OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

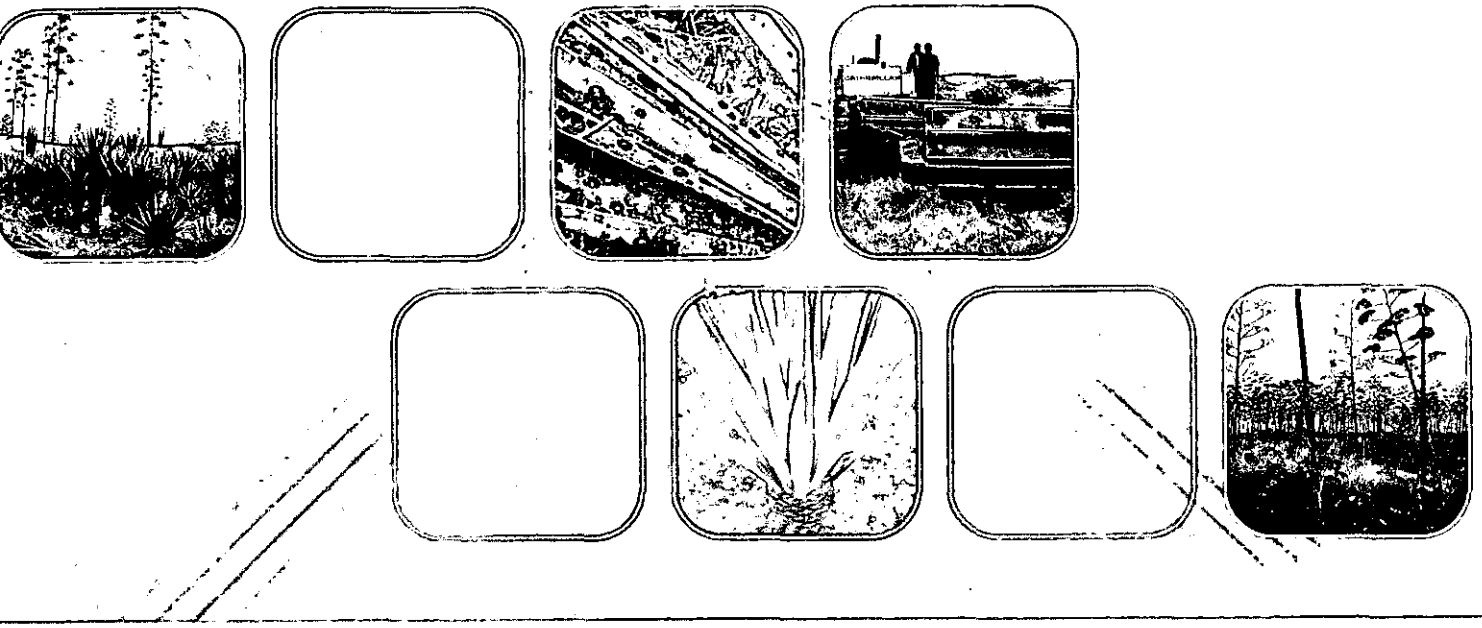
Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

COMMON FUND FOR COMMODITIES
Project CFC/FIGHF/07

Product and market development of sisal and henequen



Market Study and Trials

Project completion report/Addendum D.1

Tanzania, January 1997–September 2004

COMMON FUND FOR COMMODITIES

Product and market development of sisal and henequen

Project completion report, Addendum D.1

Market Study and Trials

Tanzania
January 1997–September 2004

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna, 2006

Project Completion Report preparation: National and international experts and consultants involved with the project, with contributions and support from the national teams.
General guidance and consolidation: Ms. Mayra. Sanchez Osuna, Project Manager.
The opinions, figures and estimates reflected in the Report and its Addenda are the responsibility of the authors and should not be necessarily be considered as reflecting the views or carrying the endorsement of the CFC or UNIDO.
The Project Completion Report and its Addenda have been reproduced without formal editing.

Common Fund for Commodities (CFC)
Stadhouderskade 55
1072 AB Amsterdam
P.O. Box 74656
1070 BR Amsterdam
The Netherlands
Telephone (++31 20) 575 4949
Fax (++31 20) 676 0231
e-mail: managing.director@common-fund.org
website: www.common-fund.org

United Nations Industrial Development Organization
Vienna International Centre
P.O. Box 300
A-1400 Vienna
Austria
Telephone (++43 1) 26026 3945
Fax (++43 1) 26026 6819
e-mail: M.Sanchez-Osuna@unido.org
website: www.unido.org

Food and Agriculture Organization of the United Nations
Commodities and Trade Division
Via delle Terme di Caracalla
00100 Rome
Italy
Telephone (++39 06) 5705 4201
Fax (++39 06) 5705 4495
e-mail: esc-registry@fao.org
website: www.fao.org

Project Completion Report

Sub-component D.1
"Market Study and Trials"

INDEX

Abbreviations and acronyms

AD	Air Dried
ADMT	Air Dried Metric Ton
BKH	Bleached Kraft Hardwood
BKS	Bleached Kraft Softwood
BS	Bleached sulfite
CEH	Chlorine (C), Alkaline Extraction (E), Hypochlorite (H)
CEPS	COAID Enhanced Production System for Sisal
CFC	Common Fund for Commodities
CIF	Cost, Insurance and Freight
COAID	Canada Overseas Agro-Industrial Development
ECF	Elemental Chlorine Free
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
MECH	Mechanical
MIN	Minerals
NWP	Non-wood pulp
OP	Other pulp
PCC	Project Coordinating Committee
SCD	Secondary fibre
SCH	Semi-chemical
TCF	Totally Chlorine Free
TORs	Terms of Reference
UBK	Unbleached kraft
UBS	Unbleached sulfite
UNIDO	United Nations Industrial Development Organization

I. Project Sub-component Summary

1. Title: Market Study and Trials

2. Location: Tanzania

3. Starting Date: January 1997

4. Completion Date: June 2004

5. Sub-component external financing – excluding counterpart contributions

Total subcomponent cost: U$ 107,468

Of which:
CFC Financing: U$ 107,468

Introductory note

The market study section of this report is an abstract of the study prepared in 1999 (and finalized in 2000) by Sevenhuijsen Associates, Netherlands. The conclusions reached by the study, in particular in terms of potential market for sisal in the pulp sector in year 2000 and 2005, have been highly criticized by fibre traders during the project dissemination workshop (Tanga, November 2004). The figures, estimated using an econometric model, are considered by the expert on the very high side.

