countries with wage development in other sectors. A time series for Sweden is provided in figure 7.6.

Having kept up with wage developments in the economy as a whole does not necessarily mean that the purchasing power of pulp and paper workers has increased. In a number of countries, particularly developing ones and those in Eastern Europe, quite the contrary was true. As figure 7.7 shows, Brazilian pulp and paper workers at the bottom end of the pay scale earned more than twice the legal minimum wage. Even so they were very close and in the summer and fall of 1990 actually below the income required to buy a basket of basic goods. In India workers in non-unionised mills are not paid more than the legal minimum wage. According to Virmani (1991) compliance with minimum wage legislation is not enforced and not always respected.

7.2.3. Benefits

To varying extents cash and non-cash benefits are provided in the pulp and paper industries in the various countries (see figure 7.8). These may include a wage supplement (equivalent to a 13th monthly salary for white-collar workers), pension, health insurance, unemployment insurance, paid leave, education and training allowances, savings and mortgage plans and company health centres. In Poland, a country where cash income is relatively low, there are many non-cash benefits such as free catering at the workplace, free or subsidised housing, transport to work, free access to company-owned holiday resorts and others (Carlsson/Celpap 1992).

The rise of non-wage personnel costs has been a difficult issue in collective bargaining in some countries. An example is the widespread concern with the cost of
health care in the United States. Like a number of other weighty components of total staff costs, the cost of health care is a factor on which the social partners in the sector have no direct influence. Tripartite cooperation appears to be called for to resolve such issues.

Figure 7.5. Japan: Comparison of the total monthly cash earnings of permanent employees in selected industries, 1989

![Graph showing comparison of monthly cash earnings in Japan](image)

Source: Japan (1989).

Figure 7.6. Sweden: Wage increases in pulp and paper and other industries, 1986-90

![Graph showing wage increases in Sweden](image)

Figure 7.7. Brazil: Basket of basic goods as a percentage of the wage floor in the pulp and paper sector and of the legal minimum wage, 1989-91


Figure 7.8. Composition of labour costs, selected countries, 1992

8. Occupational safety and health

Introduction

The information on occupational safety and health in the pulp, paper and paper converting industry presented in this chapter has been collected through correspondence with industry specialists throughout the world, through a comprehensive search in pulp and paper, medical and other journals, and from national statistical sources.

Occupational safety and health risks in the sector range from spectacular boiler explosions to the presence of invisible dust particles, the one not necessarily less harmful than the other.

This section is a first attempt to provide an international overview of safety and health in the sector. As will become clear in the following pages, it is inconclusive in many respects. To a significant extent this can be attributed to the many gaps and shortcomings in the information and statistics available.

To present as accurate a picture as possible and to avoid jumping to conclusions, this section keeps close to the original sources and data. Inevitably this renders the section rather technical, less easy to read and sometimes even confusing. A summary is provided at the end of the report.

In work, nothing affects the workers more intimately than safety and health conditions. The impact of accidents ranges from the physical disturbance of a near accident, to health impairments (reversible or not), to fatalities. Economically, a hazardous and unhealthy working environment may affect the industry through temporary or permanent losses of skilled manpower. In addition, accidents often cause technical breakdowns of varying duration.

Most health hazards in this industry are by now recognised, but the use of new substances and technologies raises new questions. Health research has difficulty keeping pace and the origins of a number of health complaints are unclear. To cope better with the myriad of substances involved, chemical registers have been established in some countries to provide safety and health information. Dust emissions and radiation originating from measuring equipment have also received more attention.

8.1. Safety

8.1.1. National accidents in international comparison

Accident rates (per 1,000 work-years) for the pulp and paper industry in selected countries are shown in figure 8.1. While the data presented supposedly relate to the same situation in each country, the differences are too large to reflect actual safety levels. An example of dissimilar reporting habits is provided by the accident rate of the former USSR, which was one tenth of Finland's, although its fatality rate was three times as high (see figure 8.2). The accident and health information presented in this report can therefore only give indications on national trends. Comparisons among countries must be treated skeptically.

8.1.2. Fatalities

Attempts to compare accident severity at the international level have proved difficult because few countries present comparable data. A more significant expression of accident severity is the number of fatalities incurred in the industry. Such figures are presented by a few countries in absolute numbers. Using available employment figures, these were converted into fatality rates. Figure 8.2 presents average fatality rates for three-year periods for selected countries per 1,000 employees or full-time workers. Compared to the all-accident statistics above, there is an inversed order of severity: Japan has the lowest
rate, followed closely by Finland and Sweden; and the former USSR presents the highest rate.

Figure 8.1. Lost-time accident rates in the pulp, paper and allied industries, selected countries, late 1980s

Source: National statistics.

Figure 8.2. Fatality rates in the paper industry and in manufacturing as a whole, selected countries, late 1980s

Source: National statistics.
In comparison with the average for the manufacturing industry as a whole in their respective countries, the Japanese and Finnish pulp and paper employees have a lower fatality rate, while Swedish employees have a rate that is double the manufacturing industry's average.

8.1.3. Problems with accident statistics

The basic material for analysing the occupational safety and health situation in the industry is obtained through occupational statistics periodicals at the national level. In all industrialised countries the industry has an accident-reporting obligation to a national body which compiles the information and presents a national labour - or an industrial accident - statistics report. Specific data for the pulp and paper sector in developing countries have been impossible to find.

A handicap in using national statistics has been that pulp and paper manufacturing is often aggregated with paperboard products (containers, boxes etc.) and also the conversion of paper products (envelopes, bags, sanitary paper etc). In other cases the sector is lumped together with printing and publishing and sometimes with the rubber industry. These latter industries (printing and publishing and rubber) have 50-70 per cent of the workforce in the combined category and the work performed is also very different, which gives misleading information. In Sweden, for example, where the sectors are reported separately, the accident rate for printing and publishing was 22-25 per cent of that in pulp, paper and allied products; the corresponding figure for the United States was 50-65 per cent.

The definitions of accidents and occupational diseases differ because of variations in regulations and insurance practices. In the United States "occupational injuries" are separated into "total cases" and "lost work-day cases". In Finnish statistics an accident leading to "three days or more of absence" is separated from accidents leading to "more than one month of absence". Belgian statistics cover all accidents and separate accidents without effect from accidents leading to temporary disability and from accidents causing permanent disability. Figure 8.3 shows the difference between the various categories of accidents for Belgium, Finland and the United States.

It becomes clear from the above that comparisons between national statistics are difficult. The matter is complicated further by the differences in reporting habits between countries. In Canada, for an accident to be reported in official statistics, it must occur at a work site that is covered by the compensation system. This immediately disqualifies 20 per cent of the Canadian workforce. The accident must also result in a lost-time claim, and many lost-time claims - whether through apathy, ignorance or deliberate suppression - do not reach the National Work Injuries Statistics Program (Hamilton, 1991).

The national Health and Safety Executive in the United Kingdom in 1990 carried out a Labour Force Survey to provide an overall picture of the national reporting of work-related injuries and ill health. The level of underreporting of non-fatal injuries in the manufacturing industry (which includes paper manufacturing) was estimated to be about 63 per cent, compared with 56 per cent in construction, 30 per cent for energy, and 82 per cent for agriculture, forestry and fish farming. The study also suggests that employers are having difficulties in interpreting the "major injury" definition (it includes incidents with potential to cause serious injuries), actually leading to even lower reporting levels than for non-fatal injuries as a whole (United Kingdom, 1991).

Work accidents result in "occupational injuries", i.e. death, personal injury or disease. A resolution concerning statistics of occupational injuries, adopted in 1982 by the 13th International Conference of Labour Statisticians, recommends that such statistics should be collected and reported separately and regularly. Injuries should be classified as leading to "no lost time" and "lost time". The latter should be separated into "up to three days" and "more than three days" absence from work. As a comparative measure, incidence rates should preferably use the denominator of the average number of people exposed to risk or, wherever possible, the number of hours worked by them, e.g. accidents per thousand workers or per 1 million work-hours. Allowance should be made for the proportion of part-time workers.
While they leave much to be desired for the purposes of international comparisons, national statistics are valuable tools for building a safer industry. Their effectiveness to that end is being enhanced in some countries. Finland recently changed its classification of industries and accidents in a way that makes interpretation easier (see section 8.1.4 below). In Canada a new national system is being discussed that would link statistics more closely to accident prevention.

The pulp and paper manufacturing industry has the advantage of consisting only of relatively large establishments, which should facilitate uniformity in reporting habits. The paper conversion industry, on the other hand, typically has more small and medium-size firms, and employs a large proportion of the sector's workforce. Variations in reporting here will thus require a bigger effort to improve.

8.1.4. Accident trends and levels

In most countries the absolute number of accidents has decreased, but given the decrease in the number of employees, a consequent downward trend in accident rates is not always forthcoming. The more general pattern is a fluctuation.

For the United States, accident statistics are broken down into various mill types and allied industries. At the end of the 1970s "all accident rates" ranged from 100 to 160 per 1,000 employees (figure 8.4). During the mid-1980s the rates decreased similarly for all parts of the pulp and paper industry. At the end of the decade, however, the rates edged up again, and the differences between subsectors narrowed.

Lost-time accidents for the United States (figure 8.5) show a similar pattern but had a larger spread. For all kinds of accidents, paper conversion (i.e. converted paper, container and boxes, and building paper) has higher rates than the pulp and paper manufacturing mills.
Figure 8.4. United States: Total accident rate in the paper and allied industries, 1978-88


Figure 8.5. United States: Lost-time accident rates in the paper and allied industries, 1977-88


Accident statistics for Japan show a steady downward trend from 1960 to the early 1980s, from 12.2 to 2.3 accidents per 1 million work-hours (see figure 8.6). The rate subsequently fluctuated; the figure was 2.31 accidents in 1989. The data represent
accidents which have resulted in one day or longer sick-leave, in enterprises with more than 100 employees (Japan, 1987-89).

Figure 8.6. Japan: Accident rate per 1 million work-hours among employees in the pulp and paper and allied industries, 1960-89

In Finland since 1988 the former single category of pulp, paper and allied industries as shown in figure 8.7 has been broken down into pulp, paper and paperboard, packaging, and other paper products. The large variations in the accident rates (per 1,000 employees) for "packaging" and "other paper products" between 1988 and 1989 are not explained. A reduction of the "all accident" rate occurred in the "other paper products" industry (from 47 to 19), but in the packaging industry the "all accident" rate rose from 96 to 134 from one year to the next. All accidents concern injuries which have led to at least three days' incapacity, while "serious accidents" have led to at least one month's sick-leave. The rates in the figure between 140 and 10 refer to "all accidents" while rates below 10 are the "serious accidents".

8.1.5. Accident comparison with other industries

In Finland the accident rate for the paper and allied industries in 1989-90 was below the average for all manufacturing industries. In 1989 the industry ranked tenth among manufacturing industries in accidents per million work-hours. In 1990 its performance worsened relative to the chemicals industry and the rubber and plastic industry and it advanced to eighth place (41.9 accidents) (see figure 8.8), but still remained below the manufacturing industry average of 50.1 accidents.

In the United States in 1988 (see figure 8.9), accident rates in total and lost-time cases (per 1,000 full-time workers) were 12.7 and 5.7 respectively in the pulp, paper and allied products industry. The average for all manufacturing industry is slightly lower, 12.1 total cases and 5.3 lost work-day cases.

The "all-reported accidents" rate in the paper manufacturing industry in the Federal Republic of Germany was 70 per cent higher than the all industries average in 1989 (89.6 versus 51.6 accidents per 1,000 workers). The compensated accidents reached similar levels. Pulp industry accident figures are included in the chemical industry, while paper
conversion accidents are covered in the printing industry; in 1989 these two industries’ accident rates were 40-45 per cent of that of the paper manufacturing industry (Deutscher Bundestag, 1990). Between 1986 and 1989 there was a considerable drop in accident rates in the paper industry, in absolute numbers and compared to the all industries average.

Figure 8.7. Finland: Accident rate per 1,000 employees in the pulp, paper and allied industries, 1980-89

Figure 8.8. Finland: Industrial accident rate per 1 million work-hours, 1989-90

Source: Finland (1987-89).
Pulp and paper employees in Sweden are 25-30 per cent more prone to accidents than the manufacturing industry average (figure 8.10). The rate in the wood products industry is 20 per cent higher still. Paper conversion employees are close to the manufacturing industry average. Obviously, blue-collar workers are more accident-prone than the average employee. In Sweden the blue-collar worker accident rate in pulp and paper in 1989 was 78 (per 1,000 full-time workers, one day or more sick-leave), i.e. 44 per cent higher than the average for the sector.

8.1.6. The causes of accidents

Machinery has increasingly become safer through the use of protective devices and measures. In Sweden occupational accidents by principal agency and main event show a continuous decrease in accidents in the close proximity of paper machines for the period 1985-89 (see figure 8.11).

A paper mill in Finland operating three generations of paper machines side by side had the same experience. While a number of serious accidents occurred on the machines installed in the 1960s and 1970s, none was recorded on the 1980s model.

Modern technology helps safety too. Machine failure leading directly to serious or fatal accidents is said to be rare. Constant improvement in design, equipment and automation means that workers spend less time in close proximity to machines, and the incidence of accidents is likely to decline. A survey of three mills in Ontario, Canada, that have individually spent millions of dollars on modernisation in recent years found that all mills recorded significant reductions in injuries (as high as 50 per cent) (Bryson, 1991). The start-up phase of new technology can be hazardous, however. In the United Kingdom, for example, paper-making accidents increased drastically during the period 1981-85, when many mills were redesigned or rebuilt and production lines altered and processes automated.

In the conversion industry the work to produce paper products of certain formats and designs often becomes repetitive and monotonous. Technical development provides the commonly used rolling, pressing and cutting machines with higher speeds and forces.
Although data specific to the industry have not been available, general accident statistics have proved this combination to be hazardous. It is expected that machine-induced accidents affect paper conversion workers in greater proportion than pulp and paper workers.

Figure 8.10. Sweden: Industrial accident rate per 1,000 employees, 1985-89


Figure 8.11. Sweden: Accidents by paper machine, 1985-89

A large number of accidents occurs in work that is not obviously hazardous. Table 8.1 presents the causes of accidents entailing three days or more sick-leave, for the pulp, paper and allied products industry in Finland.

