TOWARDS A SUSTAINABLE

Paper Cycle

Sub-Study Series

17 Labour in the Pulp and Paper Sector

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LABOUR IN THE PULP AND PAPER SECTOR

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I. Introduction

This research note examines the employment, earnings and productivity of different sub-sectors in the paper cycle. The study uses a cross-section of four countries (the United States, Sweden, Chile and India) to examine this issue in order to have a reasonable sample of developments and to place national developments in their international context. It looks at both the forestry sector and the pulp and paper sector, with the degree of disaggregation dependent upon the availability of data. It is meant to serve as a background paper for the IIED's "Sustainable Paper" project and is not analytical in nature, but is instead simply a general discussion of the available data.

II. Employment and Earnings in the Paper Cycle

Employment in the Forestry and Pulp and Paper Sectors

Estimating total employment in the forestry and pulp and paper sectors is surprisingly difficult to determine precisely. This is particularly true for developing countries where those engaged in forestry may also be engaged in other productive activities, and where some employment may be informal in nature. However, rough estimates have been obtained for sectoral employment in LDC's courtesy of the FAO. (See Table 1). Although the "forest product" sector employed 7.6 million people in LDC's in 1991, sawmilling - which is not directly relevant for this study - is the largest single sub-sector in terms of employment. In addition, harvesting covers all logging and not just that associated with pulpwood logging.

Table 1: Employment (1000s) in Forest Product Sectors in LDCs in 1991

	Harvesting	Sawmilling	Pulp&Paper	Total
Africa	350	119	15	484
Asia	1890	2687	584	5161
Americas	914	910	144	1968
All LDCs	3154	3716	743	7613

Source: Jacques Lahaussois, FAO - Personal Communication

With respect to forestry employment, data obtained for the four representative countries are listed in Table 2. Relative to the total size of the labour force in each country these figures are very small. Even in the case of Sweden the figure represents only 0.64% of the total labour force. Moreover since pulpwood only represents a small proportion of the output of the sector the proportion of employment which is relevant to the pulp and paper cycle is even lower. For instance, while 27.3% of forestry output (by weight) in the United States in 1992

was pulpwood, the relevant figure in terms of employment was only 5.4% (USDOC ESA 1995).[1] This discrepancy in physical unit of output per unit of labour input is attributable to the fact that wood quality is much less important in the case of pulpwood, an issue which is discussed below with respect to productivity. Conversely, in the case of India, non-wood fibres are much more important than wood in the production of pulp and as such employment in the paper cycle is more closely tied to other sectors, rather than forestry.

Table 2: Forestry Employment

	Forestry Employment	Pulpwood % of Output (by weight)	Employment Data Source
Chile	39555	36.6%	INFOR ('95)
India	134000	4.8%	CSO ('94b)
Sweden[2]	25780	36.8%	SC ('95)
USA[3]	83600	27.3%	DOC ESA ('95)

Production data FAO (1995). All data 1992 except India 1991.

Figures for the pulp and paper sector are more readily available. Summing UNIDO (1993) data for employment in pulp and paper (ISIC 341) in 1988, total global employment was approximately 2.6 million, however a number of countries are not included. Most importantly, China with estimated employment of 807,300 in 1990 (ILO 1992), is not covered in the UNIDO data. (Get figures for 1992-1993 from UNIDO (1995).)

In most countries employment in the sector is stagnant or even decreasing. A UNIDO index of employment for pulp and paper sector reveals that in the period 1979-1990 global employment fell by up to 5% by 1987 relative to 1979, before rebounding somewhat in the later years of the decade (UNIDO 1993). In an ILO survey of 15 countries only three countries (China, Kenya and Mexico) experienced an increase in employment in the 1980s. The study estimated overall employment in the pulp and paper sector as 3.5 million for the 1987-1990 period. However, it is clear that the sectoral definition used is rather different than that which was used in the FAO research cited above, since the figure for China

[1] It should be noted that census data may not be accurate for sub-sectors in which firms tend to produce numerous products since a firm's entire output will be attributed to the single sector in which it has the greatest output. As such logging firms which harvest pulpwood and industrial roundwood, will have all their output attributed to whichever of the two outputs is larger in value terms.