The study is undeniably old, but there were no resources in the budget to update it at the end of project, neither was it felt by the Project Coordinating Committee (PCC) that these resources should be found. Without any doubt the figures presented cannot be considered a reflection of the actual demand for sisal pulp, and the econometric models should be reviewed introducing the data of the last 5 years. Nevertheless, the results of the study were cautiously used as an indication of the potentialities of the market and as the bases for the more targeted market trials. In particular the mills that showed interest during the market study were contacted again and samples of sisal fibre and pulp were delivered to these mills. Market experts also visited some of them.

The study is presented here as any other project activity implemented, even though the figures included should be viewed in light of the fact that they are out of date and were not used "per se".

II. Background and context in which the sub-component was conceived

II. 1 Background and context

During the project design and formulation phases the following major issues were identified:

- The survival or revival of the sisal and henequen industries in the long run would depend to a great extent on finding new end uses for sisal fibre. The medium-term market outlook for sisal and henequen traditional products would continue to face strong competition from synthetic materials despite some ecological advantages and other considerations for using natural fibres;
- Any growth for sisal in the medium term was expected to be in the non-traditional outlets such as: pulp, filters, carpets, buffing cloths and composites;
- It was also found that except as raw material for pulp, there was no major new development that could, within a short time, revive the demand for sisal and henequen. It was very hard to see a major resurgence in the core uses of those fibres as agricultural twines and rope while sisal pulp could increase its share of this market with appropriate development and market promotion.
- At that time sisal fibre was already making inroads in the specialty paper market. A small pulp mill in Tanzania was producing a modest quantity of sisal pulp for specialty paper and was exporting the unbleached pulp to Japan at substantial profit. Sisal pulp was also produced by a small, integrated mill in Brazil and was used for cigarette paper production.
- There was an increasing obligation for paper manufacturers to recycle paper rather than continue to depend in virgin pulp from forest. Recycling entails losses in certain essential qualities of the recycled fibre (secondary fibre) and these losses can be compensated by adding a certain amount of reinforcement pulp in the paper furnish. At that time it was estimated that about 100 million tonnes of paper waste was recycled worldwide and a rough estimate of the amount of reinforcement pulp required was about 10 to 20 million tonnes annually. BKS is the main reinforcement pulp and sisal pulp would have to compete with it in quality, price and reliability of supply. There was an indication that sisal pulp from line fibre is competitive with BKS as reinforcement material in terms of quality but not in price. Line fibre production cost is the major manufacturing cost in pulping;
- Finally, in order for sisal pulp to make inroads into the reinforcement market and to increase its share in the specialty pulp market, a number of important issues would have to be addressed: (a) lack of good estimation of world demand for the types and qualities of pulp with which sisal pulp would have to compete, and the price at which this competition would take place; (b) cost of fibre in order to compete in most market segments with other fibres, the factory-gate cost for sisal fibre would have to be substantially lower than the prices for line fibre. To lower the costs of sisal fibre better agricultural practices and specific fibre extraction technologies are needed, together with measures to recover the waste to add value to the crop and at the same time reduce environmental hazard.

The sub-component D.1 was conceived to address the problems above mentioned, and to respond to the need for a good estimation of the world demand for reinforcement pulp and for specialty pulps as well as market development and promotion of those pulps for specialty and commodities paper.

The sub-component was originally divided into three phases:

Phase 1 – Estimation of the world demand and forecast up to 2010 for reinforcement and specialty pulps based on historical analysis and identification of pulp and paper mills interested in further participation in Phase 2.

Phase 2- selection of about 50 pulp and paper producers to collect information on the cost and price of specified pulp qualities and to identify pulp/paper mills interested in the semi-commercial production of sisal pulp to be used in Phase 3 - Market trials.

Phase 3- Market trials of sisal fibre for pulp production and use of sisal pulp in different paper sectors.

In reality Phase 2 was condensed into Phase 3 and the activities divided into market study and market trials.

II.2 Objectives, outputs and targeted beneficiaries

The broad objective of the sub-component was to establish the demand for sisal pulp in different paper production applications and carry out trials to identify potential buyers of the products.

The specific objectives of the sub-component were as follows:

1. To estimate as realistically as possible the demand potential for sisal pulp in different sectors (specialty, semi- specialty and reinforcement);
2. To provide a realistic market premium price for sisal pulp;
3. To establish market contacts for future operations;
4. To obtain feedback from mills on samples of sisal fibre and pulp.

The expected outputs for Phase 1 were as follows:

- Comprehensive market study establishing market demand for sisal pulp and its use in different sectors of paper production;
- Preparation of a list of pulp and paper mills potentially interested in sisal;
- Shipment of samples of fibre and pulp to mills potentially interested in sisal and collection of feedbacks.

The primary beneficiaries are sisal fibre and pulp producers in Kenya and Tanzania. Producers in other countries will also benefit through dissemination of information.

III. Implementation and results achieved

III.1 Market study

The Terms of Reference (TOR) for the subcontract were prepared by UNIDO following the indications of the appraisal report and submitted to CFC for approval in 1997. The TOR included the services to be provided for the three Phases of the subcontract and a request for a separate quotation and time schedule for each phase. The monitoring and supervision was carried out by UNIDO.

After the approval of the TOR by CFC, UNIDO invited different companies for biding. The UNIDO Purchase and Contract Committee evaluated the offers received and recommended awarding the contract for Phase 1 to Sevenhuijsen Associates. The contract no. 97/125 (US$ 87,560) was signed by the subcontractor in April 1998 for a duration of nine months.

The TOR envisaged the submission of four reports. The submission of the reports was delayed and, as a consequence, the progress payments were also delayed. The draft final report and six annexes, with detailed information on the work performed by the subcontractor, were submitted to UNIDO in June 1999, despite UNIDO efforts to expedite the report's submission by the subcontractor.