Table 8.1. Finland: Number and type of accidents in the pulp, paper and paper products industry, 1989

<table>
<thead>
<tr>
<th>Cause</th>
<th>Total accidents</th>
<th>Per cent</th>
<th>Severe accidents</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stepping on or striking objects</td>
<td>920</td>
<td>48.0</td>
<td>47</td>
<td>39.5</td>
</tr>
<tr>
<td>Over-exertion or unsuitable movements</td>
<td>304</td>
<td>15.8</td>
<td>11</td>
<td>9.2</td>
</tr>
<tr>
<td>Tripping</td>
<td>285</td>
<td>14.9</td>
<td>20</td>
<td>16.8</td>
</tr>
<tr>
<td>Fall</td>
<td>102</td>
<td>5.3</td>
<td>13</td>
<td>10.9</td>
</tr>
<tr>
<td>Falling material</td>
<td>98</td>
<td>5.1</td>
<td>5</td>
<td>4.2</td>
</tr>
<tr>
<td>High or low temperatures</td>
<td>76</td>
<td>4.0</td>
<td>3</td>
<td>2.5</td>
</tr>
<tr>
<td>Entanglement or being squashed</td>
<td>51</td>
<td>2.7</td>
<td>13</td>
<td>10.9</td>
</tr>
<tr>
<td>Noxious substances or radiation</td>
<td>43</td>
<td>2.2</td>
<td>4</td>
<td>3.4</td>
</tr>
<tr>
<td>Collapse of material or construction</td>
<td>14</td>
<td>0.7</td>
<td>2</td>
<td>1.7</td>
</tr>
<tr>
<td>Electricity</td>
<td>1</td>
<td>0.1</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Other</td>
<td>21</td>
<td>1.1</td>
<td>1</td>
<td>0.8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1915</strong></td>
<td><strong>100.0</strong></td>
<td><strong>119</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Source: Finland (1987-89).

Similar causes of accidents are reported for France, where the order of frequency is: work in hand, uneven floor surfaces or other obstacles, objects that fall unexpectedly, lifting and maintenance equipment, and hand tools and motors (O'Farrell, 1989).

In Sweden the Pulp and Paper Industry Working Environment Council has registered causes of accidents leading to sick-leave. The data are presented in figures 8.12 and 8.13. The period 1985-86 is slightly over-represented, since some establishments have reported all accidents. From 1987 on, the causes of accidents have been recorded in more detail, e.g. injuries through slipping became defined as fall and stepping on objects. This reduced the number of "other accidents" which used to account for over 60 per cent of the total and increased the ones with specified causes.

Squeezing has been the single worst cause for injuries (see figure 8.12), even though the numbers of incidents have been reduced by 50 per cent compared to 1980 levels. Over-exertion covered only the neck and the back up to 1986. Since 1987, arm, hand, leg and foot over-exertion was also registered, pushing up the numbers and making it the second leading cause of accidents. Similarly, falls and stepping on objects increased with the new definition; this category now ranks third among accident causes. Cuts have kept the same high accident rate over the period.

Eye injuries, through exposure to splinters or fluids, and burns (figure 8.13) have decreased over the period and in 1990 caused approximately 80-100 accidents. On-site traffic accidents, by contrast, showed a slight increase during the period.

Similar to the situation in Sweden and Finland, squeezes and strokes were dominant accident causes in Chile. In deviation from the pattern in Northern Europe chemicals are a significant safety hazard in Chile.
Figure 8.12. Sweden: Frequent causes of accidents and their occurrence to blue-collar workers in pulp and paper manufacturing, 1980-90

Number of accidents

Blue collar workers (thousands)

80 81 82 83 84 85 86 87 88 89 90

— Squeezing — Cut — Fall/stepping

x Overexertion — Other


Figure 8.13. Sweden: Less frequent causes of accidents and their occurrence to blue-collar workers in pulp and paper manufacturing, 1980-90

Number of accidents

Blue collar workers (thousands)

80 81 82 83 84 85 86 87 88 89 90

— Eye injury — Burn — Chemicals

— Electricity — On site traffic accidents

8.2. Occupational health

Putting occupational health into perspective

Occupational health problems in the pulp and paper industry draw less attention than they deserve. National statistics provide far less coverage for illnesses than for instantly occurring injuries. Likewise, trade journals hardly ever report on occupational health matters, and one has to resort to the medical press for such information.

Certainly, comparisons between present incidence rates of accidents and occupational diseases make the latter appear a far smaller problem. But these numbers are misleading. If one takes into account the number of lost days the proportions can be reversed. The incidence of health complaints may be only a third of the accident rate and yet result in twice as many work-days lost, for example in Sweden (see below).

To appreciate fully the dimensions of occupational health problems in the sector one has to consider the long incubation periods of many diseases. Certain diseases only show up in statistics 10-30 years after the first employment. Incidence rates for the active workforce tend grossly to underrepresent health complaints.

Methodological problems

As mentioned earlier, national statistics on illnesses are available to a lesser extent than for accidents. Moreover, definitions, reporting problems, and uncertainty surrounding cause-effect relationships make the data less reliable. It must be emphasised, as for accident statistics, that for these reasons a straightforward comparison of national health statistics is unlikely to be valid.

Consequently, the major tool for assessing the health situation in the industry has been special studies on the pulp, paper and allied products industry. But these also have to grapple with sampling errors. In general, health studies have to allow for employment turnover in order to avoid the bias of positive selection among workers. This is particularly important with long-term coverage. Employment turnover due to workers’ voluntary change of jobs further complicates the evaluation of health hazards. A Finnish study (Grenquist-Nordén, 1983) on pulp and paper industry workers with a minimum employment of five years, assumes high chlorine tolerance levels in the group studied due to the transfer of sensitive workers to other work earlier in their careers. A mortality study on pulp and paper workers (Solet et al., 1989) showed that certain cancers were limited to those with more than 30 years between initial employment in a pulp and paper plant and their death.

The general pattern

General mortality rates among production workers in the pulp and paper industry appear not to be significantly higher than in the population at large. Certain serious diseases are, however, more frequent than among the average population not exposed to such work.

The main causes for concern are biological agents and chemical compounds in the form of dust or gases. The effects range from skin reactions, respiratory diseases, tumours and cancer to deaths. Troubles with shift work, such as reduced attentiveness and inadequate supply of blood to the heart (ischaemic heart disease), have also come into focus. Heat and, in parts of the mills, high humidity continue to make work in pulp and paper mills unpleasant, particularly in warm climates. Noise is still a working environment problem in the sector as well as one intimately linked to the general environment. Work rhythms dictated by high-speed machines and repetitive monotonous work are common stress factors in the converting industry. Drug abuse is on the rise in the manufacturing industry in general, and the pulp and paper industry is said to be no exception.

While the exposure to health hazards in wood handling, water treatment and at the power plant is similar in all types of pulp mills, pulp and paper production has different impacts on workers’ health depending on the processes used. Long-term fatality studies on
sulphite mill workers indicate health problems different from those of sulphate mill workers. Paper and board mill workers are faced with other hazards. Machine maintenance workers have a similar exposure in pulp and paper mills. Paper converting workers encounter additives from up-stream processes in the form of dust and through contact with the product.

8.2.1. Incidence rates of health complaints

In the United States the average illness rate (per 10,000 full-time workers) for the pulp, paper and allied industries has more than doubled during a four-year period, 1985-88, from 19.4 to 43.4. However, the incidence rate is well below the manufacturing industries' average, which jumped from 38.7 to 93.6 for the same period. The total illness incidence rates in paper mills, paperboard mills and converted paper (see figure 8.14) arrived to similar levels of 50-60 illnesses per 10,000 full-time workers. Pulp mills and container factories have an approximate illness incidence rate of 20-25. The illness incidence rate is less than 3.5 per cent of the accident rate for the same period.

Figure 8.14. United States: Illness incidence rates (per 10,000 employees) in the paper and allied industries and the manufacturing industry's average, 1985-88

Occupational diseases in the Swedish pulp and paper industry (figure 8.15) have in recent years diverged favourably from chemical and allied industries and from the manufacturing industry average, and were 24 per cent lower than the latter in 1989. A slight net increase is observed in reported illnesses both in the pulp and paper mills and in the paper conversion industry between 1985 and 1989. Illness rates were 33 per cent of the accident rate in 1989.

The paper workers in the Federal Republic of Germany reported diseases at a rate of 17.8 and 17.6 per 10,000 insured persons in 1986 and 1989, respectively. The overall averages for insured persons in the country were 17.6 and 16.3 for the respective years.
For the United States illness incidence rates are available by category of illness (see figure 8.16). "Disorder associated to repeated trauma" (e.g. conditions due to repeated motion, pressure or vibration) displayed the worst development and has tripled in four years. Observations from Finland point in the same direction. High rates of strain injuries are reported among female workers in the conversion industry, which in turn might explain the high rates in the United States conversion industry. Skin diseases and disorders and respiratory conditions due to toxic agents have had a more modest increase. The only downward trend can be noticed in instances of poisoning.

Figure 8.17 presents the average number of days of compensated sick-leave per completed illness for Sweden. The pulp and paper mills have slightly lower numbers of sick-leave days than the average for manufacturing industry. The irregular pattern of sick-leave development is similar to the one for compensated illnesses. The average length of sick-leave due to illness for the pulp, paper and paper products industry was six times as high as for sick-leave due to accident (1989). The total number of sick-leave days for illness is almost twice as great as for accidents, i.e. 89,664 and 45,264 days respectively.

8.2.2. Causes of illnesses and diseases

Chemicals

Chemicals are used in many processes in the industry, e.g. water treatment (chlorinating and flocculating agents); stock preparation (biocides, defoamers, dyes, slimicides); paper bath (dyes, fillers); paper coating (dispersing agents, impregnants) etc. The production of about 5.4 million tonnes of pulp in Finland in 1982, for example, consumed approximately 1.6 million tonnes of chemicals. An additional 3.4 million tonnes were circulating inside the mills, most of which were cooking chemicals, but a total of 223 chemicals were reported (Milkinen et al., 1986).
Figure 8.16. United States: Category of illness and illness rate in the paper and allied industries, 1985-88

![Graph showing the illness rate (10,000 employees) for different categories of illness from 1985 to 1988.]


Figure 8.17. Sweden: Average number of days of compensated sick-leave per illness followed by a return to work, 1985-89

![Graph showing the average number of days of sick-leave for different industries from 1985 to 1989.]

Pulp mills

Pulp mill workers are mostly affected by irritant gases including sulphur dioxide, hydrogen sulphide, methyl mercaptan, chlorine and chlorine dioxide which are known to have cardiovascular effects. Organic sulphides have not been studied in that respect, but their effect on cellular respiration is analogous to that of hydrogen sulphide. The possible role of gaseous sulphur compounds, especially hydrogen sulphide, in the development of heart diseases, however, has not been established. The bleaching process in pulp making uses chlorine dioxide which is a severe pulmonary irritant even at very low concentration.

Increased health complaints among pulp workers in British Columbia led to a study (Enarson, 1984) of a pulp mill known to have had elevated levels of air contaminants during the 1970s. Findings from the study showed that pulp mill workers who worked in the production area of the plant, with detectable levels of chlorine (mean 0.18 ppm Cl\textsubscript{2}, eight-hours time-weighted averages) had significantly more respiratory complaints (wheezing, chest tightness) and missed more work due to chest illness than a control group of railyard workers. Individuals most affected by a reduction in air flow appeared to be younger non-smokers. Members of the maintenance group, especially workers, demonstrated significantly lower lung function (measured as the volume of air which can be exhaled from the deepest possible breath, i.e. "Forced Vital Capacity", FVC).

Pulp and paper mills

A study on lung functions of pulp and paper workers in New Hampshire, United States, conducted from 1960 to 1985, revealed that workers with pulp mill exposure had lower breathing values compared to paper workers not exposed to pulp mill work. Since 91 per cent of subjects had terminated employment in the pulp operation at the time of the study the lung functions were irreversibly affected (Henneberger, 1989a). Personnel records of the paper company indicated that subjects which remained on job in the pulp mills were probably the individuals who were least reactive to irritant gases (e.g. sulphur dioxide and chlorine).

A study from North America, (Milham and Demers, 1984) on mortality among pulp and paper workers (table 8.2) supports previous findings of certain cancers among paper and pulp workers. The study specified that stomach cancer is associated with both sulphite and sulphate processing, while Hodgkin’s disease deaths (characterised by enlargement of lymph nodes, spleen and liver) are associated primarily with the sulphate or kraft process. The sulphite process was related to lymphosarcoma and kidney, pancreatic, and rectal cancers. The study suggests that cancer mortality may also be related to tree species processed in pulp production.

In Finland (Jäppinen and Tola, 1990), a study concentrating on cardiovascular mortality (relating to the heart and blood vessels) was undertaken among sulphate mill workers exposed to sulphur dioxide and among sulphate mill workers exposed to hydrogen sulphide and organic sulphides during the period 1945-61. National mortality rates were used for comparison. The cohort exposed to sulphur dioxide suffered 24 per cent more cardiovascular deaths than expected (table 8.3). Forty five per cent of the excess was attributed to coronary deaths (interrupted blood flow to the heart due to a blood clot in a coronary artery). The corresponding figures for the sulphate mill workers, exposed to hydrogen sulphide and organic sulphides (table 8.4), were both 50 per cent. While the first cohort did not show that cardiovascular mortality was affected by duration of exposure or follow-up period, the latter cohort was increasingly affected with longer follow-up period.

Process-specific differences were found in mortality among production workers in five pulp and paper plants (Robinson, et al., 1986). Although the overall number of deaths due to malignant neoplasms was lower than expected, an excess of lymphosarcomas was observed among sulphate mill workers.

A proportionate mortality ratio (PMR) analysis in New Hampshire, United States (Schwartz, 1988), of pulp and paper plant employees who had died during the period 1975-85, suggests that exposure experienced by pulp and paper mill workers may pose a significant carcinogenic risk. Analysis of 1,071 deaths showed an incidence of cancers of
the digestive tract and lymphatic tissues (Table 8.5) which was higher than for 452 timber cutters. The study was followed up by a cause-specific study, of 883 fatalities (Henneberger, 1989b). A standardised mortality ratio (SMR) analysis was used to compare death rates for each of the exposure groups with the United States national rates. Among pulp mill workers, the number of cancers of the digestive system was elevated and the SMR for pancreatic cancer was especially high. Among paper mill workers, more deaths were due to leukaemia and cancers of the digestive system than expected.