[2] Two other sources - NBF (1995) and Skogsindustrierna (1995) - give slightly higher figures of 30,000 for total employment. The OECD (1995) lists a figure of only 17,000 for employees but 35,900 persons, indicating significant casual employment in the sector.

[3] The American Forest and Paper Association (1995) gives a much lower figure of 59,100 for 1990.

(807,300) exceeds that for all LDCs listed above (743,000). Unfortunately, few methodological details are given in the ILO study and as such it is difficult to trace the source of the discrepancy.

At the national level pulp and paper sector employment data is generally available in a disaggregated form. Unfortunately the nature of disaggregation differs by country, making cross-country comparisons difficult and misleading. The only international source which disaggregates below the 3-digit ISIC level is UNIDO's *International Yearbook of Industrial Statistics* (1995), but the only real distinction is between paperboard containers and boxes (ISIC 3412) on the one hand and other paper and paperboard articles (ISIC 3411) on the other, along with another broad category which covers miscellaneous products (ISIC 3419). (See Table 3.)

Table 3: Employment in Pulp, Paper, Paperboard and Converted Products[4]

	P, P & PB	P & PB	Other	Percentage of
	Articles	Containers	Articles	Manufacturing
Chile	5422	2972	2102	1.7%
India	113900	24200	6200	2.0%
Sweden	38800	6900	5900	7.2%
USA	198000	217000	171000	3.5%

Source: UNIDO (1995).

The manufacturing stages are, therefore, responsible for considerably more employment than the primary commodities sector and in some cases (i.e Sweden) represent a large proportion of total employment in manufacturing.

Characteristics of Labour in the Sector

The percentage of non-production workers in the paper and allied sector relative to manufacturing overall is higher in Sweden and the United States and lower in Chile and India. (See Table 4.) The proportion of production workers in the paper and allied sector in the United States increased rapidly in the post-war years, but has been stable since approximately 1975 (USDOL 1989). This is generally true in OECD countries, with the exception of pulp, paper and paperboard mills (ILO 1992). Little comparable data is available for LDCs.

[4] Data for India and United States are 1991 and Chile and Sweden are 1990.

Table 4: % of Production Workers in Employment		
	Pulp&Paper	Manufacturing
Chile	67	73
India	77	79
Sweden	76	69
USA	76	69
Source: UNIDO (1993)		

Earnings in the Forestry and Pulp and Paper Sectors

Limited data is available for earnings in the forestry sector. In the case of the United States the USDOC ESA (1995) lists a total payroll of US$1.693 billion for the logging sector (SIC 2411) for employment of 83,600 in 1992, which yields an average annual salary of US$20,251. In Sweden forestry sector workers had an average hourly wage of US$13.61/hr in 1992 (SC 1995). On the basis of industry data on the length of the work-year this can be converted into an annual salary of US$25,895. Relative to other primary commodity sectors, wages in forestry appear to be quite high, although data has only been obtained for Sweden. According to 1993 figures, average hourly earnings for forestry were 11% higher than agricultural earnings (SC 1995). However, relative to the much less important mining sector, wages in forestry are as much as 20% lower in Sweden.

Labour cost figures for the pulp and paper sector are more readily available and a comparison can be obtained for the cross-section of countries chosen using ILO (1995) data. (See Table 5.) Across the four countries the variation is significant, with wages in India being 2.3% those in Sweden, although non-wage benefits will affect relative earnings significantly. For instance, in the case of India non-wage earnings were equal to over 18% of total earnings in 1985-1986.[5]

Expressed in annual terms, a figure of US$570 is given for the paper and paper products sector (which includes printing and publishing) in India in 1989. (CSO 1994a) In the United States average annual earnings at the SIC four-digit level for the pulp and paper sector in 1992 varied from a high of US$43,340 for pulp mills to only US$19,576 for setup paperboard boxes (USDOC ESA 1995). All milling sectors were over US$40,000 while most other manufacturing stages were between US$30,000 and US$40,000. The figure for the pulp and