Copies of the draft final report and annexes were sent to CFC and to the counterparts in Kenya and Tanzania for comments. The draft final report was also evaluated by the members of the mid term evaluation team. The main conclusions were as follows:

- Although the draft final report and annexes included a massive amount of substantive technical data concerning: (i) paper production and demand (historical from1980 to 1997 and forecast up to 2010); (ii) fibre balance and raw material requirements for selected paper grades and selected regions based in the paper furnish characteristics for each region; (iii) potential demand for reinforced pulp up to 2010 based in the raw material requirements for different paper grades using this type of fibre and in announced expansion or installation of new BKS pulp mills; and (iv) historical and forecast prices for BKS, manufacturing costs of this pulp grade and data of sisal pulp compared with BKS, the main report was presented in a format that made its reading and interpretation difficult, particularly for people not familiar with the pulp and paper sector.
- The chapter dealing with specialty paper applications was not included as requested in the TOR.
- The results of the queries were presented and discussed in the main report and detailed in its Annex 6, however, the pulp and paper mills that answered positively to the queries on specialty paper and reinforcement pulp were not identified in Annex 6 in terms of name, address of the companies and contact persons.

Thus UNIDO requested the subcontractor to: (i) review the report and Annex 6 concerning format and data presentation, in order to make it more easily readable and understandable; (ii) include the missing chapter on specialty paper; (iii) list name, address and contact person of the pulp and paper mills that replied positively to the

queries; and, (iv) correct some data in the main report that were not in agreement with the data in the annexes as well as minor editing errors.

The last two progress payments were put on hold until the revised version of the report and the list of pulp and paper mills were submitted to and approved by UNIDO.

A new outline for the main body of the revised version of the report was submitted to UNIDO at the beginning of 2000 second quarter, but the list of pulp and paper mills was not included. The outline was approved but payments remained on hold until submission of the revised draft report and the list of mills. The subcontractor was very reluctant in supplying the list, but after a long negotiation the revised versions of the report and of the Annex 6, including the list with the name, address and contact name of mills interested in sisal, were submitted to UNIDO in the first half of 2001. All the mills to which queries were sent were identified in the revised version of Annex 6. To facilitate contacts with the companies, UNIDO divided the list of interested companies into two: Those interested in Sisal fibre for reinforced pulp and those interested in specialty papers.

III.1.1 Methodology

In order to accomplish specific objectives 1 and 2 (to estimate as realistically as possible the demand potential for sisal pulp in different sectors and to provide a realistic market premium price for sisal pulp) the following methodology was used:

- Survey of the statistics on production and trade of paper and relating these to population and gross domestic product (GDP) in selected countries in Europe, North America, Latin America and Asia;
- Estimate the future demand for paper based in the population and GDP using an econometric model including indexes for disposable income, inflation, social cost, education, commodity prices and trade, labor cost and productivity, industrial production and future expansions in pulp and paper production in selected countries in Europe, North America, Latin America and Asia;
- Survey on the average furnish (fibre balance) of selected paper grades in the selected countries and future trends;
- Survey on the average production costs and market prices for BKS as major reinforcement pulp;
- Survey on the market price of sisal pulp.

On the bases of the results the following was estimated: (i) the demand for reinforcement and specialty pulps for the period 1995 to 2010; (ii) the market price and trends of BKS for the period 1995-2010; (iii) prospects of sisal pulp for reinforcement and specialty pulps.

The data used in the market study was mostly taken from the database of NKL Consultants, Canada. The data for selected African countries not included in the NKL database was collected separated using FAO statistics.

Table 1. Countries considered in the analysis, by region

Europe	North America	Latin America	Asia	Other Asia	Australasia
Austria, Belgium, Great Britain, Finland, France, Germany, Italy, Netherlands, Norway, Portugal, Sweden, Spain, Switzerland	Canada United States	Argentina Brazil Chile Mexico	China Japan	India Indonesia Malaysia Philippines South Korea Taiwan Thailand	Australia New Zealand

Table 2. Data and calculation for selected paper grades

Selected paper grades	Data included in database	Calculation
Printing & writing papers - coated wood free - uncoated wood free - coated mechanical - uncoated mechanical	World production, statistics and projections, forecast assumptions	Fibre balance
Tissue	World production, statistics and projections, forecast assumptions	Fibre balance
Board	World production, statistics and projections, forecast assumptions	Fibre balance
Newsprint	World production, statistics and projections, forecast assumptions	Fibre balance
Others	World production, statistics and projections, forecast assumptions	Fibre balance

In order to accomplish Specific Objective 3 (to establish market contacts for future operations;) the following methodology was used:

- Preparation of questionnaires to be forwarded to selected pulp and paper mills using reinforcement pulp and specialty paper mills worldwide;
- Delivery of the questionnaires and follow up of the responses;
- Analyze the answers received;
- Identification of specialty paper mills interested in receiving samples and/or information of sisal fibre and/or sisal pulp;
- Identification of paper mills using reinforcement pulp, interested in receiving samples and/or information of sisal fibre and/or sisal pulp.

III.1.2 Results achieved

III.1.2.1 Sisal pulp characteristics, current uses and competitors

Specialty papers are high valued products produced for a restricted market and designed to meet specific purposes. Theses grades of paper are usually produced by small specialty mills using small paper machines. Some examples of specialty papers are:

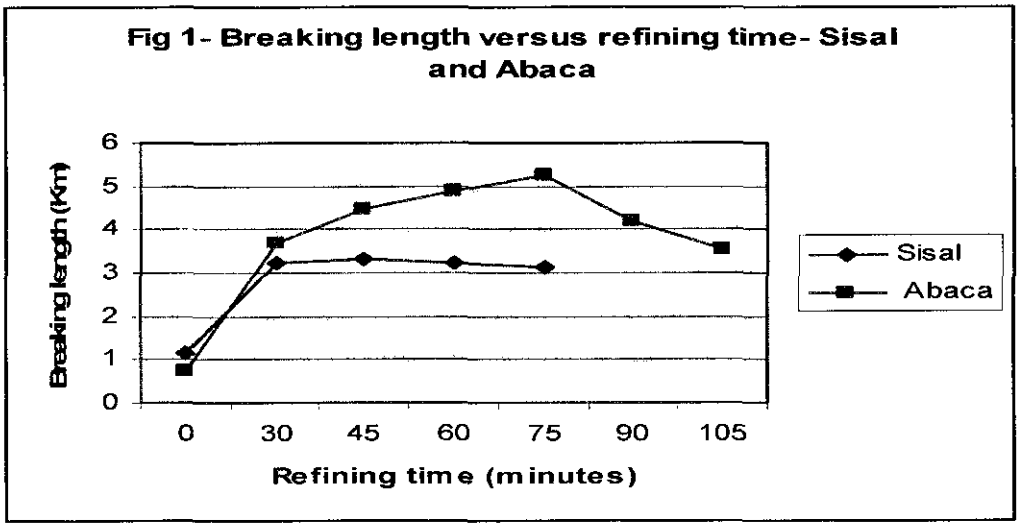
- Currency/security, cigarette, dielectric, filtration, fine printing, onion skin, bible papers;
- Tea and vacuum bags, wet laid non-woven;
- Laminating substrates, fruit wrap, antistatic, water repellent papers.