Table 8.2. United States and Canada: Proportionate mortality among pulp, sulphite, and Paper Mill Workers' Union members (1935-64 inclusive)

<table>
<thead>
<tr>
<th>Cause of death</th>
<th>ICDA (Eighth revision) No.</th>
<th>Observed</th>
<th>Expected</th>
<th>PMR</th>
</tr>
</thead>
<tbody>
<tr>
<td>All causes</td>
<td>000-999</td>
<td>2,113</td>
<td>2,113</td>
<td>100</td>
</tr>
<tr>
<td>All malignant neoplasms</td>
<td>140-209</td>
<td>333</td>
<td>316.4</td>
<td>105</td>
</tr>
<tr>
<td>Gastric cancer</td>
<td>151</td>
<td>68</td>
<td>38.7</td>
<td>176*</td>
</tr>
<tr>
<td>Cancer of small intestine</td>
<td>152</td>
<td>4</td>
<td>0.9</td>
<td>444*</td>
</tr>
<tr>
<td>Cancer of large intestine</td>
<td>153</td>
<td>22</td>
<td>29.7</td>
<td>74</td>
</tr>
<tr>
<td>Cancer of rectum</td>
<td>154</td>
<td>19</td>
<td>16.1</td>
<td>118</td>
</tr>
<tr>
<td>Cancer of pancreas</td>
<td>157</td>
<td>21</td>
<td>16.0</td>
<td>131</td>
</tr>
<tr>
<td>Cancer of lung</td>
<td>162.1</td>
<td>57</td>
<td>62.0</td>
<td>92</td>
</tr>
<tr>
<td>Cancer of urinary bladder</td>
<td>188</td>
<td>12</td>
<td>10.6</td>
<td>113</td>
</tr>
<tr>
<td>Cancer of kidney</td>
<td>189</td>
<td>9</td>
<td>7.6</td>
<td>118</td>
</tr>
<tr>
<td>Cancer of brain</td>
<td>191</td>
<td>13</td>
<td>10.5</td>
<td>124</td>
</tr>
<tr>
<td>Lymphosarcoma and reticulum cell sarcoma</td>
<td>200</td>
<td>11</td>
<td>6.7</td>
<td>164</td>
</tr>
<tr>
<td>Hodgkin's disease</td>
<td>201</td>
<td>7</td>
<td>6.8</td>
<td>103</td>
</tr>
<tr>
<td>Leukaemia</td>
<td>204-207</td>
<td>15</td>
<td>14.0</td>
<td>107</td>
</tr>
<tr>
<td>Circulatory diseases</td>
<td>390-458</td>
<td>1,110</td>
<td>975.2</td>
<td>114</td>
</tr>
<tr>
<td>Respiratory diseases</td>
<td>460-519</td>
<td>80</td>
<td>102.4</td>
<td>78</td>
</tr>
<tr>
<td>Accidents</td>
<td>E800-E999</td>
<td>266</td>
<td>217.2</td>
<td>122*</td>
</tr>
</tbody>
</table>

Maintenance workers

Maintenance workers in Sweden complain of headaches, respiratory distress, nose bleeds and allergic reactions caused by endotoxines (a group of bactericides). The problem persists in spite of technical measures (ventilation etc.). In Germany, the Federal Bureau of Health and the Environmental Protection Agency (Lukassowitz, 1990) has introduced measures to reduce dioxin emissions. One author asserts that dioxin has never been linked to the death of any human being. Other effects such as liver enlargement, psychological disorder and non-melanoma skin cancer have, however, been reported (Glenn, 1990).

In many countries there is increasing concern about exposure to gases in the industry, and revisions of exposure levels and threshold values are being called for. Not only the pulp and paper industry workers are worried; construction workers in British Columbia, Canada, who live in mill-site camps are also calling for action. In construction camps where up to 1,500 workers can live within 300 yards of the mill, fumes, especially from burning of gases at night, are believed to cause nausea and exhaustion among workers.
Table 8.3. Observed and expected numbers of deaths from all causes and from diseases of the circulatory system and the corresponding SMRs with 95 per cent CI by duration of employment, referred to the population of Finland, in men exposed to sulphur dioxide of duration of employment (y)  

<table>
<thead>
<tr>
<th>Cause of death, ICD, 8th rev:</th>
<th>1-4</th>
<th>≥5</th>
</tr>
</thead>
<tbody>
<tr>
<td>All causes (000-999)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diseases of the circulatory system (390-458)</td>
<td>15</td>
<td>9.3</td>
</tr>
<tr>
<td>Ischaemic heart disease (410-414)</td>
<td>7</td>
<td>4.3</td>
</tr>
</tbody>
</table>

Table 8.4. Observed and expected numbers of deaths from all causes and from diseases of the circulatory system and the corresponding SMRs with 95 per cent CI by duration of employment, referred to the population of Finland, in men exposed to hydrogen sulphide and organic sulphides of duration of employment (y)  

<table>
<thead>
<tr>
<th>Cause of death, ICD, 8th rev:</th>
<th>1-4</th>
<th>≥5</th>
</tr>
</thead>
<tbody>
<tr>
<td>All causes (000-999)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diseases of the circulatory system (390-458)</td>
<td>16</td>
<td>9.6</td>
</tr>
<tr>
<td>Ischaemic heart disease (410-414)</td>
<td>9</td>
<td>4.2</td>
</tr>
</tbody>
</table>
Table 8.5. Statistically significant PMRs and observed and expected deaths in pulp, paper and paperboard mill workers: New Hampshire, 1975-85

<table>
<thead>
<tr>
<th>Total No. of deaths = 1,071</th>
<th>Industrial code 160</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICD</td>
<td>Cause of death</td>
</tr>
<tr>
<td>-----</td>
<td>----------------</td>
</tr>
<tr>
<td>140-149</td>
<td>Cancer of buccal cavity &amp; pharynx</td>
</tr>
<tr>
<td>150-159</td>
<td>Cancer of digestive organs</td>
</tr>
<tr>
<td>151</td>
<td>Cancer of stomach</td>
</tr>
<tr>
<td>154</td>
<td>Cancer of rectum</td>
</tr>
<tr>
<td>161</td>
<td>Cancer of larynx</td>
</tr>
<tr>
<td>204-207</td>
<td>Leukaemia and aleukaemia</td>
</tr>
<tr>
<td>250</td>
<td>Diabetes mellitus</td>
</tr>
<tr>
<td>290-317</td>
<td>Mental &amp; psychoneurotic disorders</td>
</tr>
</tbody>
</table>

*p < 0.10
**p < 0.05

Paper manufacture

In paper making the soft pulp is suspended in water, and chemicals are added to impart the desired characteristics to the final product; paper mill workers may thus be more exposed to the various additives and fillers.

Slimicides (biocides) are used in paper mills to suppress the growth of micro-organisms, known as slime plugs, in process water. While various slimicides are reported to cause contact dermatitis among maintenance workers in the United Kingdom (Rycroft and Calnan, 1980), a Swedish study (Ahlberg, 1976) suspects certain components of slimicides to be potential causes of cancer and foetus injuries. The components of slimicides may spread through evaporation from machinery and the high moisture content in the air. Contact dermatitis developed after contacts with the pulp mixture in a paper mill. The Swedish report is based on tests on animals and emphasises that the chemical components alone may be harmless, but they are transformed in the body to other, harmful substances.

Paper conversion

In paper conversion, additives from the paper-making process and new chemicals used in paper product development can present health problems. Skin diseases (dermatoses) were investigated among 238 employees in Sweden in 1985-86, in a plant producing decorative equipment made of paper sheets impregnated with resol resins based on phenol and formaldehyde. In a questionnaire (91.6 per cent response rate) 98 workers (41 per cent of all employees) reported previous or current skin problems, and among those, 89 agreed to be examined and patch-tested. A physical examination revealed work-related skin diseases present in 30 workers (12.6 per cent of all employees). In six cases (2.5 per cent) diseases were aggravated by work; no work relationship was found in 42 workers (17.6 per cent), while for 11 diseases unknown relationships to work were diagnosed (Bruze and Almgren, 1988). Compared with the control group, the total number of patch-test reactions was significantly higher, which may indicate a positive selection among workers in the plant.

A study in an envelope-making factory in Denmark (Thormann et al., 1985) revealed that 10 of 20 workers developed contact dermatitis. The identified agent, dibutyl maleinate, was removed and the symptoms disappeared within three months.
8.2.3. Dust

Types of dusts and their effects

Airborne dust, especially in soft-paper mills, contains fibres of cellulose and kaolinite, wollastonite, talc and other silicates. From the Netherlands, Heederik et al. (1987) reported on dust and spore measurements and workers’ exposure to soft-paper dust. The exposure to paper dust was regularly found to exceed the Dutch maximum allowable concentrations (MACs) for total and respirable dust (10 and 5 mg per cubic metre, respectively). A very important contribution to the dust levels comes from the cleaning of machines with compressed air.

A mortality study (Thorén et al., 1989) on asthma and pulmonary diseases among workers in a soft-paper mill (toilet paper, paper towels and napkins) was performed in Sweden. The study encompassed 33 death cases and 228 references to potential risks for asthma and chronic obstructive pulmonary diseases, and respiratory cancer. The cases were selected from death and burial registers in the vicinity of the mill. At some places in the mill the concentrations of paper dust had previously been high, 10-30 mg/m³. Although it was not possible to classify the subjects into different exposure categories, the study provides evidence for a possible association between employment in the mill and increased risk of, and mortality due to, asthma and chronic obstructive pulmonary disease.

Asbestos has been shown to contribute to an increased risk of a rare, but highly fatal tumour of the membrane enveloping the lungs (pleural mesotheliomas). In old mills asbestos still remains a potential health hazard and can be found in the insulation of pipes, boilers and ventilation ducts, etc. Preventative health measures in this respect thus continue to be valuable.

In Sweden workers in the pulp and paper industry are one of the occupational groups found to have an increased risk of malignant pleural mesothelioma. A study (Järvholm et al., 1988) investigated whether the death during 1961-79 of 25 former pulp and paper workers diagnosed with mesothelioma might be explained in terms of their exposure to asbestos. A second hypothesis was that paper dust might be involved in the introduction of the mesothelioma. The results indicate that asbestos exposure was the cause for the increased incidence of the tumour in workers in the pulp and paper industry. Paper dust, by contrast, is unlikely to be associated with pleural mesothelioma.

In an investigation into working conditions in a pulp mill in Alberta, Canada in 1989, workers and especially construction workers expressed concern about asbestos, lime dust and chlorine gas (Bryson, 1991).

Control of dust concentrations

In the United Kingdom the Control of Substance Hazardous to Health Regulations (COSHH) put the responsibility on the employer for the control of dust concentrations. Although not all dusts have been assigned occupational exposure limits, the lack of such limits should not be taken to imply an absence of hazard, and they are all covered by the legislation. In the absence of a specific exposure limit for a particular dust, personal exposure should be kept below 10 mg/m³ for an eight-hour time-weighted average (TWA) of inhalable dust and below 5 mg/m³ per eight-hour TWA for respirable dust. Other countries have even stricter regulations. In the Federal Republic of Germany the hygienic level value (HLV) is set at 5 mg (total)/m³ (TRGS 102 Anlage 1 Statute published by the Bundesminister für Arbeit und Sozialordnung).

Sweden, which may be the strictest nation with respect to health and safety at work, has set its HLV at the same level (5 mg/m³) for all organic dust (Jones, 1991). Total dust exposure measured in a Swedish soft-paper plant was generally below 3 mg/m³. The respiratory fraction of the total dust was 15-70 per cent. The inorganic fibres to total fibres concentration in the plant was 10-15 per cent (Sahle et al., 1990).
In the Dutch dust study quoted above, (Heederik et al., 1987) there were also indications of a qualitatively different exposure to moulds inside the mill. An average of 900 CFU was found per cubic metre. Compared to outdoor conditions the air contained in particular more species of Penicillium and Aspergillus. The study showed a consistent trend toward higher prevalences of respiratory symptoms in the exposed group. Positive skin (intradermal) tests against one or more of the fungal extracts were associated with a decrease of pulmonary function over the week in exposed workers. The relationship between intradermal test results and pulmonary function data indicates that the change in pulmonary function over the week may have an immunological component. The study suggests that standardisation of measurements of fungal spores in the air is necessary. Pulmonary function changes among (soft) paper workers in relation to immunological changes deserve more attention. Immunochemical methods to determine allergen concentrations in the air will also play an important role in the future.

8.2.4. Noise

Noise is an unpleasant and undesired sound. High levels affect the nervous system, cause discomfort, irritation and make conversation difficult. High levels in combination with long exposure times result in permanent hearing losses.

Noise is a major hazard in mechanical processing during debarking, grinding and defibration in pulp mills as well as during paper making and conversion operations. New machines with extremely high speed and capacity generate as high if not higher levels of noise than older ones. Exposure levels exceed limits for hearing damage in most production sections of the plant. It may be the most important area where technological change has failed to improve the occupational safety and health situation.

In the debarking, mechanical pulping and paper machine sections, noise-insulated cabins have sufficiently reduced exposure to noise levels above 85dB (a) during most of the shift. A study in a Swedish liner board mill on the propagation of noise and vibration in a representative control cabin, also shows levels below Swedish hygiene recommendations (Tyrman et al., 1987).

Insulated cabins are often impracticable in conversion, however, where the operator has to stand next to the machine most of the time. Therefore, insulation of the machines is attempted instead. The effectiveness is often limited because the material inlets and outlets cannot be covered. Throughout the industry hearing protection (muffs or earplugs) is thus an important complementary (pulp and paper mills) or primary (conversion) measure to prevent hearing loss.

8.2.5. Shift work

Shift work has long been a prominent feature of work in the pulp and paper processing industry. Irregular working hours (particularly when including night work) are known to disturb sleep, alertness, eating patterns and social life. It has also been established that shift work increases the risk of so-called psychosomatic illnesses such as stomach ulcers, heart and intestinal complaints.

An ILO report on shift work in the chemical industries reckons that only about 30 per cent of shiftworkers are able to tolerate shift work all their working lives with no observable health effects (ILO, 1988b).

The structure of a shift schedule is known to be important in improving the worker’s ability to obtain the proper amount of sleep at home. Data collected in numerous operations, including the paper industry, show that there is a direct relationship between sleep at home, alertness on the job and the incidence of falling asleep at work.

Rotation of shifts is a particularly important issue in continuous (i.e. 24 hours, seven days a week) shift schedules. As occurs with jet-lag during long distance travel across time zones, the body is only capable of adjusting by about 60 to 90 minutes a day.
Studies of the biological rhythm of the human body have established that rapid rotation (e.g. every two or three days) has fewer negative health effects on the worker than weekly rotation. Alternatively, much slower rotation (e.g. keeping a worker on a shift for three weeks) is also much better than weekly rotation because it allows adjustment to take place.

It has also been shown that the forward rotation of shifts, following the hours of the clock, is more favourable for the adjustment process than backward rotation. Furthermore, it is considered that the longest rest period should follow the night shift (ILO, 1988b).

Properly designed schedules increased sleep at home by up to 23 per cent and reduced the incidence of "nodding off" on the job by as much as 75 per cent (Connolly, 1988).