[5] At a more detailed level Ewing and Chalk (1988) list labour costs per ton of bleached softwood kraft pulp for five countries, three regions of Canada and two regions of the United States. The values for Sweden and Chile are US$35 and US$25, while the American labour costs are US$46 for the South and US$49 for the Pacific Northwest. Equivalent data for newsprint reveals much more variability with figures of US$43 for Sweden, US$6 for Chile, US$74 for the US-South and US$91 for the Pacific Northwest. The relatively less significant variability than that which is revealed in the hourly labour cost data is explained by international differences in labour productivity, an issue which is discussed below.

paper sector in Sweden in 1992 was calculated to be just under US$30,000 (SC 1995), but in this case the data includes printing and publishing.

Table 5: Wages and Earnings in the Pulp and Paper Sector		
	Wages (US$/hr)	Labour Cost (US$/hr)
Chile	1.58	NA
India	0.34	0.64
Sweden	14.99	20.48
USA	13.42	19.42
Source: ILO (1995). 1993 except India 1989. Data converted from original units on basis of ILO data.		

Wages in the sector relative to other manufacturing wages appear to be quite high. Taking the ratio of wages in the sector over wages in manufacturing - see Table 6 - it is found that wages are higher in three of the four countries, with only Chile having lower wages for pulp and paper than for manufacturing in general.

The existence of relatively high wages in the sector seems to have been increasing. Taking US historical data obtained from another source the ratio between real average hourly earnings of production workers in the paper and allied sector and non-durable manufacturing in general has increased from 1.117 in 1970 to 1.235 in 1988 (USDOL 1991), indicating that wages have increased at approximately twice the rate as in non-durable manufacturing.

Table 6: Pulp and Paper Sector Wages Relative to Average Manufacturing Wages	
	Ratio
Chile	0.61
India	1.26
Sweden	1.03
USA	1.14
Source: ILO (1992). 1992 except India 1989.	

Relative wages in the forestry and pulp and paper sectors differ by region. In the case of Sweden in 1992, the pulp and paper sector had earnings 11.7% higher than forestry. (SC 1995). In the United States, forestry had higher average earnings than two sub-sectors associated with manufacturing stages of the pulp and paper cycle (die-cut paper and paperboard and setup paperboard boxes), but considerably lower than all milling stages and most other manufacturing stages.

III. Labour Productivity Levels and Technological Change in the Sector

Unlike most other sectors productivity levels can be discussed in both value terms and physical terms since data is kept in both forms. However, it should be emphasized that the more heterogeneous production is for a given sector the less valuable will be productivity levels expressed strictly in physical terms. Thus cross-sectional comparisons of productivity expressed in metric tonnes or cubic metres may be grossly misleading if some countries specialize in low-weight high-value goods to a greater extent than others. The same may be true of time-series comparisons if a country changes its composition of production within the aggregated sub-sector. For this reason, discussions of productivity should be carried out at the greatest degree of disaggregation possible.

Forestry

Reliable productivity data in the forestry sector are not readily available, but on the basis of national sources Table 7 gives a general indication of relative productivity - in both value terms and physical terms - for the four countries. However, it should be emphasized that the use of value of shipments as the measure of output may be misleading if value added and the value of shipments differ significantly by country. For instance, countries in which companies tend to source most of their intermediate inputs from elsewhere will have a much higher ratio of value of shipments to value added than countries in which the companies use more fully integrated production processes.

Productivity in pulpwood production may be rather different than in logging in general. American data casts light on the relative productivity of pulpwood logging. Not surprisingly, labour in pulpwood logging is considerably more productive in physical terms. More surprisingly it is also somewhat more productive in value terms. (See Table 8.) This indicates that the lower value of the product relative to other logging is more than compensated for by the ease of exploitation. Unfortunately comparable data is not available for other countries.

Table 7: Productivity in Forestry in 1992

	VOS (US$) / Worker	Production (m^3) / Worker
Chile	1865	539
India[6]	NA	179
United States	165604	4815
Sweden	113654	2344

Production Data from FAO (1995). Other data from CSO ('94b), INFOR ('95), USDOC ESA ('95) and SC ('95). Chile converted from VA on basis of historical data.