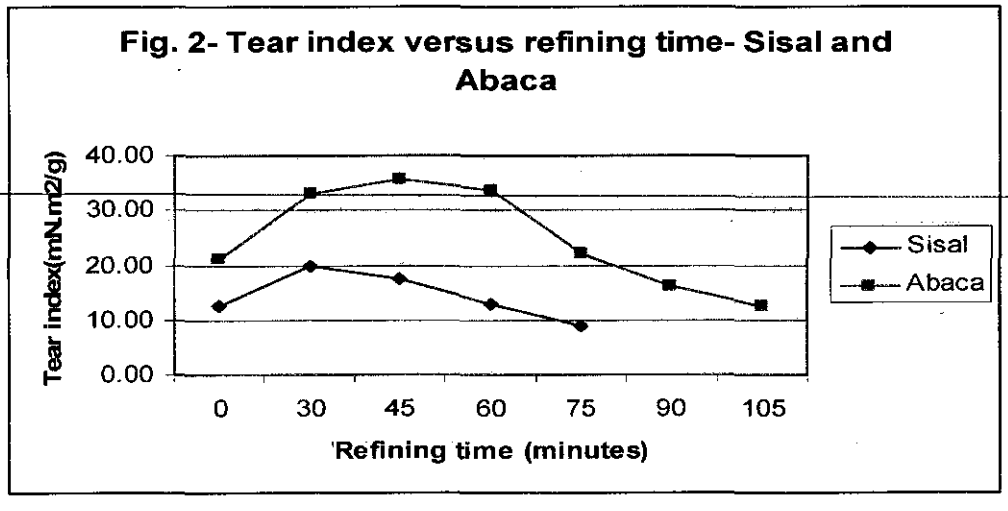
Bleached and unbleached sisal pulp are ideally suited for use in dielectric papers, plug wrap, vacuum and tea bags, filtration papers, laminating substrates, wet laid non woven. Bleached sisal pulp is also suited for cigarette paper.

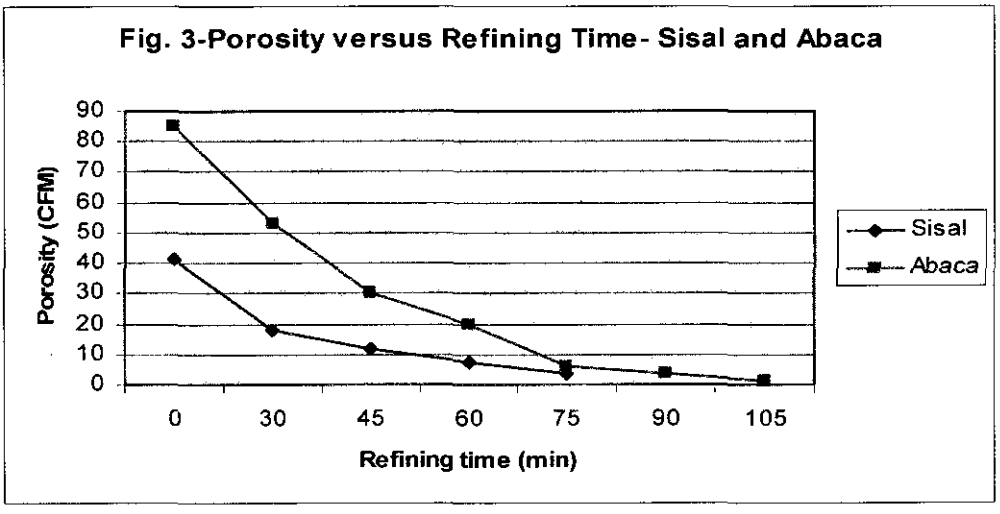
The main competitors of sisal specialty pulps are: (i) bleached and unbleached abaca pulps due to their high strength, viscosity and porosity; (ii) flax pulp for currency/security and cigarette papers; and, (iii) hemp and jute pulps for cigarette papers.

The important properties of sisal and abaca specialty pulps measured in hand sheets at 40 g/m^2 are illustrated in Figures 1, 2 and 3. As indicated in the graphs, abaca pulp has better properties than sisal pulp, however, the market price for abaca is in the range of US$ 2,400 – US$ 2,800/ADMT, while for sisal is about US$ 1,500 – US$ 1,700/ADMT. The most important consumers of sisal specialty pulp are Europe, North America and Japan.

Figures 1, 2 and 3. Comparison of sisal and abaca pulps main characteristics







Reinforcement pulp is used in the paper furnish to improve the wet web and the final paper properties. This grade of pulp is used in printing and tissue paper furnishes

containing mechanical and hardwood pulps as well as recycled fibres that are poor bonding materials. Currently BKS is, the main material for reinforced pulp.

The most important properties for reinforced pulps are:

- Aspect ratio (that is the ratio between fibre length and fibre width);
- Relation of tear and tensile index or breaking length at the same freeness level.

The aspect ratio of sisal and selected softwood commercial pulps are indicated in Table 3 below.

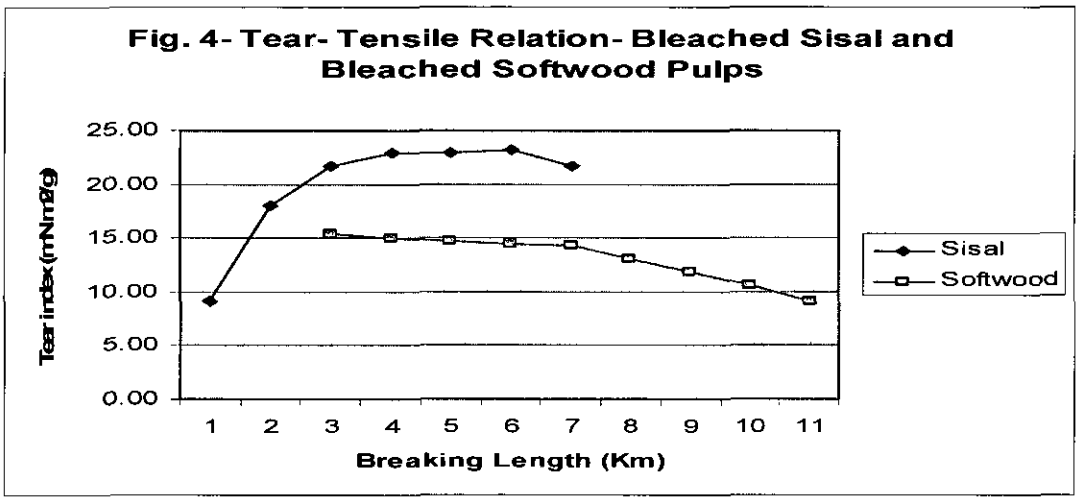
Table 3. Aspect ratio of sisal and selected softwood pulps