In Sweden 504 paper mill workers were followed for 15 years (Knutsson et al., 1986), and shiftworkers were compared with daytime workers regarding the incidence of ischaemic heart disease (IHD, inadequate supply of blood to the heart). The relative risk (RR) of IHD rose with increased exposure to shift work. A significant risk was associated with an exposure of 11-15 years (RR=2.2) and 16-20 years (RR=2.8) of shift work. A fall in relative risk after 20 years of shift work was ascribed to the positive selection that had taken place in the group. A comparison of background variables further showed that shiftworkers were significantly more likely to be divorced. They also smoke more, but neither family status nor smoking could directly be linked to IHD rates. The study, together with other studies, suggests that there is an association between shift work and ischaemic heart diseases that merits further research.

An example for a simple and cheap, yet very effective measure to buffer the negative effects of shift work is provided by Finland. At the Veitsiluoto Pulp and Paper Mill gastric diseases were very common and a major contributor to the number of work-days lost. The gastric diseases were attributed to excessive smoking and drinking of coffee and a concomitant lack of adequate meals. In 1980 the employer started to provide warm food for shiftworkers in order to encourage good eating habits. A significant reduction in stomach complaints and lost days was registered within a year and there was a continuous improvement thereafter (see figure 8.18).

8.2.6. Drug abuse

The use of drugs or alcohol is an issue for the workforce’s safety and the workers’ health as well as for the economy of the industry. Workforce drug abuse has increased drastically in recent years. Some experts estimate that one out of seven members of the workforce in North America is affected in some way by significant drug or alcohol addiction (Horton, 1987), and other sources indicate that American business is losing an estimated US$1,250 per employee per year because of drugs and alcohol (Jensen, 1990).

The pulp and paper industry is said to be neither better nor worse than the average and rehabilitation programmes in individual enterprises have been implemented. For the last six years the Gilham Paper Company in the United States, for example, has had an "employee assistance programme" that workers can use free of charge and of their own free will. The programme incorporates staff doctors and psychiatrists, and patients undergo group therapy and counselling. The enterprise’s insurance pays up to US$10,000 per employee for rehabilitation. The scheme has a success rate of 50 per cent and the enterprise will allow the employee to use the programme twice. The company will allow an employee who has returned to drugs to be attached to the programme once more, but his employment will, thereafter, be terminated.

At the Union Camp Corporation, also in the United States, the "substance abuse programme" is administered throughout the medical department, which is a part of the human resources function. At a person’s request he is sent to an outside facility and the company grants a leave of absence for 30 days of treatment. Upon returning to work the employee must meet certain stipulations such as having good work habits, regular attendance and participation in an out-patient support group such as Alcoholics Anonymous. The health insurance covers the cost of the programme.
Some companies are fighting drug and alcohol abuse with other tactics such as personal searches and undercover agents. This approach has proved to be inappropriate if only because the identity of the agents is quickly discovered.

Drug testing is a critical issue, and has run into difficulties where it has been used. The legislation varies between countries, but in general is unclear; complaints over drug testing occur frequently and some have led to arbitrations. The Court of Justice in Sweden gave the employer the right to fire two construction workers for their refusal to be tested for drugs. A rumour of cannabis use among construction workers at the mill had prompted management to carry out urine tests to ascertain that there was no use of drugs at the mill site. All workers had to participate in the test to avoid discrimination, and if traces of drugs were found, the worker was offered a rehabilitation programme. The two workers who were later dismissed, refused to take the test. The verdict backing the employer was not unanimous, but the mill’s senior safety delegate appreciated the support that the verdict gave to the working environment law (safety at the work site) rather than to the law of employment (Ericsson, 1991).

8.3. Occupational safety and health initiatives outlook

Activities in occupational safety and health in the sector have increased in recent years. In several countries joint working environment councils composed of unions, employers’ federations and governments have been established. Programmes of action, including research and development, have been implemented in various countries, with the objective of improving the working environment. The concern for occupational safety and health is expected to continue to grow throughout the 1990s.

In the United Kingdom a Paper and Board Industry Advisory Committee was formed in 1979 to advise the Health and Safety Commission on matters concerning the paper and board industries. Employers and unions are members and the Health and Safety Executive provides the chairman and the secretary. The Committee works to encourage good standards of safety and health in the industry. Over the years several guides have been prepared and revised covering various matters such as “safe systems of work for
paper machines", "handling bales of pulp and waste paper", "chemicals", etc. (United Kingdom, 1988).

Sweden has set up a programme for the industry which is designed to meet the demand and wishes of mill employees and their employers to achieve together an effective and safe working environment. A joint working environment council composed of representatives of management and labour outlines its aims as: "drawing up programmes of action (including research and development), advising employees and employers and acting as coordinators of projects". Emphasis has been placed on paper dust, chemical hazards, noise and vibrations, and shift work (O'Farrell, 1989).

Workplace activities are also making great advances. A landmark local safety document was signed in Green Bay, Wisconsin, United States, in October 1991 (The Paperworker, 1991). By granting workers the right to act and the right to refuse dangerous work, the local agreement has reached what labour hopes to achieve nationally via the National Occupational Health and Safety Administration Reform Bill. The agreement spells out the individual worker's right to refuse unsafe work and the right to full training in all operations he/she encounters. The company (James River Corp.) guarantees job transfer or pay for lost time if an unsafe condition necessitates extended shut-down of the machine.

Something is also being done about the lack of information on the longer-term health impact of employment in the pulp and paper industry noted above. Medical researchers have long suspected that mill workers are at greater risk for certain types of cancers and lung diseases because of their exposure to the chemicals used to process pulp. The American Paper Institute has responded to the concerns by sponsoring a US$8.8 million epidemiological study on health trends among paper workers, involving 10,000 workers and 50 mills over a period of seven years.

The chapter on the environment and the pulp and paper industry in this report demonstrates the increasingly intimate link between the working and the general environment. While this is often seen as an encroachment by the general environment it is quite likely that, as regards remedial measures, there will be more outreach and extension in the opposite direction in the future.

In Canada, for example, the view is advanced that occupational health and safety professionals in general should be natural contributors to the fight against pollution outside the workplace because of their work in controlling the pollution inside the workplace (Bergen, 1989). Their understanding of how to deal with human health and safety issues in a technical and economic manner should be a useful contribution to solving safety and environmental problems.
Summary and suggested points for discussion

Summary

Development and status of the industry

The pulp and paper manufacturing and converting industry is one of the major industrial sectors in many countries, making a significant contribution to gross national product, to the trade balance and to employment. Paper is a vital commodity, not least because of its function in education.

The last two decades have been a prosperous period for the sector. Pulp and paper production rose steadily and rapidly worldwide at an average annual rate of 3.5 per cent between 1975 and 1989. During this period the industry made major advances in a number of developing countries as well. None the less, production and consumption of paper remain heavily concentrated in the industrialised countries of North America, Europe and Japan. The per capita consumption of paper in the United States (311 kg) is almost 100 times that in India.

Pulp and paper are traded widely on a global market, making world market prices a powerful parameter for economic decisions in all countries. While converted paper products tend to be more customised and less easily transported because of unfavourable weight/volume to value ratios, there is increasing international trade, and hence competition, in the converting industry.

The status and the development of the sector differ considerably from region to region. Africa has very low production levels by international standards. Development has been impeded by small markets as well as capital and raw material shortages. As in many other respects, Asia is also a region of great diversity in terms of its pulp and paper industry. There are high-tech, high-volume producers such as Japan and South Korea, as well as countries like China and India with high volumes but fairly small, labour-intensive mills. Finally, there are some countries such as Thailand, Malaysia or Indonesia that are on the way to becoming world-class producers.

Europe is the second largest pulp and paper-producing region. Northern Europe features large, modern and export-oriented pulp and paper-manufacturing industries. In the rest of Europe paper conversion often exceeds the manufacturing industry in terms of turnover and employment. Eastern Europe has a good number of sizeable producer countries. Many of the mills, however, are technologically obsolescent. Even weightier problems are posed by the transition to market economies.

The pulp and paper industry in Latin America is fairly large and varied. It has tremendous momentum in some countries like Brazil and Chile where major investments are being made on the basis of fast-growing plantations. North America is home to the two biggest players worldwide. The United States is by far the largest producer and converter of pulp and paper and Canada is the second largest pulp maker and the premier exporter of pulp and paper.

The outlook for pulp and paper is mixed. The industry is currently in the trough of a recurrent four-to-five year business cycle characterised by a period of boom and expansion followed by overcapacity and depression. In the medium term it is likely to resume its long-standing path of growth, but at a very uneven pace in the various regions. Developing countries, Northern and Western Europe and Japan are poised to see capacity expand at around 4 per cent per year. The North American industry will probably grow at no more than half that rate, and Eastern Europe is expected to see its capacity stagnate or even shrink.

The pulp and paper industry and the environment

As a major consumer of wood, water, energy and chemicals, the pulp and paper industry is almost bound to get involved in the controversy over the relationship between
industry and the environment. Environmental concerns are changing consumer attitudes and behaviour, generating new market forces and more stringent legislation. Governments often find themselves in a dilemma, having to reconcile conflicting public and environmental interests with those of the industry and its employees. Clearly the ILO constituents have a stake in this debate since environmental requirements can directly affect employment, and the working and the general environments often overlap. Bipartite as well as tripartite action can contribute to a mitigation of conflict in many ways.

On the face of it the pulp and paper industry has a strong environmental advantage over other industries. Its raw material, wood and other fibre, is fully renewable, and its products, paper and board, can be recycled. Despite these favourable factors the debate about the environmental impact of pulp and paper making has been heated. Toxic emissions into air and water, high energy consumption, alleged detrimental effects on forest ecosystems, and the large quantities of waste products to be disposed of have dominated the discussion. Notwithstanding the enormous investments made by the industry over the last two decades into environmental clean-up, many problems persist.

While the social and labour impact of increasingly stringent environmental regulations can be severe, particularly in terms of employment, the impact need not be negative in the longer term as new employment opportunities arise, such as in recycling.

The general and working environments are often two sides of the same coin. Chemicals that constitute a health hazard in the working environment are usually also major pollutants. Moreover, accidental discharges often add in a major way to the effluent loads of the technology used. Employees are also potentially affected by environmental problems arising from pulp and paper making because legislation in a number of countries holds them individually responsible and liable in the case of offences.

The traditional attitude of the pulp and paper industry, as of many others, towards its environmental impact has been defensive. Lately, however, there have been signs that employers and workers increasingly recognise a need and opportunity for being proactive with respect to the environment. Employees can help to improve public relations and to set the often misrepresented environmental record of the sector straight. In some cases employers and workers have successfully involved themselves in multipartite mechanisms for conflict resolution such as environmental roundtables.

Bipartite and tripartite initiatives may also help to improve environmental performance. Environmental committees modelled on those active in occupational safety can contribute to avoiding accidental discharges and to reducing the risk of major disasters. In some countries joint (management and labour) yield and waste committees have successfully eliminated inefficiencies in the processes, reducing the consumption of raw material, energy and harmful chemicals. Like other initiatives in the environment field the measures taken by yield and waste committees make sense in purely business terms in addition to benefiting the environment.

Employers’ and workers’ organisations can cooperate in this field also in providing workers with the necessary training on general environmental conservation in the pulp and paper industry and hazard control in particular. Finally, workers will be favourable affected by the new, cleaner technologies required to meet environmental constraints and can contribute to their development. There are good reasons to believe that a proactive bipartite and tripartite strategy in the pulp and paper industry with respect to the environment would go a long way towards safeguarding the future for all concerned and sparing the industry from having to undergo more of the sometimes traumatic change that environmental requirements have forced on it in the past.

Technological and structural change

Technological change has played a central role in the development of the industry over the last ten to 15 years, with far-reaching consequences for its structure, employment, work organisation and human resources. Over this period the pulp and paper industry evolved into the high-tech era. Significant technological change took place at all stages of the process, from fibre preparation to converting. It led to new products such as recycled
fibre for high quality end uses, new paper grades and composite packaging materials. New processes were introduced and conventional ones were greatly improved.

While most technological change in the sector was incremental the numerous individual changes add up to a significantly modified technology. Chemical pulp mills have become gigantic. Mechanical pulping methods have been much improved and are gaining in importance. Paper- and board-making machines have become much wider and faster, and therefore much more productive. Computerised process control played a key role in increasing capacity and quality in both manufacturing and conversion. Modern converting equipment has a higher speed, improved reliability and shorter change-over times between runs. Computer controls facilitate just-in-time operations and deliveries. The most significant development in converting has been the closing of the technological gap between the (formerly stand-alone) machines used in converting and packaging.

Technological change has been driven by a number of factors. Customer attitudes and legislation had a major impact on the development of recycling and on pollution abatement. Customers demanded higher and more consistent quality. Competition from rival products, but even more from within the sector, intensified. A key factor in pulp and paper manufacture has been the benefits arising from economies of scale which provided a strong push for the rapid structural change the sector is witnessing. This change has proceeded on three fronts: integration, concentration and globalisation. Integration and concentration often took place across frontiers as companies sought access to global markets and hedged against the potential risks associated with emerging trade blocs, particularly the single European market. Integration upstream into raw material sources as well as downstream into converting and marketing was motivated by value-added strategies and a quest for higher market shares. Concentration of the industry has been more important than integration. Economies of scale give large machines and mills a significant competitive edge in production cost but, to reap the full benefit, enormous investments, access to international markets and product diversification in large companies are necessary. As a result, large numbers of small mills and even larger numbers of small companies have disappeared. Despite these moves the degree of concentration of the pulp and paper industry remains modest compared with some other industries. The top 150 pulp and paper companies in the world accounted for two-thirds of world output in paper and board in 1991, and for about one-third of employment in the sector.

These developments have social and labour implications in terms of employment, working conditions and collective bargaining. Technological and structural change have tended to reduce employment opportunities and job security. A widening information gap and the leverage of multi-mill corporations in collective bargaining have often put union negotiators in a difficult position.

**Employment and productivity**

A conservative estimate puts world employment in the pulp and paper industry at 3.5 million. In addition to direct employment in pulp and paper manufacture and in converting there are substantial employment spin-offs in other sectors of the economy. Employment in the sector tends to be concentrated in a limited number of countries and in the regions and localities where it is established the industry is often a significant employer. In countries that are both major producers and consumers of paper the converting industry typically employs about twice as many people as pulp and paper manufacture. Box makers and paper mills are the two largest subsectors in terms of employment.