[6] Data for India refers to 1986.

Table 8: Output per Worker in US Logging in 1992			
	VA (1000 US$)	VOS (1000 US$)	Production (m^3)
Logging	61	166	4815
Pulpwood	75	266	13173
Source: USDOC ESA (1995)			

Pulp and Paper

In the pulp and paper sector (ISIC 341) productivity across the representative countries can be documented using UNIDO (1995) and FAO (1995) data. (See Table 9.) In physical terms (1000 MTs) there is substantial variation across countries with India being an outlier. The figure for Chile is surprisingly close to Swedish and American levels. In value terms, India remains a significant outlier, while Chile is somewhat less productive relative to Sweden and the United States than the physical measurement indicated.

The high level of productivity in the sector means that despite the relatively high wages in the sector (with the notable exception of Chile), the total wage/salary bill relative to output (expressed in factor values) is quite low. Table 10 indicates that across countries with very different structural characteristics of production (i.e. scale of plant, nature of primary input, etc....) the pulp and paper sector (ISIC 341) is less labour-intensive - expressed in value terms - than manufacturing on average. This finding is hardly surprising given the oft-stated observation that the sector is particularly capital-intensive.

Table 9: Labour Productivity in the Pulp, Paper, Board and Converted Product Sector in 1991		
	Output*/Worker	Product/Worker
	(US$ million)	(1000 MT)
Chile	118980	0.15
India	14340	0.02
Sweden	237810	0.25
USA	211092	0.22
Source: UNIDO (1995) and FAO (1995). *Factor Values except Chile Producer Prices. All data refers to 1991 except Chile 1990.		

Table 10: Earnings as a % of Total Output*		
	Pulp&Paper	Manufacturing
Chile ('91)	5.6%	7.3%
India ('90)	6.8%	6.9%
Sweden ('92)	12.8%	15.4%
USA ('91)	14.9%	16.5%
* Factor values. Chile in Producer Prices. UNIDO (1995).		

Given the heterogeneous nature of production within the sector it is necessary to disaggregate this further. Unfortunately it is not possible to do so in a consistent way across countries. However, in the case of the United States productivity (in value-of-shipments, value added and by weight) by sub-sector is listed in Table 11. It is surprising to find that paperboard mills have lower physical output per worker than more processed stages which include manufacturing of paperboard boxes.

However, this could be due to differences in product/industry classifications for the data sources. Value-added per employee, which is the most useful guide to productivity, varies widely, with the milling stages being very high. This is probably due to their capital-intensity. Similarly, sanitary paper is also high, which may be due to the fact that it is a higher value product.

The difference between relative productivity in value terms and mass terms for the different sub-sectors in Table 11 illustrates the dangers involved in measuring productivity in physical terms at aggregated levels, such as is in the ILO study. Changes in aggregate output per unit of labour input may more accurately reflect the composition of output in terms of products than labour productivity itself.

Table 11: Sub-Sectoral Labour Input Coefficients for the United States in 1992			
	VOS ($) / Empl	VA ($) / Empl	Prod/Empl (ins)
Pulp Mills	343748	160672	3649
Paper Mills	251044	113688	543
Paperboard Mills	313398	159132	82
Paperboard Boxes	141119	21789	193
Corr'd & S Fibre Boxes	177170	60325	
Sanitary Food Containers	161740	68298	
Fibre Cans, Drums etc	155008	63153	
Coated & Lam'd Paper	225277	100173	
Die-Cut Paper & Board	128916	54192	
Sanitary Paper Products	385745	202972	
Envelopes & Stationery	124354	59779	
Other Converted Prod's	145083	63585	

Source: USDOC ESA (1995). Production from PPI (1995). * Paper Mill Production is Residual from Pulp & Board Production.

Trends and Determinants of Labour Productivity

Increased output per unit of labour input can be broken down into two issues: the scale of other factor inputs and the efficiency of labour. The former would arise from an increase in the amount of other factor inputs (principally capital) that each unit of labour has available to work with. The latter arises from changes in the qualitative characteristics of other factor inputs or of labour itself. Thus, increases in labour productivity are derived principally from investment in larger capital stock (technological scale), in more efficient capital equipment (technological progress) and from investment in the labour force (human capital improvements). It is not always possible to determine which of these factors is primarily responsible for changes in labour productivity.