Fibre	Length (L) mm	Width (W) micron	Aspect ratio (L:W)
Sisal	3.30	20	165:1
Sisal	3.03	17	178:1
Western Hemlock	3.35	35	96:1
Douglas Fir	4.00	40	100:1
Hesperaloe	3.60	15	240:1

Compared with softwood pulps, sisal pulp provides a better aspect ratio, indicating that this pulp has better reinforcement characteristics.

The relation between tear and tensile indexes of sisal and softwood pulps, at the same freeness level, is indicated in Figure 4.

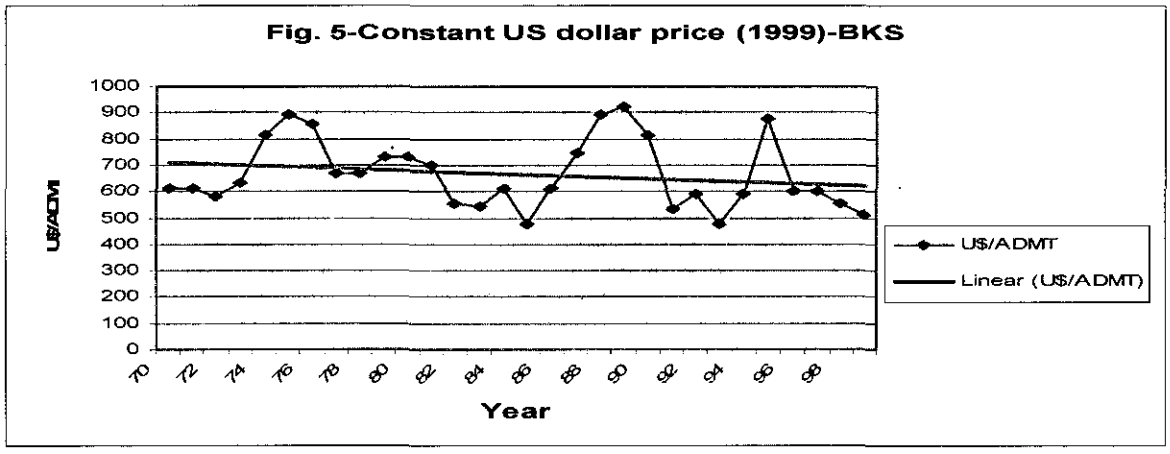
Figure 4. Tear and tensile indexes of sisal and softwood pulps



Sisal pulp has better tear index than softwood pulp at the same breaking length. This, in conjunction with the better aspect ratio, indicates that sisal pulp has good reinforcement characteristics and can compete effectively with softwood pulp in terms of quality.

The constant 1999 US dollar prices of BKS are shown in Figure 5 below.

Figure 5. Constant 1999 USD prices of bleached kraft softwood



The market price of BKS pulp in 2000 was in the range of US$ 600/ADMT (CIF Europe) while sisal pulp was about US$ 1,500 – US$ 1,700/ADMT. The main cost in sisal pulp production is the sisal fibre. In order to improve the sisal competitiveness with softwood pulps and its potential to penetrate in the reinforcement market, the fibre cost has to be drastically reduced.

III.1.2.2 General considerations on possible markets for sisal pulp

Statistics and forecast of paper demand and production

The historical data for paper demand and production for the selected countries and regions, for the period 1980 to 1997, were obtained from the electronic database of NLK Consultants, Canada. The paper demand was estimated taking into consideration the imports and exports by the selected countries and regions. Based on the historical data, the average paper consumption per capita was calculated for each year. The forecast of the paper demand and production for the period 1997 to 2010 was estimated taking into consideration various econometric indexes such as: Gross Domestic Product (GDP), population, inflation, social cost, education, disposable income, labor productivity and cost, paper consumption per capita, industrial production and commodity prices and trade. Details are indicated in Annex 2 of the market study report.

The results for the paper demand (calculated as the production plus imports minus exports), production and respective forecasts for the selected regions are shown in Tables 4 and 5. The results for the grades of papers indicated in Table 2 are reflected in Tables 4A and 5A. These results are illustrated in Figures 6, 7, 6A and 7A in Annex 2 of this report.

Tables 4 and 4A. World paper demand (production + imports - exports) and forecast 1980-2010 by region and by grade

4. World paper demand and forecast by region (million tonnes)								
		1980	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**
Europe		40.0	43.8	57.6	63.4	71.6	77.5	82.3
North America		70.4	72.8	83.3	94.1	103.9	110.8	113.6
Latin America		7.2	7.2	8.4	10.7	13.7	17.8	23.5
Asia	Japan	17.9	20.3	28.2	30.0	32.1	33.5	34.0
	China	6.2	9.9	14.4	26.5	36.8	54.4	75.8
	Others	6.2	8.2	14.3	22.2	34.5	51.2	72.5
	Subtotal Asia	30.4	38.4	56.9	78.7	103.5	139.1	182.3
Australasia		2.5	3.0	3.4	4.1	4.9	5.6	6.1
Total		**150.5**	**165.2**	**209.6**	**251.1**	**297.6**	**350.8**	**407.9**

4A. World Paper Demand and Forecast by Grade (million tonnes)							
	1980	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**
Coated woodfree	5.3	7.4	11.7	15.6	20.6	26.2	31.6
Uncoated woodfree	19.8	23.9	29.5	36.2	43.2	51.5	57.5
Coated mechanical	5.9	7.7	10.4	11.9	13.9	16.0	19.1
Uncoated mechanical	7.5	9.1	10.0	10.7	11.7	12.6	14.3
Tissue	8.6	10.1	12.5	14.9	17.9	21.7	26.0
Board	17.0	19.7	28.1	34.1	41.8	51.6	62.5
Newsprint	23.0	25.5	30.0	32.2	34.2	35.0	36.1
Other paper and board	63.4	61.9	77.4	95.6	114.2	136.3	160.7
Total	**150.5**	**165.2**	**209.6**	**251.1**	**297.6**	**350.8**	**407.9**