Global employment levels have remained virtually unchanged over the last decade. In some countries and regions, however, there were some significant changes. Most developing countries saw employment gains, while in the majority of industrialised countries there were drastic declines - mainly in pulp and paper manufacture; converting was less affected. The jobs that remained often became more secure. Workers, employees and trade unions in the sector face a dilemma: join in, help to improve productivity and lose some employment, or don't - and risk losing all.

In most countries productivity gains outpaced even the swift growth in output experienced during the last ten years. New greenfield mills or major rebuilds of existing
mills produced the major benefits for productivity, often twice former levels, leaving the
giant halls and installations of modern mills conspicuously devoid of people.

Mill closures have a severe impact on the local community since they often mean a
near-total loss of local employment opportunities. Because of the general recession the
short-term prospects for employment in the sector are gloomy in many countries.
Medium-term development will in all likelihood be influenced mainly by product demand,
technological change, the balance of production factors and, to a lesser extent, working
time.

Technological change looks set to continue, and its effects will be compounded by
rationalisations not based on hardware. Productivity is likely to continue to grow faster
than output in many industrialised countries. The resilience of smaller and older mills
trying to survive in niche markets will have a significant impact on employment. These
mills have much higher labour intensities and many prospering small mills demonstrate
that the labour-saving bias in technology and investment decisions is by no means
inevitable. The situation in developing countries and Central and Eastern Europe is likely
to be different. Employment in developing countries will probably continue to rise,
whereas the industry in Central and Eastern Europe must expect a drastic drop in
employment in the medium term.

Job security will probably be one of the major social and labour issues in the sector
in the 1990s. The process of employment adjustment can and will be influenced in a
number of ways by the social partners in the industry and governments. This will concern
modalities, such as finding socially acceptable ways of dealing with redundancy and
coping with technological change.

Technological change and flexibility

Flexibility has become a "buzz-word" in this industry, as in many others, but there
are few empirical studies of it. There are four forms of flexibility: functional (e.g.
multiskilling), numerical (e.g. temporary and part-time work), financial (e.g.
performance-based pay) and distancing (e.g. contract labour). Contrary to some other
observers this present report argues that all forms are relevant in the pulp and paper
industry.

Contract labour is fairly common in some countries, particularly for maintenance
operations. Experience with contract labour in forestry, such as in pulpwood harvesting,
indicates that it can present serious problems. Part-time and temporary employment are
significant for subgroups in the workforce, particularly for women. Those employed on
such a basis are often not entitled to full social protection and benefits. Some collective
agreements have addressed this. Contractors and temporary workers record high accident
rates, although legislation, collective agreements and mill-level arrangements in some
countries attempt to contain the safety problem. While such forms of employment attract
much attention, there is a less visible trend to bring the status of blue-collar workers more
in line with that of white-collar ones.

Working time practices in the industry exhibit considerable flexibility. Work
organisation is the area where much more flexibility is emerging including more unspecific
job classifications, broader skills, flatter organisations with self-managed teams and
internal job rotation. There are many successful examples of team approaches enabling
mills to break production records and to make long-term efficiency improvements. These
moves were often welcomed by employees who benefit from higher pay, better career
prospects and higher job satisfaction.

The controversy over flexibility seems to be fuelled more by a lack of trust between
management and labour and a past of adversarial relationships in many countries than by
flexibility per se. Strong and well-informed trade unions can play and have played a crucial
role in devising and implementing equitable schemes of flexibility. The partnership
between employers and unions over the last decade that has made the industry in Finland
one of the most modern and most productive in the world is a striking example of what
dialogue and cooperation can achieve for mutual benefit.
Human resources and training

As in other sectors, hardware and the intelligence of a handful of technocrats will no longer be enough to meet the technological and economic challenges facing the pulp and paper industry in the future. Successful technology adoption, quality assurance, innovation and other needs call for more emphasis on human resources development.

The workforce of the future is likely to be composed of fewer unskilled and manual workers, but will probably not have a significantly lower share of skilled blue-collar workers, as rationalisation increasingly focuses on administrative, support and managerial staff. At all grades skills will be broader and skill levels considerably higher. Training is thus receiving renewed attention even in countries with well established training traditions. The industry usually does well in providing retraining associated with new technologies. There is, however, a clear need for broader basic education and initial vocational training as well as for life-long learning. This is one of the reasons for a growing dissatisfaction with exclusive reliance on on-the-job training.

Coordination and a coherent training strategy for the industry are vital for systematic, up-to-date and cost-effective training. Otherwise serious mismatches can develop between industry requirements and training systems. Thorough stock-taking often reveals that present training is top-heavy, emphasising the academic level, whereas the biggest deficits are found at the skilled and semi-skilled levels.

To keep pulp, paper and converting jobs attractive as work organisation changes, to enhance job security for the individual and help redeployment in the case of redundancy, training and career patterns should allow for a maximum of upward and lateral mobility. Formal skill recognition is an important measure to this end.

The industry already suffers from some workforce shortages and is not immune to the growing competition that will prevail in the future for qualified, high-potential employees. The situation of women employees illustrates many deficiencies in terms of human resources development, with women typically being limited to low-skill, low-pay jobs with hardly any career opportunities.

More and more changes in technology, work organisation, job content and lines of progression call for a synchronisation with workforce planning, training, promotion and remuneration packages. This would promote smooth adjustment by companies and help keep workplaces attractive, employment secure and career prospects appealing. Strategy development and implementation stand to benefit greatly from tripartite cooperation.

Working time and remuneration

In line with national legislation and practice the normal working week is 37-45 hours in the countries covered, with an average around 40 hours. Actual working hours per year are considerably fewer than scheduled ones in most cases. They range from 1,500 to more than 2,000 hours per year. Reductions in scheduled working hours have taken place in a number of countries over the last decade, but actual hours worked decreased more slowly, suggesting an increase in overtime. Shift work is very common in the sector. Small converting plants may practice day work or discontinuous shifts. Larger converters and most pulp and paper manufacturers are on continuous shift operation, sometimes 365 days per year.

Not surprisingly, there are big differences in the incomes of employees between countries. National as well as numerous local agreements differ in many ways: wage levels, the spread across job classifications, overtime, weekend and shift bonuses, special allowances, incentives and others.

In most cases pulp and paper makers have appreciably higher incomes than converting workers. Earnings in the industry as a whole are better, often markedly so, than average manufacturing incomes in the respective countries. At the top of the list are probably pulp and paper makers in the United States, where average annual blue-collar earnings were about $45,000 in 1991 and top worker incomes (including much overtime) reached $70,000.
This positive picture notwithstanding, there are serious economic problems facing workers in many developing countries and in Central and Eastern Europe as they see their purchasing power eroded by hyperinflation. Subsections of the workforce, such as part-time workers and women, are also much less well off than the average worker in the industry.

**Occupational safety and health**

This report may represent the first attempt to provide an international overview on safety and health in the industry. For this reason it is inconclusive in many respects; many questions are left without a definite answer and many gaps and shortcomings in the information available were identified.

The limited data available on accidents in the pulp and paper industry show large, unexplained differences between accident rates recorded in different countries. Moreover, the pattern for accident frequencies is not in line with the one for fatalities. The underlying differences in national reporting systems and practices are so large as to render comparisons of statistics between countries meaningless.

In spite of their limitations, accident statistics are a crucial guide for the assessment and improvement of safety in the pulp and paper industry at the national level. There are no clear trends in the countries for which reports are available with respect to either the differences between manufacture and conversion of paper products, or between this industry and other manufacturing industries. While in one country conversion has higher accident rates than paper manufacture, this is not true in another. The industry has a better safety performance than the average for manufacturing industry in some countries, but fares markedly worse in others.

Trends in accident rates are also inconsistent. Some countries have seen their record improve, but in most performance has fluctuated. Closer inspection reveals that while machine-related accidents have declined in number, there has been an increase of accidents away from machines and in not obviously hazardous situations.

Occupational health appears to have received less attention than it deserves. While there is a lower incidence of occupational sickness and disease than accidents in the industry, and than health complaints in other industrial sectors, occupational diseases may cause more workday losses and serious long-term health problems than accidents.

There is a lack of adequate data. The few long-term studies available had to grapple with big methodological obstacles. What they tend to show is that mortality among production workers is not significantly higher than for the population at large. A number of serious diseases including various types of cancers, however, are much more common in the sector than elsewhere. The main causes of concern in this connection are chemicals and biological agents. Serious complaints related to chemicals are found at all stages from pulp making to converting. Many appear to be process-specific.

Shift work, particularly where it involves night work, may lead to health problems. Present shift schedules appear susceptible to improvement. Heat and noise continue to be hazards in spite of energy-saving measures and noise containment through insulated cabins. Monotonous work at intensive work rhythms results in many strain injuries in the converting industry.

Joint labour-management initiatives in the field of safety and health include a major study sponsored by the industry in the United States in collaboration with the trade unions to improve the understanding of long-term health effects of chemicals in the pulp and paper industry.

**Suggested points for discussion**

In the light of the foregoing treatment of the issues, the following list of points is offered as a basis for discussion to enable the Meeting to develop and adopt appropriate
conclusions on the matters it considers of primary importance. The Meeting is, of course, free to modify this list as it sees fit.

Industrial development

1. The pulp and paper industry has developed slowly in many developing countries and is faced with a difficult transition process in Central and Eastern Europe. How might governments, employers’ and workers’ organisations, as well as national and international organisations, assist the industry in the countries concerned to deal with the social and labour aspects of its development?

Employment

2. Technological change and rationalisation measures have led to substantial increases in productivity in the industry, in some instances leading to reduced employment levels. What measures need to be taken by governments and employers’ and workers’ organisations to reconcile the industry’s need for higher efficiency with the need for more employment opportunities in many countries and adequate job security for the individual?

Human resources and training

3. Changes in technology and work organisation give a renewed emphasis to human resources as a critical production factor. What points need attention in the training systems used in or by the industry and what are the adjustments needed to meet future requirements? What are the roles of governments and the social partners in devising and implementing coherent strategies for human resources development?

4. What needs to be done to maintain and increase the attractiveness of employment in the pulp and paper industry so as to ensure a sufficient level of suitable new entrants in the future?

Working conditions

5. Various forms of flexibility in employment and in work organisation are being practised in the pulp and paper sector. What is the economic and social impact of these practices?

6. What policies, mechanisms and procedures are needed to enable the industry to benefit from flexible practices while ensuring adequate social protection for its workers and the equitable sharing of the benefits between employers and workers?

Occupational safety and health

7. While there are many gaps in existing information, it appears that there are significant industry-specific safety and health problems. Which problems should be addressed as a matter of priority; how could they best be resolved; and what needs to be done to improve understanding of safety and health problems in the industry?

Environmental considerations

8. The general and the working environments overlap in the pulp and paper industry, as they do in some other sectors. The industry is faced with challenges in both areas, particularly the general environment, that could have major social and labour repercussions for the workers and the communities. What are these repercussions? How can their positive aspects - e.g. that paper is a fully recyclable product based on a renewable natural resource - be emphasised and their negative aspects be minimised?
Labour-management relations

9. Technological and structural change has resulted in an increased concentration of the industry and a trend towards globalisation. What are the implications of these changes for labour-management relations; and what adjustments in those relations might be needed in the future?

Role of the ILO

10. How should the ILO assist its constituents in identifying and dealing with social and labour problems in the pulp and paper industry?


Forest Development Corporation of Maharashtra Ltd. 1981. Project report for setting up handmade paper unit at Junona, Dt. Chandrapur, State Maharashtra (Nagpur, India).


Simons, H.A. 1991. Scientific and technical training and utilization to improve competitiveness of the Canadian forests products industry, Policy and Economics Directorate, Forestry Canada (Ottawa), pp. 47, 55-57, 60, 72, etc.


*Wall Street Journal*. 1992. "MoDo's profit plunged 82% last year on 5% sales drop".

A Review of Women and Employment in Bangladesh

Rashidan Islam Rahman
A REVIEW OF WOMEN AND EMPLOYMENT
IN BANGLADESH

Rushidan Islam Rahman

International Labour Organisation
Asian Regional Team for Employment Promotion (ARTEP)
NEW DELHI

March 1992
PREFACE

This paper forms part of a series of working papers being brought out by ILO-ARTEP under the Asian HRD Network Project (RAS/86/071) which is supported by the UNDP. These papers are aimed at strengthening the institutional machinery engaged in the formulation, coordination, monitoring and implementation of employment and manpower planning in the Asian region.

The study discusses empirical studies on women's labour force participation in Bangladesh based on national level data available. The questions of unemployment and underemployment, determinants of women's employment, benefits gained from employment and the status of women are examined in the light of findings from existing studies. An attempt is also made to relate these findings to theoretical frameworks. Areas that have not been addressed by existing studies are also pointed out along with the need for further research.

New Delhi
March 1992
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1. ORGANISATION OF THE STUDY

A study of women's employment is important for two major reasons. It reflects women's role in the economic development of a country by taking into account their contribution to the GDP. Thus an analysis of women's employment will throw light on the development and utilisation of human resources. Secondly, employment enables women to share in the fruits of economic development by having direct access to income. This paper reviews studies on women and employment in Bangladesh to examine how far they throw light on these two aspects of women's employment.

The questions that arise in any discussion of women and employment are: (a) why does women's employment need separate attention? and (b) how can we place these specific issues into a systematic analysis? These two questions are interrelated and the answer to the second question must be sought on the basis of the answer to the first.

The review will begin with a discussion of the studies on the methodological issues related to women's employment in Bangladesh (Section 2). This will be followed by a discussion on empirical studies on women's labour force participation. The discussion will be organised in two sections, viz. according to national level data on participation of women in employment in Bangladesh (Section 3), and micro level studies on women's participation in different types of employment (Section 4).

In labour surplus economies such as Bangladesh, the question of unemployment and underemployment have been the active subject of debates and discussions among academicians and policy-makers. Studies on the female labour market focussing on these above issues are discussed in Section 5. Section 6 will discuss the studies on the determinants of women's employment and labour supply.

Employment and time allocation affect access to income, and it needs to be assessed how far women's remuneration compensates their productive employment. In this respect the studies on earnings and wage rate received by women are examined (Section 7). A discussion on whether education of women leads to productive employment is presented in Section 8. Similarly, the effect of access
to productive assets, particularly land and capital on women's employment will be examined (Section 9). Benefit from employment may be reaped in terms of non-economic gains, the most important of which are social and family status. Information on these aspects will be presented in Section 10.