Using American data some light can be cast on the issue of trends in relative productivity for the forestry sector. Between 1977 and 1992 employment in the logging sector (SIC 2411) increased by less than 0.5%, while the real value of shipments increased by 39.8% (USDOC ESA 1995 and USDOC BEA 1994). Real value added increased by 33.1% over the same period. In the case of Sweden the number of labour-hours worked in forestry and logging decreased by 3.1% per annum between the years 1981 and 1992, while real domestic product increased by 1.1% per annum. (OECD 1995).

Productivity in the pulp and paper sector has also been increasing considerably over the course of recent years, particularly in the manufacturing stages of production. In their survey the ILO (1992) found that productivity increases have been highest in France over the period 1980-1989, where paper and board mills experienced annual productivity increases of 6% and pulp mills 7%. Other developed countries also had high rates, with Finland reaching 10% in recent years. More generally, according UNIDO (1993) indices of production (in real value terms) and employment (in labour input terms) for OECD, LDC and former COMECON countries for the period 1979-1990, productivity in the ISIC 341 sector has increased by between 3.4% and 4.9% per year, with the LDCs having the largest increase in productivity. (See Table 12).

Table 12: Change (%) in Productivity in the Pulp and Paper Sector - 1979-90

	LDCs	DCs	Comecon
Total	69.2	46.6	44.4
Annual	4.9	3.5	3.4

Source: UNIDO (1993).

Few studies have been conducted on the determinants of labour productivity increases in the sector, and most of those have concentrated on the issue of technological progress. In his study of the American pulp and paper sector, Stier (1985) found that technological change was labour-saving and capital-using - i.e. new investment tended to employ relatively less labour and more capital per unit of output than older investment, even when the effects of factor substitution arising from changes in relative factor costs had been subtracted. The estimated annual bias was -0.009, indicating that *ceteris paribus* there was an annual increase in labour productivity of just under 1% per year (i.e. a fall in labour inputs per unit of output of slightly less than 1%) due to technological progress.

In a more recent study of the Canadian wood and pulp and paper industries, Mohnen *et al* (1993) examined the determinants of changes in total factor productivity in closer detail. They found positive contributions from research and development, which might be considered a proxy for technological progress. However, the effect was slight, being much less than the effect of scale of production. Moreover, since the dependent variable is *total* factor productivity and not just labour productivity, the effect of technological progress on labour efficiency would be correspondingly smaller.

In a more general study, the ILO (1992) found that there was no discernible pattern in changes in productivity across sub-sectors, with different countries exhibiting different relative changes in productivity growth for the principal sub-sectors (i.e. pulp and paper mills, converting, paperboard manufacturing, etc....). For instance in France, productivity growth in pulp manufacturing was greater than for paper and board in the 1980s, while the reverse was true in the case of Japan.

The potential importance of changes in the technological characteristics of the capital stock can be illustrated in a concrete manner through a discussion of the parameters employed in the NAPAP model (Ince 1993). Variance in the amount of labour (hours) required per unit of output (tonnes) illustrates the potential importance of different *types* of capital equipment employed in North America. In the case of newsprint, labour inputs range from 0.30 hours per ton of output to 0.49 hours, depending on capital employed and material inputs used. In the case of coated free sheet paper, the range is 0.19 hours to 0.28 hours. Market pulp production ranges the most widely, from 0.06 hours to 0.40 hours. Thus, even with presently existing technology the potential increase in labour productivity is large if there is increased penetration of the more efficient capital equipment in the market.

Table 13: Labour Productivity in North America (hrs per ton of finished product)

	Recycled	Virgin
Newsprint	0.16-0.18	0.55-0.59
Uncoated Free Sheet	0.45	0.32
Unbleached Kraft Paper	0.45	0.52

Source: Ince (1993). * Virgin fibre technology is that which is used most commonly in the industry.