Tables 5 and 5A. World paper production and forecast 1980-2010 by region and by grade

5. World Paper Production and Forecast by Region (million tonnes)								
		1980	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**
Europe (EU)		43.15	48.40	62.07	72.58	81.94	88.34	95.31
North America (NA)		76.51	75.29	88.01	99.71	107.05	113.36	117.15
Latin America (LA)		6.37	7.66	9.10	10.48	13.50	17.42	22.37
Asia	Japan	18.09	20.47	28.09	29.66	32.19	33.41	33.99
	China	5.63	9.31	13.72	24.00	29.55	44.62	62.44
	Others	5.26	7.15	13.22	20.76	32.76	50.20	71.97
	Subtotal(A)	28.97	36.93	55.02	74.43	94.50	128.24	168.40
Australasia		2.15	2.38	2.82	3.20	4.10	4.64	5.26
Total World		**157.16**	**170.65**	**217.02**	**260.39**	**301.08**	**352.00**	**408.49**

5A. World paper production and forecast by grade (million tonnes)							
	1980	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**
Coated woodfree	5.8	7.7	11.7	16.4	20.7	26.2	32.4
Uncoated woodfree	20.4	24.5	30.7	36.7	42.8	49.3	54.8
Coated mechanical	6.4	8.2	10.8	13.5	16.3	18.6	21.4
Uncoated mechanical	8.1	9.9	11.0	12.7	14.4	16.0	18.0
Tissue	8.7	10.3	12.7	15.1	18.0	21.6	25.7
Board	17.6	21.3	30.0	36.1	41.5	49.6	58.9
Newsprint	23.4	25.8	30.2	32.8	35.7	36.9	39.0
Other paper and board	66.8	63.0	79.9	97.2	111.6	133.8	158.3
Total	**157.2**	**170.7**	**217.0**	**260.4**	**301.1**	**352.0**	**408.5**

The paper demand and the production history for East African countries is not included in the database of NLK Consultants, and the results included in the market study are based on FAO (Food and Agriculture Organization) statistics for the period 1988 to 1997. The forecasts for paper production and demand for the period from 1990 to 2010 were based on this information assuming a linear progression. The results are indicated in Table 6 below. The illustrations are included in Annex 2.

Table 6. Total paper demand and production in East Africa

Total paper demand (thousand tonnes)					
	Historical		Forecast		
Year	1990	1995	2000	2005	2010
Demand	225.29	236.42	277.91	294.18	310.45

Total paper production (thousand tonnes)					
	Historical		Forecast		
Year	1990	1995	2000	2005	2010
Production	144.25	162.57	194.03	208.17	222.31

Fibre balance and furnish

The composition (furnish) or the raw material requirements (fibre + minerals) for the selected paper grades (as indicated in Table 2) were prepared taking into consideration the following assumptions (per paper grade, per country and per region):

- Paper production and forecast 1995-2010 as in tables 4 and 4A;
- Variations in the paper furnish in the period;
- Paper machine losses at about 6 to 6.5% depending on the region, with lower figures for developed regions
- Percentage of total fibre and raw material requirement coming from integrated mills and from the market.

The total paper furnish composition is not the same in the various regions as indicated in Table 7. The main differences between North America and Europe are related to

the use of secondary fibre (SCD) and minerals in furnish composition. China uses a significant amount of non wood pulp (NWP) in paper making while in the other regions the utilization of non wood pulp is insignificant.

The raw materials consumption (fibre + minerals) for the world is indicated per region and per grade in the tables included in Annex 1. These tables also reflect the amount of raw materials used by integrated mills and available for the market. The paper-making efficiency for the world is about 94% per year, equivalent to raw material losses of about 6%.

Table 7. Total furnish in selected regions

Region/ Country	Year	Pulp grade in the furnish										MIN	Total
		BKS	BKH	UBK	BS	UBS	SCH	MECH	SCD	NWP	OP		
		%	%	%	%	%	%	%	%	%	%	%	%
North America	1995	14	14	21	1	1	4	15	22			8	100
	2000	14	14	22	1		3	14	24			8	100
	2005	13	13	23			2	14	26			9	100
	2010	12	13	23			2	13	28			9	100
Europe	1995	14	11	6	3		2	16	36			12	100
	2000	13	10	5	2		2	15	40			13	100
	2005	12	8	5	2		2	15	42		1	13	100
	2010	12	7	4	2		1	16	44			14	100
Latin America	1995	9	20	15				10	36	3		7	100
	2000	9	20	13				12	36	3		7	100
	2005	10	20	12				13	35	2		8	100
	2010	11	19	10				15	34	2		9	100
Japan	1995	9	23	6			1	7	43			11	100
	2000	9	23	6			1	7	42			12	100
	2005	8	23	5			1	8	42			13	100
	2010	8	22	5			1	8	42			14	100
China	1995	3	2	2	1			2	39	47		4	100
	2000	5	3	2	1			4	39	41		5	100
	2005	6	5	2				6	40	35		6	100
	2010	8	6	2				7	41	29		7	100
Other-Asia	1995	6	18	5			1	2	57	6		5	100
	2000	6	19	4			1	3	56	5		6	100
	2005	6	17	4			1	4	59	3		6	100
	2010	6	15	4			1	5	60	3		6	100
Australasia	1995	9	7	11	3		5	26	33	1		5	100
	2000	10	10	10	3		3	22	34	1		7	100
	2005	9	11	9	3		2	20	37	1		8	100
	2010	9	11	8	2		2	18	39	1		10	100

BKS= bleached kraft softwood; **BKH**=bleached kraft hardwood; **UBK**=unbleached kraft; **BS**=bleached sulfite; **UBS**=unbleached sulfite; **SCH**=semi-chemical; **MECH**= mechanical; **NWP**= non wood pulp; **SCD**=secondary fibre; **OP**=other pulp; **MIN**=minerals

III.1.2.3 Possible Markets for Sisal Pulp for Reinforcement

Considering the data included in Table 7 it can be inferred that BKS is the main material for reinforced pulp. The estimated consumption of BKS for the period 1995 to 2010 is shown in Tables 8 and 8A and the consumption distribution is included in Table 9.