On each of the issues mentioned above, this study will review the findings of existing studies, arrive at conclusions after comparing findings from various studies, and whenever possible, relate the findings to existing theoretical frameworks to analyse these issues. In the last section, the major feature of studies on women and employment in Bangladesh will be summarised. Areas which have not been addressed by the existing studies will be pointed out along with the need for further research.
2. CONCEPTUAL ISSUES IN THE DEFINITION OF WOMEN'S EMPLOYMENT AND VALUATION OF THEIR WORK

In conventional labour allocation studies only two alternative uses of time are taken into account: paid employment and leisure. Extension of such studies to economies with self employment as the predominant mode of labour use, necessitated the classification to be more general: work vs. leisure, where work may be self employment or paid employment. Under self employment goods and services are produced in activities organised by oneself of by one’s family where the output is the remuneration for that work and no wage is paid since the employer and the worker are the same. However, the produced goods and services may either be consumed by the family of the worker or may be sold in the market. In a competitive market, the output of self employment may be a perfect substitute for wage earning since the products may be sold in the market at any time.

In contrast, housework is an activity which produces goods and services which are consumed by the workers and his/her family. It is similar to self employment in so far as no wages are paid. It is distinct from self employment in that housework output cannot be sold, it must be consumed by the family members. This does not preclude the possibility of hired workers being used to produce household services; in such a case the worker is paid a wage and his/her employment is counted as paid employment.

Women's contribution to housework is not viewed as productive employment in the usual classification. In fact, the same services as produced by the housewife may be purchased in the market. This leads to the question of why housework should not be viewed as gainful employment.

Even though housework is by definition a non-market activity, it adds to the total consumption benefit of the family, the society and the economy. This needs to be formally acknowledged if proper recognition is to be given to the contribution of women to housework. This issue has been raised in many international fora (United Nations 1977); individual studies have attempted to

These two studies followed the earlier theoretical and empirical work on the valuation of housework and subsistence activities. Both these relied on comparisons of hours of work performed by men and women and some monetary evaluation of these tasks. While the genderwise comparison of the amount of employment gives a straightforward comparison of efforts, the monetisation aspect has severe limitations. Before discussing these limitations, the estimates obtained from these studies are briefly mentioned. Chowdhury uses data from village level studies to show that in terms of hours worked, women contribute as much as or more than men. On the basis of some village level surveys, Chowdhury calculates that women contribute 41 per cent of potential full income of the family whereas they contribute only 15 per cent of the value generated by productive work.

Hamid (1989) endeavours to make a monetary valuation of subsistence production by women. She uses Labour Force Survey data on the amount of subsistence work done by women and the prevailing market wage rate for unskilled labour (two alternative estimates using male and female wage rate are presented). This estimate does not attempt a valuation of housework. Thus it misses the major component of women's contribution. This study focusses on the valuation of subsistence production which is traditionally not captured by sector classification used in national income accounts. Her estimates show that inclusion of this value added would raise the GDP of Bangladesh by 24 per cent of which 11 per cent is female contribution and 13 per cent is by males. The usefulness of this estimate depends on the validity of her assumption that these activities escape national accounting as it is presently conducted. In the definition of subsistence activities in Labour Force Surveys (which provide Hamid's data), some components overlap with primary production output which have
already been included in the GDP. Hence the estimate of 24 per cent addition to GDP is misleading.

Moreover, there are problems in using the market price of labour for attaching a monetary valuation to women's housework and subsistence employment. Wage rate can be used as an opportunity cost of labour only if it is exogenously given and any amount of employment at that wage rate may be obtained without affecting that wage rate. This may be somewhere near reality for the industrial economies which do not face significant unemployment. But in Bangladesh, the prevalence of substantial amount of unemployment and underemployment is a widely accepted phenomenon. The Labour Force Survey 1983-84 gives a figure of 18 per cent of workers as underemployed. Among female workers, 41 per cent were underemployed. In this situation, employment may not be obtained at the prevailing wage rate and thus this wage is not the correct opportunity cost of labour. Therefore, the valuation using market wage rate will give an inflated monetary value.

In addition, it may be argued that even if the wage rate is a market clearing rate, it cannot be justified as the rate for valuation of time of workers who do not take up paid employment. Those who are engaged in own housework, despite the availability of wage employment, must do so because they believe that the market purchased services are not the same quality as their own service and thus market wage rate underestimates the value of their time. Secondly, even in developed countries, female participation rate is much lower than male rates. If it is envisaged that there is a large increase in female participation, this may change the demand for services that are substitutes for housework output and thus affect prices and affect wage structures in the process. Thus the existing wage rates would be inadequate to evaluate the time of all household activities.

Another important point that needs to be mentioned is that the wage rates even when they are competitively determined, depend on the social values which determine the sectoral segmentation of labour, pushing women to low productive occupations. This tendency will be more prominent when wages are institutionally
determined, whether by formal institution in industrial economies or informal social institutions in developing countries like Bangladesh.

Valuation of housework of women in families where neither male nor female workers engage in wage employment but are employed in own farm cannot be based on market wage. It has been demonstrated that these workers do not equate their marginal productivities with market wage rates (Sen 1966, Mellor 1969, Nakajima 1986). In these cases, the valuation will depend on the productivity levels of housework which will vary with the resources of the family. Depending on family size, homestead size and farm size, the productivity of housework may vary and thus same market price cannot be applied to all families.

These problems make monetary valuation of women's household activities difficult, but, do not reduce the need for such valuation. To capture a comparison of male and female contribution to GDP, the total hours of work done may provide a basis. Yet this has problems: work may have direct utility for the workers, apart from contribution to GDP. Such direct utility depends on job satisfaction, scope for diversification of activities, social recognition, etc. Hours of employment will not reflect this aspect.

For developing countries like Bangladesh, monetary valuation of housework is difficult. Therefore emphasis on their contribution in terms of hours of work will continue (Hamid 1989). In addition, the types of work done by women, remuneration for that work and their access to consumption opportunities as compared to male workers need to be studied. These are not substitutes of monetary valuation and cannot correct the inadequacy of GDP estimation but may complement our understanding and recognition of women's contribution which would be one of the objectives for correcting the GDP estimates.
PARTICIPATION OF WOMEN IN EMPLOYMENT: NATIONAL LEVEL DATA

Bangladesh is a country with one of the lowest female participation ratios even in comparison with other developing countries of Asia. Table 1 presents data on female labour force participation rates over the last few decades.

Table 1: Female participation rate in Bangladesh in selected years

<table>
<thead>
<tr>
<th>Source and period</th>
<th>Refined activity rate*</th>
<th>Crude activity rate**</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Urban</td>
<td>Rural</td>
</tr>
<tr>
<td>1961 Census</td>
<td>7.6</td>
<td>5.0</td>
</tr>
<tr>
<td>1974 Census</td>
<td>5.8</td>
<td>3.8</td>
</tr>
<tr>
<td>1980 Manpower</td>
<td>8.4</td>
<td>5.4</td>
</tr>
<tr>
<td>1981 Census</td>
<td>6.8</td>
<td>5.0</td>
</tr>
<tr>
<td>1983-84 LFS</td>
<td>12.3</td>
<td>7.4</td>
</tr>
<tr>
<td>1984-85 LFS</td>
<td>12.8</td>
<td>7.6</td>
</tr>
<tr>
<td>1985-86 LFS</td>
<td>14.0</td>
<td>9.0</td>
</tr>
</tbody>
</table>

*Refined activity rate is defined as the economically active population of ages 10 years and above.

** 100/Total population in that age group. In crude rate, the denominator is the total population.


Table 1 shows that the rate of female participation has been more or less stable between 1961 and 1981. Data reveal an increase in the participation rate in 1983-84 and in 1985-86 but it is difficult to judge how far this is due to definitional and enumeration problems. Discussion of the definitions adopted will help to interpret this data and attention is given to the two recent figures.
Census defines a person to be participating in the labour force if his/her major occupation is income generating employment. The LFS has adopted a less restrictive definition of labour force participation. Anyone who was 'working one or more hours for pay or profit or working 15 hours or more without pay in a family farm' (GOB 1986) or was on leave from a job or was looking for a job or was willing to work are considered as labour force participants. The inadequacies of this definition are discussed in detail so that they may be incorporated in the future rounds of the survey.

The definition of employment used by LFS as quoted above does not make it clear whether farm work includes homestead production (kitchen garden, horticulture, poultry, crop processing and storage) and livestock. The low participation ratio may as well be due to exclusion of homestead production which is taken into account in the statistics of some other countries like Thailand. Secondly, work for profit appears to overlap with work in the family farm. If it implies non-farm family enterprise or profit sharing employee, it remains to be clarified. In the unemployed category, people are included if they are 'willing to work but not looking for work because they were ill or believed no work was available'. It is not clear whether those in self employment, currently without work in the family farm but willing to work only in family enterprises should be included in this category.

Enumeration in LFS is spread out over the year so that the seasonal pattern of employment is balanced. Another approach to take into account the seasonal pattern of employment, specially for the self employed, would be to enquire about a longer period than a week. The reference period of one month would be realistic. But in that case the hours worked would be difficult to obtain due to problems of memory recall. However, the days during which one was employed may be obtained without much difficulty. The other approach would be to obtain an usual status information, as to whether one is employed in the family farm whenever there is work and whether that keeps him/her employed for say more than 15 hours a week. This would give a much higher rate of labour force participation of both male and female workers. Whether seasonally employed workers are to be considered in labour force or this is viewed as inflated representation of
participation and should be balanced by seasonal non-participation is a matter of judgement.

A recent study (Safilios-Rothschild and Mahmud 1989) on women's involvement in agriculture conducted a national level sample survey in 20 districts and arrived at a labour force participation rate of 54.4 per cent for women. This was based on primary occupation of a woman. This is a high figure compared to data from the Census of LFS. The difference is, at least partly due to the interpretation and classification of the activities performed by women.

Even if the definitional problem is to some extent responsible for showing a low participation ratio among women, there are, however, important social and economic reasons for low participation rate of women in Bangladesh. Time consuming housework activities and lack of their market substitutes may imply that housework has a large opportunity cost in terms of family welfare (World Bank 1990) and restricts women from being engaged in low productive self employment. Family enterprises may generate a low product at the margin because of lack of productive capital. Social reasons may work through values and attitudes which keep women confined within the homestead as far as possible. Therefore women try to avoid participating in employment which takes them outside their homes. They do not make their employment needs known to outsiders unless they are compelled due to the low income generating capacity of the male workers.

3.1 Types of employment of women: National data

The difference in the pattern of employment between men and women may be accounted for in terms of the sector of employment as well the role in which they are employed in each sector. Tables 2 and 3 show that there are pronounced differences in the sectoral and role distribution between employed men and women in Bangladesh.
<table>
<thead>
<tr>
<th>Classification</th>
<th>Urban</th>
<th>Rural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household sector</td>
<td>58.8</td>
<td>44.5</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>13.3</td>
<td>31.9</td>
</tr>
<tr>
<td>Community and personal services</td>
<td>17.8</td>
<td>5.9</td>
</tr>
<tr>
<td>Finance, business and services</td>
<td>0.7</td>
<td></td>
</tr>
<tr>
<td>Construction</td>
<td>0.6</td>
<td>0.3</td>
</tr>
<tr>
<td>Trade and restaurants</td>
<td>6.2</td>
<td>5.4</td>
</tr>
<tr>
<td>Agriculture</td>
<td>1.2</td>
<td>10.6</td>
</tr>
<tr>
<td>Transport, storage and communication</td>
<td>1.3</td>
<td>0.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100.0</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Source: BBS 1986:42

Women's employment is found to be concentrated within the household sector and services sector. These two fall outside the mainstream economic sphere which is related to direct production activities (primary or secondary). Agricultural production accounts for only 11 per cent of the employed women in the rural areas whereas 70 per cent of men are dependent on agriculture. However, there is doubt about the type of manufacturing which engages women because in the urban areas only 15 per cent of women are in this sector and in rural areas 28 per cent of employed women are in this sector. In the rural areas manufacturing often consists of small scale and processing activities and thus would closely resemble the household sector. This sectoral employment pattern indicates that women are reluctant to get involved in activities which take them away from their traditional responsibilities within the homestead.
Table 3 shows that 77 per cent of women are in the category of employees whereas only 15 per cent are in family employment. This may be due to two reasons. Firstly, those who are in wage employment report themselves to be in employment whereas the self employed women may be uncertain about their employment status and may report themselves as housewives thus leading to underenumeration of those in family employment. The difference could also be due to the fact that families with own employment generate more housework for their women and thus these women are not able to participate in employment to the extent (15 hours or more per week) to be counted as labour force participants.

Table 4: Employed female population of age 10 years and above by major occupation, 1981

<table>
<thead>
<tr>
<th>Sector</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>333,000</td>
<td>27.98</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>61,000</td>
<td>5.13</td>
</tr>
<tr>
<td>Business</td>
<td>58,000</td>
<td>4.87</td>
</tr>
<tr>
<td>Others</td>
<td>738,000</td>
<td>62.02</td>
</tr>
</tbody>
</table>

Differences in sectoral participation by men and women are also reflected in Census data (Table 4). Unfortunately, a very large percentage of women are in the unspecified sector which makes it difficult to assess their situation. It is still evident that women do not come within the specified major sectors of the economy.

Safilios-Rothschild and Mahmud (1989) show a contrasting sectoral pattern of women's employment. They maintain that 44.7 per cent of women reported agriculture as their primary occupation. The differences were to some extent due to differences in definition. They noted that women from small landowning households are involved in field operations of agriculture. They do not, however, provide any information on the extent of such involvement. They estimate that 'when women's work in homestead is added to involvement in field agriculture, in about one-third of small and medium-size farm households, women are very actively involved in crop production' (Safilios-Rothschild and Mahmud 1989:2). Thus actual involvement in field activity in these households would be among 16 per cent women (this is obtained as half of the one-third who are in crop production). Thus considering all women from the villages, including larger landowners, the extent of involvement in field agriculture appears to be rather small.

Women's activity would thus revolve around the homestead. The dispersion of women's employment in terms of distance from the homestead may be an important issue for research. This will be emphasised in the concluding section.
4. MICRO LEVEL FINDINGS ON WOMEN'S LABOUR FORCE PARTICIPATION

Micro level findings on women's participation in the labour force may supplement national level data by providing data based on an alternative definitional basis and enumeration procedures and provide more in-depth analysis of the determinants of such participation.

Micro level studies concentrate on rural areas. Most of these studies on employment and labour market focus on the amount of employment for women; only a few discuss the participation rates and its determinants.

One of the early studies (Farouk and Ali 1975) reported that 30 per cent of wives participated in income earning activities within the household. This survey was conducted in 1974 among sample households from two unions in Dhaka city and five unions from rural areas. However, this data cannot be compared to other studies because it is based only on a time budget study for one day.

A large household survey conducted by the Bangladesh Institute of Development Studies (in 1979) covering 6,157 women found that 13 per cent of women in the active age group (age 10 and above) were participating in income earning activities (RISP 1981). The criterion for a participant was that she had to be engaged in an income earning activity as a major occupation. This definition corresponds to refined activity rate in the census data which gave a participation rate of 4.3 per cent for women in Bangladesh in 1981.