In environmental terms it is interesting to note that there is significant variation in the labour productivity for the manufacture of pulp and paper products when recycled inputs are used relative to virgin fibre inputs. (See Table 13). In some cases productivity is much higher (i.e. newsprint) when production processes are such as to enable the use of recycled inputs and in other cases the converse is true (i.e. uncoated free sheet). It should, however, be emphasized that these figures relate only to the actual manufacturing process involved and not the entire life cycle. For instance, the relative labour-intensity of wastepaper collection, etc... must be compared with virgin fibre harvesting to obtain a picture of the relative labour productivity of the whole production process.

IV. International Employment Trends in the Pulp and Paper Sector

The pulp and paper sector - along with many other manufacturing sectors - is sub-dividing into firms and regions which specialize in the production of high value-added and differentiated products which are manufactured using specialized capital equipment, and firms and regions which specialize in lower value-added commodity-grade products which are manufactured using standardized capital equipment. (See IIED Sub-Study 17.) This has significant repercussions for the level, characteristics and distribution of employment in the sector, some of which can be illustrated with reference to the notion of the "product cycle," as developed by Vernon (1966).

In the early stages of the industry's life research and development and agglomeration economies are such that the geographical concentration of production is likely. In the second

stage, increased economies of scale in production are realized as the market for its product expands. In the third stage the product has been standardized and thus less skilled labour becomes a relatively more important factor of production and intra-firm interaction becomes less important. In the final stage there is declining demand and increased price competition as the industry declines.

To a great extent, the pulp and paper sector has characteristics of all stages due to the increasingly heterogeneous nature of its outputs. On the one hand markets for commodity-grade production are clearly in the third or fourth stage of the cycle, while on the other hand the markets for many of the more specialized products are more accurately characterized in terms of the first or second stages. Thus, some studies (i.e. ILO 1992) have predicted that the OECD economies will tend to specialize in the latter markets, while non-OECD will specialize in the former. Some regions (i.e. Scandinavia and North America) may be in a position to exploit both markets if they are able to remain competitive in commodity-grade product markets. However, this may become increasingly difficult. There are two principal reasons why this is the case.

- Competitiveness in commodity-grade production in these regions will depend upon the introduction of labour-saving technological improvements which mitigate the relatively higher labour costs than elsewhere. However, given that demand for such products is likely to be stagnant relative to higher value-added markets, the incentives for such technological innovation are not likely to be great.

- Commodity-grade production is relatively "mature," with most of the potential gains in productivity already having been realized. As such, even if there were significant economic incentives for increased productivity gains, realizing such gains may be much more difficult than in newer sub-sectors.

In order to see how these trends are reflected in national employment levels, the sources of changes of employment in the sector in the four countries chosen were examined for the period 1985-1993. Changes in employment are attributed to three factors:

- Demand effects, which arise from changes in the size of the domestic market.

- Trade effects, which arise from changes in the country's sectoral trade balance.

- Technology effects, which arise from increases in labour productivity in the sector.

The results are presented in Tables 14-17. All four countries have experienced increases in employment due to increases in the size of the domestic market, although the relative importance of this factor varies greatly with the United States and India, the two large markets, having much larger increases than Chile and Sweden. Sweden, the United States and Chile have all had increases in employment attributable to improved sectoral trade balances, while India has lost employment due to a net deterioration in the trade balance. And finally, all four countries experienced increases in labour productivity. However, only

some of this would be attributable to technological progress within commodity classes, while the rest would be attributable to changing sectoral composition of output.

Table 14: Employment Change (1000s) in the P&P Sector in the USA

	Demand	Trade	Productivity	Total
1985-86	35.82	2.59	-42.41	-4.00
1986-87	32.21	-1.95	-23.26	7.00
1987-88	18.43	5.16	-8.59	15.00
1988-89	-1.77	4.08	4.70	7.00
1989-90	12.06	1.77	-12.83	1.00
1990-91	0.88	11.07	-20.95	-9.00
1991-92	5.25	7.11	-10.37	2.00
1992-93	19.10	-10.05	-7.05	2.00
Total	121.98	19.78	-120.76	21.00
Average	15.25	2.47	-15.10	2.63