Tables 8 and 8A. Market BKS Consumption 1995-2010 by region and by grade

8. Market bleached softwood consumption by region (million tonnes)					
Region		**1995**	**2000**	**2005**	**2010**
Europe (EU)		7.1	7.3	7.6	7.9
North America (NA)		3.9	4.1	3.8	3.6
Latin America (LA)		0.7	0.9	1.3	1.9
Asia (A)	China	0.6	1.0	2.0	3.2
	Japan	1.7	1.9	2.0	2.1
	Other Asia	1.3	2.2	3.2	4.4
	Subtotal Asia	3.6	5.1	7.2	9.7
Australasia (AT)		0.2	0.4	0.4	0.5
Total		**15.6**	**17.7**	**20.3**	**23.5**

8A. Market bleached softwood consumption by grade (million tonnes)				
Grade	**1995**	**2000**	**2005**	**2010**
Coated wood free	2.1	2.3	2.7	3.2
Uncoated wood free	3.1	3.7	4.2	4.7
Coated.mechanical	2.5	2.5	2.5	2.8
Uncoated mechanical	1.1	1.2	1.4	1.8
Tissue	1.6	1.8	2.0	1.9
Board	2.7	3.1	3.6	4.3
Newsprint	0.7	1.0	1.3	1.7
Other papers	1.8	2.1	2.6	3.1
Total	**15.6**	**17.7**	**20.3**	**23.5**

Table 9. Distribution of BKS consumption 1995-2010

	1995	**2000**	**2005**	**2010**
Reinforcement	14	16	17	20
Other applications	2	2	3	4
Total	**16**	**18**	**20**	**24**

The potential market for sisal as reinforcement for pulp was estimated on the bases of the replies received from 175 companies that answered the questionnaires, out of which 147 were based in Europe, 26 in North America, and 2 in Australasia (see Annex 3). The survey identified 16 mills interested in receiving fibre and 29 mills interested in receiving pulp samples.

The key assumptions used for calculating the potential market for sisal pulp were as follows:

- Paper grades produced by the mills (printing, packing, tissue and specialty);
- Number of mills willing to pay premium price for sisal pulp (plus 10% and more than 10%);
- Amount of long fibre purchased in the market per year (<4,000, 4,000 - 16,000, 16,000 -32,000 and >32,000 per year);
- Use of bleached and unbleached long fibre pulp.

The number of mills willing to pay premium price for long fibre is indicated in Table 10 below. Since those mills are also producing specialty papers, and in order to avoid duplication with the results related to the market for specialty pulp, the amount of bleached long fibre was estimated only taking into consideration the mills producing printing and tissue papers that are the main grades that use bleached kraft softwood and reinforcement pulp.

Table 10. Estimated demand for bleached long fibre

Demand for printing, tissue and specialty paper mills											
	Long Fibre (tonnes/year) per mill		**No premium price**			**plus 10%**			**>10%**		
			No. of mills	**Long Fibre (tonnes/year)**		**No. of mills**	**Long Fibre (tonnes/year)**		**No. of mills**	**Long Fibre (tonnes/year)**	
Long Fibre range	**Min.**	**Max.**		**Min.**	**Max.**		**Min.**	**Max.**		**Min.**	**Max.**
<4,000	4,000	4,000	6	24,000	24,000	4	16,000	16,000	1	4,000	4,000
4,000- 16,000	4,000	16,000	9	36,000	144,000	8	32,000	128,000	2	8,000	32,000
16,000- 32,000	16,000	32,000	14	224,000	448,000	9	144,000	288,000		-	-
>32,000	32,000	32,000	13	416,000	416,000	7	224,000	224,000		-	-
Total				**700,000**	**1,032,000**		**416,000**	**656,000**		**12,000**	**36,000**
Bleached Long Fibre (80%)				**560,000**	**825,600**		**332,800**	**524,800**		**9,600**	**28,800**
2. Estimated amount of bleached long fibre for printing and tissue mills											
<4,000	4,000	4,000	9	36,000	36,000	2	8,000	8,000	0	0	0
4,000- 16,000	4,000	16,000	16	64,000	256,000	3	12,000	48,000	0	0	0
16,000- 32,000	16,000	32,000	21	336,000	672,000	4	64,000	128,000		0	0
>32,000	32,000	32,000	16	512,000	512,000	4	128,000	128,000		0	0
Total				**948,000**	**1,476,000**		**212,000**	**312,000**		**0**	**0**
Bleached Long Fibre (80%)				**758,400**	**1,180,800**		**169,600**	**249,600**		**0**	**0**

The quantity of bleached long fibre purchased by printing and tissue manufacturers not willing to pay premium price is in the range of 1 million tones per year, however the sisal pulp might have difficulties in competing with the market price of BKS that is in the range of US$ 600/ADMT. Bleached sisal pulp is competitive in terms of quality and the study indicated that there are mills willing to pay at least 10% premium price for sisal. Therefore, a conservative estimate of the potential market, in 2000, for sisal pulp as reinforcement pulp is in the range of 169,600 to 249,600 tonnes or 1.06 and 1.56 % of the demand of BKS estimated as 16 million tonnes in 2000. Assuming that these percentages will remain in the future years the forecasts are indicated in Table 11.

These forecasts, however, assume that sisal pulp and pulpable fibre would be produced at price levels that would make the pulp price at the paper mill gate around US$ 660/ADMT. It should be stressed once again that the forecasts were obtained using an econometric model.

Table 11. Estimated market for reinforcement sisal pulp and raw fibre (tonnes)

Year		**2000**	**2005**	**2010**
Sisal pulp	*minimum*	169,600	180,200	212,000
	maximum	249,600	265,200	312,000
Sisal fibre	*minimum*	282,666	303,333	353,333
	maximum	416,000	442,000	520,000

III.1.2.4 Possible markets for sisal pulp for specialty paper

Statistics for specialty paper production and demand are not easily found in available databases. This grade of paper is normally included in statistics as "other grades". The producers are very secretive about the average furnishes composition of specialty paper grades and this information is practically impossible to obtain.

For this reason, the estimation of the potential market for sisal specialty pulp was carried out on the bases of the answers provided by specialty paper mills to a questionnaire.

The paper production for the year 2000 reported by 103 specialty paper mills that answered the questionnaires was 3,995,306 tonnes/year. Those mills also reported that they produce, in addition to specialty paper, other grades such as: printing, packaging, technical and other. The amount of about 4 million tonnes above mentioned includes all grades of paper produced by the mills and it represents about 1.33% of the world paper production in 2000 of 301.08 million tonnes.