Khuda (1982) estimated female (and male) labour force participation rate in one village in Comilla district on the basis of his survey in 1976. He presented alternative definitions and estimates of participation rates. These are presented in Table 5. Gainful worker was defined as someone whose occupation involved income generation for the family. He did not spell out whether income generation should be the major occupation for being counted in the labour force. However, the large percentage of women in this category indicates that secondary occupation may also have been taken into account. The labour force approach defines a worker as one who was in productive employment during the last week.
for at least one-third of standard hours or has been looking for work. This is a very strict definition because women in rural areas may be involved in employment only for a small number of hours. Khuda in his other definition (labour utilisation approach) included a woman as a labour force participant if she worked at least seven hours during the reference week or expressed her willingness to work, if it was available.

Table 5: Crude labour force participation rates in village Barkait

<table>
<thead>
<tr>
<th>Definition</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gainful worker</td>
<td>52.9</td>
<td>42.3</td>
</tr>
<tr>
<td>Labour force approach</td>
<td>51.1</td>
<td>4.9</td>
</tr>
<tr>
<td>Labour utilisation approach</td>
<td>54.5</td>
<td>49.2</td>
</tr>
</tbody>
</table>


His data shows that male participation ratio does not vary depending on the definition. Female rates show wide variation for different definitions. Thus more importance must be attached to finding an appropriate definition in order to obtain actual and relevant information for women.

Among the determinants of labour force Khuda discussed the role of age. On the basis of any definition, labour force participation among women was highest in the age group of 25 to 34 years. Male participation rate was almost 100 per cent over all the ages ranging between 25 to 54 years. Female participation rate showed rapid decline after age 64 which has not been the case for male workers.

Rahman and Islam (1986) reported female participation rates of 7 and 14 per cent in two villages in Dinajpur and Dhaka respectively on the basis of their survey conducted from July 1981 to June 1982. Participation ratio has been
defined as per cent of potential labour force (population above age 10 willing and capable of participating in employment) employed for more than 20 weeks a year. This definition is even more strict than the LFS definition which requires 27 per cent of one's time to be in employment and includes the unemployed as labour force participants, whereas this study sets the requirement at 38 per cent of one's time and does not include the unemployed. The broad definition of any person willing and capable of participating in female employment gives the range of female participation rate between 23 to 24 per cent in the Rahman and Islam study. This demonstrates the wide range in which participation ratio may vary depending on the definition adopted.

Hossain (1988) presented participation ratio of men and women aged 10 to 25 years in a sample from 16 villages (data relates to the year 1982). Such rates cannot be compared to national level data because they relate to a special age group. The value of his data lies in the fact that it shows that agricultural technology is an important factor affecting female participation rate. A labour force participant (he calls them 'workers') was defined as a person who was available for work in income earning or expenditure saving activities during any of the eight weeks of the survey. The rate of female labour force participation was 5.8 per cent and 9.2 per cent respectively in the village with backward and advanced agriculture.

Cain et al. (1979) reported indirect data on participation rates of women of households in a village of Mymensingh district on the basis of his survey conducted during 1976. Nineteen per cent of women were found to be involved in income earning work and spent 1.6 hours daily on such work. This implies an average of 12 hours per week which is lower than the standard set by the LFS.

Kirstengaard’s (1983) study in two villages of Comilla District indirectly indicates high labour force participation of women, though she did not present participation rates on the basis of specific definition. For example, she reported that 17 per cent of households had women taking up paid employment outside one’s own household. She reported a large percentage of women involved in each of the following self employment activities: paddy processing and
husking, looking after poultry and livestock, sewing and mat making, marketing of products, etc. She did not, however, report the extent of involvement in terms of hours. Her data shows that greater percentage of women from medium and large landowning groups are involved in these self employed activities; the reason is quite obvious as landowning households offer greater scope for self employment.

On the basis of the criterion of primary occupation, Rahman (1989) provides low female participation rates for four villages of Tangail and Faridpur districts. She reports that female participation is quite high among the landless households where 21 to 54 per cent of households have women participating in paid employment. Households with female wage workers as a percentage of all households vary between 8 to 19 per cent in these villages.

The above studies give a wide range of values for participation ratios of women depending on the definition used. Therefore, the major point that needs to be emphasised from these findings is that great care must be taken in defining and interpreting female labour force participation data. The value of the larger estimates of participation rate lie not so much in showing that women work hard (which can be fully demonstrated only when housework activities are taken into account) but lies in the fact that there is a potential that women's participation in employment may rise considerably if they are given the scope to generate employment to suit their specific circumstances.
5. LEVEL OF UNEMPLOYMENT AND UNDEREMPLOYMENT AMONG WOMEN

Concepts of unemployment and underemployment are quite illusive even for male workers in the rural areas where self employment predominates. The problems arise from the fact that the concept of involuntary unemployment depends on one's willingness to accept employment at the given market wage rate. This poses a problem because willingness is a subjective phenomenon which is difficult to identify in the absence of a formal job search process and in the case of self employment. Secondly, the wage rate may not be exogenously given but determined in a non-competitive market. Added difficulty in measuring female unemployment arises from measuring employment itself, when self employment and housework resemble closely.

National Labour Force Survey applied a slightly modified version of the conventional definition of unemployment. They classified persons aged 10 years or above as unemployed if they were involuntarily out of gainful employment during the reference week and were either actively looking for work or were willing to work but did not look for employment because they were ill or believed no work was available. On the basis of this definition, rate of female unemployment was 4.0 per cent in 1983-84 (BBS (a) 1986:65).

An additional problem of this definition, along with those mentioned above is that it does not refer to any wage rate or type of work when considering the willingness to work. Moreover, women may not actively look for work or refrain from reporting to the enumerators that they did so, because the search may not be socially prestigious. These problems may be responsible for the low rate of unemployment obtained by LFS.

Khuda (1982) collected information on unemployment in a village using a similar and even broader definition. As a criterion for unemployment, he used the question of whether one would accept work, if it was available. This again has the problem that it does not refer to any wage rate at which one would accept paid employment nor to the return for time in the case of self employment.
His data gives unemployment rates of 6.3 per cent and 14.3 per cent respectively for male and female workers. These rates are considerably higher than the rates obtained by LFS. In Khuda's study, unemployment was highest among the landless.

To avoid the above problems of defining unemployment, the emphasis in micro studies has been on the extent of underemployment. The other important reason to emphasise underemployment has not been explicitly discussed in those studies. This relates to the fact that employment in rural areas is mostly seasonal and wage employment is offered on a casual basis. As a result those who want to work will not be without employment for the entire year and those who are found to be employed at any point of time may not be employed for the whole year. Therefore the relevant concern is the amount of days not worked by an employed person and not those who are entirely unemployed for the whole year whose number will be negligible.

One of the definitions that is most commonly used for measuring underemployment among rural self employed workers is the time criterion. This measures the difference between a hypothetical norm of days per year or hours per week set as the standard and the actual days or hours worked.

According to LFS data 62 per cent women were underemployed and they worked less than a standard of 40 hours per week (BBS 1986:128).

Khuda uses the difference between hours potentially available and hours actually used for directly productive activities as the measure of underemployment. To calculate the potentially available time, he uses the actual time spent on other personal and household activities. The problem with this measure is that when there is not much scope for productive activities, women may be spending more hours on personal and household activities which they would not do if more productive work was available. This will give a downward bias to the time available for productive employment and thus to the calculated underemployment rate. His estimates give 24.2 per cent and 32 per cent underemployment rate for male and female workers.
On the basis of a norm of 285 standard days to be worked the average underemployment rate among women wage workers in four villages was estimated as 56 per cent (Rahman 1990). Underemployment rate among male wage workers in those areas had been reported to be much lower.

The calculation of underemployment rates on the basis of a standard norm suffers from the shortcoming that it does not ask the question whether the worker would be willing to work that many hours. It is assumed that the wage workers would be willing to take up as much work as available, because of the poverty situation in which they live. Khan and Hossain (1989) report that 85 per cent among the landless households live below the poverty level. The willingness to work more has been directly tested by Rahman (1990) where female wage workers intended to take up as many days of employment as would be available at the wage rate they received. On the basis of these evidences the use of standard hours may be justified to calculate underemployment for landless households. However, this criterion may be misleading for self employed workers from richer households. Their underemployment may be voluntary to a large extent.

Since the magnitude of underemployment is sensitive to the definition used, a discussion of the determinants of underemployment is even more difficult and has not effectively been addressed for female workers. For the purposes of policy formulation related to the enhancement of the level of employment and for removing underemployment, a discussion of the determinants of employment along with discussions of labour supply will be more appropriate. Studies which discuss the determinants of employment are reviewed in Section 6.
6. DETERMINANTS OF EMPLOYMENT AND LABOUR SUPPLY

The determinants of employment are discussed here to throw light on the causes of underemployment. The extent of employment will be determined by forces of demand, since employment available is insufficient.

The major problem with most of the studies on the determinants of employment is that they overlook this issue and explain the determinants of employment in terms of supply related factors.

In the context of labour markets with more or less full employment, employment of a worker is identified with his/her labour supply and the determinant of employment is analysed as a labour supply function. For workers faced with underemployment, labour supply will be the amount of employment they want to take up which is obviously greater than the amount of employment obtained.

Among the early studies Cain et al. (1979) showed the relationship between the amount of time women spent on income earning activities and the landholding of the family. His findings show that women in households with less than 0.2 hectares of land spent more time on income earning activities as compared to women from larger landholding households. This two-fold category is, however, not sufficient to explain the causality of the difference in time use pattern. The smallest landowners are possibly engaged in wage employment whose demand will depend on a different set of factors than those with higher land sizes who are possibly engaged in own farming.

Khuda (1982) discusses the relationship of the amount of directly productive activities with the age of workers and the landownership. Average number of hours rises with age, then starts falling at the age group of 35 to 44 years. Khuda did not elaborate on the reasons for this observation. This is in conformity with the usual human capital explanation, which is based on the contention that demand for labour depends on a worker's productivity which increases up to a certain age limit and then starts falling.
The relationship between women’s work and the size of landholding shows an inverse pattern in Khuda’s time budget data (daily recall). This is in contrast to the findings in Cain et al.

Rahman (1980) shows that women’s employment varies positively with landownership. Land as a productive asset helps to generate more productive employment in crop processing and related activities like kitchen gardening, livestock, etc. This study shows that women in a village with more advanced agriculture are involved in productive employment for larger number of hours than women in an agriculturally backward village. More productive agriculture generates greater scope for employment of women in crop processing and other related agricultural activities.

Estimates from regression equations in Rahman and Islam (1986) show that employment of women depends negatively on land ownership and positively on the percentage of land devoted to kitchen gardening and the size of livestock. The latter are reasonable as they increase the scope of productive activity of women within the household. There are, however, problems in interpreting these estimates. Firstly, to explain the negative impact of landownership, they argue that in rural societies, land area is considered as an important status symbol, and females of the larger households consider it below their dignity to engage in directly productive activities both within and outside the household. It is well known that the size of livestock shows a strong positive relationship with landownership. In that case how would women in families having large numbers of livestock and large landownership work hard in raising their stock if landownership imposes a status constraint against work? The same will be true for kitchen gardening. Women who had pre-school age children were found to spend less time in productive employment which is rational as the productivity of their child care time is higher. A similar impact of total family size is expected. They did not test the influence of this variable which is somewhat surprising in view of the fact that this variable had been included in the regression equation explaining male workers’ employment in the same study.
Wallace et al. (1987) provides estimates of the hours spent on direct and indirect economic activity by women from different landholding groups. In both villages studied by them, when the total hours on indirect and direct activities are considered, landless women work the largest number of hours. Women from landowning groups work mostly in indirect economic activities (fairly organised). The amount of indirect economic activity does not show large or systematic variation among the various land size groups in one village; in the other village large landowners work longer hours as is expected because of larger farm size which places greater responsibility on crop processing and related activities.

Hossain (1988) attempts to analyse variations of employment among samples consisting of male and female workers. He interprets them as labour supply functions which may not be justified because he reports the existence of underemployment in his sample. The coefficients of the explanatory variables in Hossain's regression equation may be interpreted to reflect the factors determining demand for labour from workers with various characteristics. For example, wage rate has a negative influence on the amount of hired employment among the landless workers. This may be interpreted as the reason for lowering employment opportunities being offered to workers who need to be paid higher wage rates. Similarly landownership and family size may be interpreted as the reason for raising recruitment cost of wage workers and reducing the amount of employment obtained. For landowning self employed workers, these variables increase the amount of self employment as family size raises the utility of income and farm size raises the marginal productivity of labour input.

Khandker (1988) analyses the employment of women in some Bangladesh villages and interprets it as a labour supply function. He assumes a competitive framework and does not deal with the existence of underemployment, although as already indicated, all studies on women's employment in Bangladesh suggest that underemployment is considerable. His study shows that women's employment depends positively on their husbands' education, on the distance to schooling and the predicted female wage rate. He does not explain the reason behind the role of husband's education. The role of market wage rate is also controversial in a highly imperfect labour market, where many women do not take up wage employment.
at all and in the case of educated women, skilled jobs are not easily available. Moreover, the wage rate based on the fortunate few who get access to such jobs is by no means a representative opportunity cost of labour. The conclusion that husband's assets, landholding and wage rate have significant negative influence on women's employment is contrary to findings in other studies. Khandker explains these as a negative income effect. More importantly, these influences could be manifestations of the problem of aggregating wage employment and self employment in this study. He aggregates the labour input in wage employment and cash producing family employment on the ground that econometrically their aggregation gave a better result than separate equations in explaining participation in economic activity. However, the characteristics of these two types of employment are completely different. Self employment is more compatible with household work and may be taken up for a lower marginal return than the current wage rate. This type of employment, therefore, cannot be explained in terms of wage rates.

Next we examine how far the determinant of female labour supply has been analysed by existing studies. As already mentioned, these studies are inadequate as studies of labour supply because they define a worker's employment as his labour supply which is not justified where underemployment exists.

Another problem in the above studies on the determinants of labour supply (Hossain's and Khandker's studies) is that they aggregate the analysis for wage workers and self employed workers. This gives misleading results because the opportunity cost of labour, to which labour supply responds, are not represented by same factors for both groups.