Sources: FAO 1995, PPI 1996 and ILO 1995

Table 15: Employment Change (1000s) in the P&P Sector in Sweden

	Demand	*Trade*	Productivity	Total
1985-86	2.40	-0.25	-2.51	-0.36
1986-87	0.41	2.15	-2.71	-0.15
1987-88	0.88	0.74	-1.99	-0.37
1988-89	0.95	-0.33	0.49	1.11
1989-90	-0.62	-0.19	-0.95	-1.76
1990-91	-0.19	-0.23	-2.45	-2.87
1991-92	-0.64	0.33	-2.42	-2.72
1992-93	0.55	0.90	-4.97	-3.52
Total	3.75	3.11	-17.50	-10.64
Average	0.47	0.39	-2.19	-1.33

Sources: FAO 1995, PPI 1996 and ILO 1995

Table 16: Employment Change (1000s) in the P&P Sector in Chile				
	Demand	Trade	Productivity	Total Change
1985-86	NA	NA	NA	NA
1986-87	NA	NA	NA	NA
1987-88	NA	NA	NA	NA
1988-89	NA	NA	NA	NA
1989-90	NA	NA	NA	NA
1990-91	1.82	0.03	-0.97	0.87
1991-92	0.07	3.10	-2.67	0.50
1992-93	-0.61	1.37	-1.28	-0.52
Total	1.28	4.50	4.93	0.85
Average	0.43	1.50	-1.64	0.28
Sources: FAO 1995, INFOR 1995, PPI 1996 and ILO 1995				

Table 17: Employment Change (1000s) in the P&P Sector in India				
	Demand	Trade	Productivity	Total Change
1985-86	61.13	-10.07	-47.06	4.00
1986-87	16.05	-2.53	-13.52	0.00
1987-88	11.54	4.86	-8.40	8.00
1988-89	11.51	-0.59	-4.92	6.00
1989-90	27.27	-9.83	-7.44	10.00
1990-91	43.69	-23.74	-5.95	14.00
1991-92	NA	NA	NA	NA
1992-93	NA	NA	NA	NA
Total	43.69	-23.74	-5.95	14.00
Average	7.28	-3.96	-0.99	2.33
Sources: FAO 1995, India-CSO 1994a, PPI 1996 and ILO 1995				

However, it should be emphasized that the methodology employed means that the results are at best illustrative.[7] It is not possible to conclude the demand, trade and productivity *caused* employment losses or increases of the magnitudes listed. The results merely cast some light on the relative importance of different *influences* on sectoral employment levels in different countries. Moreover, the effects of the three determinants are interdependent. For instance, an increase in productivity will tend to result in an improved trade balance, and thus, perhaps increased aggregate employment, even if labour inputs per unit of output fall.

V. Conclusion

The paper cycle has undergone significant transformation in recent years. Most countries have experienced a drop in employment levels, although some LDCs and a smaller number of OECD countries have experienced increased sectoral employment. Those workers who have managed to hold onto their jobs tend to be relatively well compensated in most countries, particularly in the milling and conversion stages of production. Productivity in the sector tends to be high and the rate of increase has been fast, although this varies significantly by region. And finally, it is clear that changes within the sector in individual countries must be understood in an international context since countries seem to be specializing in different commodity classes, and are thus faced by different influences on employment levels.

[7] See appendix for a brief discussion of the methodology.

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Appendix: Methodology for Decomposition of Determinants of Changes in Employment[8]

The change in employment from period t_1 to period t_2 is defined as:

$$3)\Delta L = \frac{\Delta C}{P_{t_1}} - \frac{\Delta T}{P_{t_1}} - \frac{\Delta P}{P_{t_1}} * L_{t_2}$$

Where L is employment; C is consumption, T is the trade balance (imports minus exports), and P is productivtity (output over employment). The first term captures demand effects, the second trade effects and the third productivity effects. However, as pointed out in the text such a decomposition should be seen as a general approximation of the *influence* of difference factors and should not be interpreted as actual estimates the relative importance of different *causes* of changes in employment levels.

[8] See Clark (1985).