Rahman (1990) attempts to provide separate analyses of labour supply function and employment determinant functions for female wage workers. Labour supply function was described to be unresponsive to wage rate and other personal characteristics because the female wage workers expressed their willingness to work for the whole year at the wage rate they had been receiving. In contrast, the amount of employment obtained by these workers was negatively related to the wage rates and recruitment cost variables for the workers and it was positively related with village agricultural productivity levels. These variables represent
the demand for female labour and their influence on employment obtained is expected because, as has been mentioned, employment is demand determined in a situation of underemployment.
7. WAGE RATES AND EARNINGS OF WOMEN

Valuation of the work done by women in self employment and wage employment needs to be done separately. The valuation of paid employment merely consists of payment by the employer even though in some cases, depending on the type of labour contract, this payment may be quite informal. The question of valuation of self employment was discussed in Section 1. This section will concentrate on the wage rates and earnings of women in paid employment.

Since the participation of women in wage employment is very small, most studies do not place enough emphasis on the wage labour market for women. Most of the studies discussed earlier do not look at women's wage rates. National level data on wage rates is given by LFS 1983-84. These are presented in Table 6.

Table 6: Average wage rate (with food) of day labourers

<table>
<thead>
<tr>
<th>Major Occupation</th>
<th>Male Urban</th>
<th>Male Rural</th>
<th>Female Urban</th>
<th>Female Rural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>15.3</td>
<td>14.7</td>
<td>13.5</td>
<td>7.0</td>
</tr>
<tr>
<td>Non-agriculture</td>
<td>19.6</td>
<td>17.6</td>
<td>9.6</td>
<td>6.9</td>
</tr>
</tbody>
</table>


It is observed that female wage rate is less than half the male wage rate in all cases (except in urban agricultural occupations, which engage less than one percent of employed women). Male wage rates are higher in non-agricultural occupations. The trend is opposite for women. This is possibly due to the fact that non-agricultural activities in which women are employed are mainly in the service sector and include marginal activities.

The low wage rates and the large amount of underemployment result in very low earnings for women. Table 7 gives weekly earnings of women in rural and urban areas.
Table 7: Weekly earnings of employed workers by residence

<table>
<thead>
<tr>
<th>Residence</th>
<th>Sex</th>
<th>Weekly earnings (taka)</th>
<th>1983-84</th>
<th>1985-86</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban</td>
<td>Female</td>
<td>60.3</td>
<td>174.20</td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>Female</td>
<td>35.3</td>
<td>109.21</td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>Male</td>
<td>111.1</td>
<td>376.92</td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>Male</td>
<td>58.5</td>
<td>189.80</td>
<td></td>
</tr>
</tbody>
</table>


At this rate of weekly earnings, a rural woman earns only taka 5678 even if she works throughout the year. This is less than the income required to maintain two persons above the poverty level income (Khan and Hossain 1989). Another study (Rahman 1990) shows the earnings obtained by female wage workers in rural areas to be even lower. The results show that the average yearly earnings of female wage workers was only taka 1156. Yearly earnings obtained from LFS weekly earnings may give an overestimation because in many of the weeks the women may not obtain employment at all.

Micro level data on female wage rates show similar (to LFS data) or even greater discrepancy between male and female wage rates. Cain (1979) reported that the female wage in a village was taka 3 while the male wage rate was taka 10 during the same period. Rural Industry Studies Project (1981) reports similar evidences of wage differential with female wage rates as 42 per cent of male wage rates in small scale rural industries. Rahman (1980) reported female wage rates varying between taka 3.0 and 4.0 in a backward village and taka 7.0 to 8.0 in an advanced village while wage rates of casual male labourers was in the range of taka 10.0 and taka 13.0 in the two villages. Rahman (1990) reported average female wage rate as taka 1.20 per hour while male wage rate was 3.30 per hour. One study by Baketh and Bhattacharya (quoted by World Bank 1990) reported that while real wages of male workers in handloom weaving increased by 12 per cent between 1979-80 and 1986-87, those of females declined by 17 per cent.
There have been few attempts to analyse the determinants of female wage rate and the male-female wage differential. This may be attributed to difficulties in measuring marginal productivities through production function studies due to lack of data and other problems. Moreover, it is also not established whether the female wage rates (and male wage rates as well) are at all determined by competitive forces and therefore by marginal productivities. When the presence of involuntary underemployment is recognised, wages are not determined by competitive forces.

Studies on female wage determination are rather scanty. Empirical studies on male wage determination in the rural areas of Bangladesh show that (Cain and Mozumdar 1980) non-economic factors play a role in wage determination. The difference in male wage rate is often found to be associated with areawise difference in agricultural productivity. Rahman (1980) found female wage differential to be associated with the level of agricultural productivity. Rahman (1990) found that wage variation is explained by factors which lead to variations in women's reservation wage rate. Such variations are related to a woman's family situation in terms of marital status and having male workers in the family. Widowed and divorced women earn a lower wage while women with male earners in the family are paid a higher wage. One important factor responsible for lower hourly wage rate is the extension of workday to longer hours reflecting women's attempt to enhance total earnings. However, the elasticity of employment with respect to wage rate was found to be less than unity. Thus women were not able to raise the level of earnings even by accepting lower wage rates.
8. EDUCATION AND EMPLOYMENT OF WOMEN

The importance of education in developing human capital is recognised in both developed and developing economies. In recognition of this the Government of Bangladesh has allocated a large outlay (compared to total development outlay) to the education sector. All levels of education are subsidized. Whether this is justified in terms of suitable employment and utilisation of skilled human power is an important issue for research. Social rate of return to education of women will depend on the type of employment obtained by educated women and this leads us to research on education and employment.

Unfortunately, there has not been any research on the utilisation of skilled women power and the impact of education on women's employment and productivity in Bangladesh.

Educational attainment of women in Bangladesh is very low. Only 8 per cent of rural women between the ages of 15 and 29 have education above primary level. Only 1.4 per cent among them study after age 10. Therefore the influence of education cannot be adequately studied from observations on rural women in general because any sample will contain only a small number of educated women.

Some studies (Rahman and Islam 1986, Khandker 1988) show that hours of employment for women is negatively influenced by their level of education. Rahman (1990) shows that educational attainment does not influence Grameen Bank women members' productivity levels or the number of hours worked.

These findings may be a mere reflection of the fact that the type of employment in which these women are engaged does not require formal education and such employment as would be suitable for proper utilisation of their education, is not made available to them.

To understand the utilisation of skill, studies should specifically focus on employment pattern and the extent of unemployment among educated women. LFS 1985-86 data show that only 2 per cent of women with year 10 or above level of education were employed. This finding may also be a reflection of the type of employment which these women are engaged in, which does not require formal education.
education reported themselves to be unemployed (willing to take up a job or actively looking for work). Thus involuntary underutilisation of skilled women appears to be small. However, this unemployment rate needs to be interpreted with caution, for reasons mentioned in the previous sections.

It may be noted that refined activity rate of urban women was only 14 per cent. If this rate applies separately to educated and uneducated women, it implies that educated women are not utilising their skill and voluntarily choose not to take up employment. In that case indirect return to education for the non-participating women would be an important research issue because this will be required to justify the government expenditure on this sector. In addition, research is required to investigate whether the unemployment of educated women is really voluntary or not and the reason behind the low rates of employment among educated women.

In this respect, findings from a study by Majumder (1988) show that among educated women who are not currently in employment, 55 per cent reported that child care poses a problem in taking up employment. 24 per cent of the women without employment expressed the opinion that 'non-availability of preferred jobs' was the reason for not taking outside employment. In the absence of a formal job search process and unemployment benefit, it is difficult to confirm whether the need for auxiliary services restricts entry to employment. When the labour market for educated workers is not at all competitive (as demonstrated by the existence of widespread unemployment among educated males), it is difficult to decide what job is suitable for a woman with a specific background and how to decide whether she is voluntarily unemployed or not. More research on this question is desirable.
9. ACCESS TO PRODUCTIVE ASSETS AND EMPLOYMENT

A family's ownership of productive assets will determine the marginal productivity of self employment and thereby determine the extent of self employment taken up by a family worker. The same would be true for women's employment and it has been demonstrated above that a family's ownership of land and livestock may have a positive influence on women's employment. An additional question that may be asked about women's employment is whether it matters who owns the family's productive asset: the male members or the female members. An investigation of the existing studies on women and employment revealed that only a small proportion of married women owned land (Safilios-Rothschild and Mahmud 1989). Therefore the influence of such ownership on employment could not be determined.

Women's access to capital markets is also quite restricted. Financial institutions do not produce separate data on credit disbursed to women. Safilios-Rothschild (1989) found that 15 per cent of a rural women's sample obtained loans from Krishi Bank and other financial institutions. Hossain and Afsar (1989) reported the results of a survey of households in 40 randomly selected villages which found that only in one per cent households women borrowed from institutional sources. They form 8 per cent of all the households who borrowed from institutional sources. Their study emphasised the fact that credit obtained by women may have been utilised by male members of the household.

Women's access to loans has been expanded mostly through specialised agencies with programmes for giving loans to women. Such loans are often targeted for poor women only. Grameen Bank loans to poor women have been found to generate substantial employment and income for them (Hossain 1985, Rahman 1990). A comparison of loans to landless male and female members shows that loans to women generate more employment for women and a larger total income for the family (Rahman 1986a). More study on women's access to formal financial institutions in both rural and urban areas is necessary along with information on who controls the use of these loans and how they generate income and employment for women.
10. WOMEN’S EMPLOYMENT AND STATUS

There have been few studies to identify the impact of income generating employment on the status of women. Even though it is recognised that status is a multi-dimensional and slippery concept, unless women’s employment is considered in relation to their status, the implication of such employment cannot be fully understood.

Male employment is synonymous with greater welfare of the earner as it generates income for him and his family. This relationship may not be equally obvious for women. Employed women’s access to cash expenditure may not be directly proportional to their earnings because of the patriarchal pattern of the society. For the same reason it is important to investigate whether women’s involvement in employment brings her any advantage in terms of consumption standard which may compensate the double burden of housework and employment. There have been few studies on these issues of impact of women’s employment. Studies were searched for three broad categories of status factors: i) control over the expenditure of the income earned and family decision making, ii) access to consumption, iii) subjective status considerations by the family of the worker and her close society of neighbours.

A general observation made in the research related to women in Bangladesh is that women enjoy few decision making powers regarding their own life in the family and in overall family affairs (Wallace et al. 1987, Marum et al. 1983, Hossain et al. 1988, Safilios-Rothschild and Mahmud 1989, Rahman 1986). Most of these studies do not compare the situation of employed and unemployed women.

Safilios-Rothschild and Mahmud (1989) show that only a small percentage of women (where a male adult is present) have decision making powers regarding agricultural production by the family. Such decisions were found to be negatively influenced by the size of landownership and educational level of women. Though this study had collected data on the employment status of women, the decision-making power was not related to employment. It was found that only a small percentage of women have control over income from sale of field crop, though this
percentage was above 50 for sale of homestead produce, the income from which is obviously a small proportion of total family income.

Wallace et al. observe that, in general, women do not have much decision making power in the villages they studied. They found that women from poorest households had more independence because poverty forced them outside the home. Women from medium and large farm households had little independence though they were found to contribute labour in family enterprises in a significant degree.

Marum's study (1983) asks a question: If a woman earns money herself, who should decide how to spend this money? Women including those who earned income and those who did not, overwhelmingly (56 per cent cases) held the view that the husband should make the decision. Only 19 per cent women replied that the woman herself should take the decision. Most women (employed or not) in this sample had a positive attitude towards the employment of women.

A study on women wage workers (Rahman 1986) reports that a woman's position within the family improves as she earns an income, though her status in the village society is lowered.

The relationship between status and employment, however, depends on the type of employment taken up and the rate of earnings. A study has shown that women who are self employed with loans from the Grameen Bank of Bangladesh (a specialised financial institution to lend to rural poor), have improved their status even in the village society as well as within the family (Rahman 1986). They enjoy greater decision making powers compared to other poor and rich women in the villages.

The Hossain et al. study (1988) of women employed in industries reported that women consider that their position in the family had improved after they joined outside employment. Yet there was substantial dependence of women on their male guardian/husband who took decisions regarding spending of cash. Women were found to have a smaller amount of money for personal expenditure, as compared to male earners. However this lower amount of personal money could be a voluntary
choice of women and cannot be a very important measure of the benefits derived from own earning. Information on the consumption of basic necessities of life is also necessary to arrive at any final conclusion.

A study by Rahman (1990) shows that self-employed women in Grameen Bank financed enterprises enjoy better consumption standards in terms of food and clothing as compared to other women with similar background.
11. CONCLUSIONS AND ISSUES FOR FURTHER RESEARCH

Research on women's participation in productive employment and the extent of their contribution to a country's GDP shows that they depend on the definitions on which the measurements are based. This must be emphasised in any comparison across studies.

Women's contribution to family welfare and to the functioning of a village economy are well documented in a number of research works on women's time use in rural Bangladesh though a very formal and rigid definition (unsuitable for women workers with dual roles) gives very low rates of labour force participation.

Women in paid employment are found to be mostly in the tertiary sectors and in case of formal jobs, they are employed in occupations which require less skill and provide lower remunerations. Women in wage employment are disadvantaged by very low wage rates, which are much lower than the wage rates of unskilled male workers. There are hardly any studies to investigate the reasons for such a discrepancy. A high degree of genderwise segmentation of labour markets is likely to be one of the reasons. More research is required on this aspect.

Research has shown that women's employment is not synonymous with a control over income. In self employment this happens because the ownership of productive assets is mostly in male hands. Even when income accrues to women's own hands, specially in the case of wage employment, they are not able to decide its expenditure independently. More research on the factors determining the relationship between women's decision making role and employment are necessary.

Less research has been focussed on employment among urban women. In this respect no study has been done on women entrepreneurs in various activities, ranging from formal industrial enterprises to single worker retail sale activity in the informal sector.
There have been no studies on the determinants of labour force participation of urban women and the determinants of the type of employment they obtain and the remunerations they receive. A related aspect is the influence of education on women's employment and the rate of return from such employment. The issue of the rate of return to education may be applicable to self employed women as well.

It cannot be denied that the education of women has a high social rate of return and is a prerequisite for their obtaining more remunerative employment. The generation of demand for skilled female workers is still a question of concern. The prospects for creation of such a demand needs to be ascertained. Proper planning for women's education and the utilisation of skilled female labour power through suitable employment will be able to provide a basis for structural change of the economy and the development of the society.
References


Fong, M., 1980. "One reason that women are too easily excluded from national development planning is because they are victims of old fashioned statistics", Ceres, May-June:28-32.

Gelber, S., 1970. The Labour Force, the GNP and Unpaid Housekeeping Services, Canadian Department of Labour, Ottawa.


Khuda, B., 1982. The Use of Time and Underemployment in Rural Bangladesh, University of Dhaka.