Assuming that this proportion is constant in the previous and future years, the estimated production of finish paper produced from 1990 to 2010 was calculated and is indicated in Table 12.

Table 12. Estimated production of specialty paper mills (thousand tonnes)

	1990	**1995**	**2000**	**2005**	**2010**
World paper production (thousand tonnes)	217,020	260,320	301,080	352,000	408,490
Percentage produced by specialty paper mills (%)	1.33	1.33	1.33	1.33	1.33
Production of specialty paper mills (thousand tonnes)	2,088	3,460	4,000	4,680	5,430

The specialty paper mills, besides producing other paper grades, also reported that various types of pulps were used such as: cotton, flax, hemp, sisal, abaca, other non-wood, softwood, hardwood and waste paper.

The total specialty pulp requirements for specialty grade papers were estimated based on the specialty pulp market reported by Hurter of about 110,000 ADMT/year in 1989/1990 excluding China. It was assumed that since China produces mainly non-wood pulp, the amount of this grade of pulp being used in specialty paper manufacturing is 10% of the total amount of specialty paper production. This resulted in a total pulp demand of 4.1% of the world specialty paper production, including China. For the subsequent year the values assumed and calculated are shown in Table 13.

Table 13. Estimated world requirements of specialty pulp

		1990	1995	2000	2005	2010
Paper production	World	217020.00	260390.00	301080.00	352000.00	408490.00
	China	13720.00	24000.00	29550.00	44620.00	62440.00
	World -China	203300.00	236390.00	271530.00	307380.00	346050.00
Specialty paper production	% paper production	1.33	1.33	1.33	1.33	1.33
	World	2883.22	3459.41	4000.00	4676.50	5427.00
	China	182.28	318.85	392.59	592.80	829.55
	World -China	2700.94	3140.56	3607.41	4083.70	4597.45
Specialty pulp requirements world minus China	Hurter	110.00				
	% specialty paper	4.1				
	% assumed	4.1	4.5	5	5.5	5.5
	Specialty pulp	110.00	141.33	180.37	224.60	252.86
Specialty pulp requirements China	% specialty paper	10	10	10	10	10
	Specialty pulp	18.23	31.89	39.26	59.28	82.95
Specialty pulp requirements world	% specialty paper	4.4	5.0	5.5	6.1	6.2
	Specialty pulp	128.23	173.21	219.63	283.88	335.81

The use of abaca pulp was estimated based on the FAO statistics and assumed that all abaca raw fibre exported by Philippines and Ecuador is converted in abaca pulp. Flax, hemp and jute pulps were estimated as 30% of the pulp demand while 25% was covered by cotton. The remaining pulp demand was equally distributed among wood pulp and sisal. The results are shown in Table 14.

Table 14. Estimated specialty pulp demand by type of pulp (thousand tonnes)

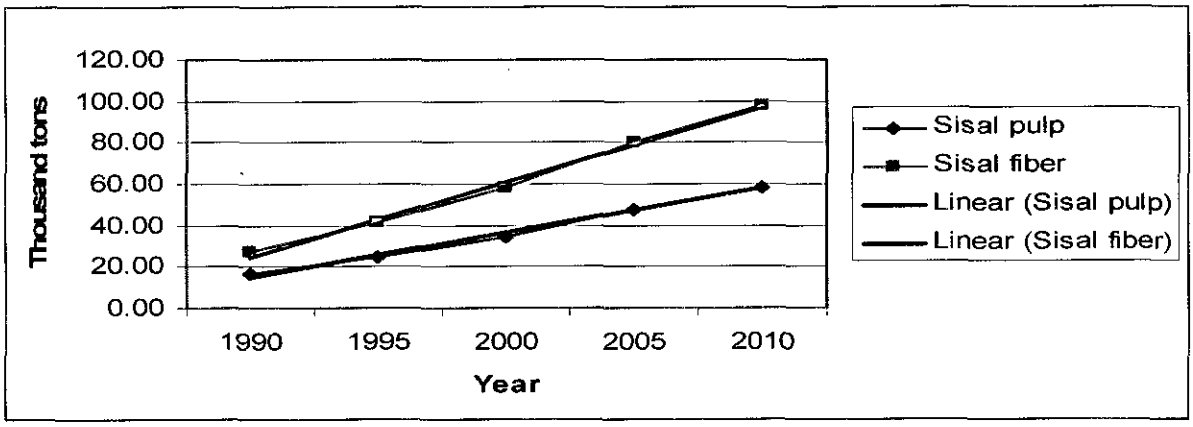
World specialty pulp demand (thousand tonnes)	1990	1995	2000	2005	2010
Total	**128.23**	**173.16**	**219.63**	**283.88**	**335.82**
Abaca	25.00	27.83	29.43	31.82	33.81
Flax, hemp, jute	38.47	51.95	65.89	85.16	100.75
Cotton	32.06	43.29	54.91	70.97	83.95
Wood	16.35	25.05	34.70	47.96	58.65
Sisal	16.35	25.05	34.70	47.96	58.65

Following on the estimated demand of sisal pulp indicated in Table 14, the demand for sisal raw fibre was calculated assuming 60% pulp yield as a conservative value.

The results are indicated in Table 15 and in the graph below.

Table 15. Estimated demand for specialty sisal pulp and raw fibre (thousand tonnes)

	1990	1995	2000	2005	2010
Sisal pulp (thousand tonnes)	16.35	25.05	34.70	47.96	58.65
Sisal fibre (thousand tonnes)	27.25	41.74	57.84	79.94	97.76



The total number of replies to the questionnaires on specialty paper was 160, out of which 112 were from Europe, five from Asia, four from South America and 39 from North America. The number of mills interested in receiving fibre and pulp samples was 15 and 45 respectively (Annex 3).

III.2 Market Trials

As mentioned before, the Phase 2 foreseen in the Appraisal Report was condensed into Phase 3 and consisted mainly in contacting research institutions and the mills that showed interest in sisal during the market study.

In August 2003, 14 research institutions (and laboratories) were contacted to evaluate the possibility of performing ECF (Elemental Chlorine Free) and/or TCF (Totally Chlorine Free) bleaching trials of about five tonnes of pulp. The offers received (from the Centre Technique du Papier, France, the Wageningen University, the Netherlands, the Swedish Pulp and Paper Research Institute, the Norwegian Pulp and Paper Research Institute, and the Pulp and Paper Institute, Slovenia) were all too high compared to the resources available in the project. A tentative effort was also made to involve the selected commercial mills in the bleaching trials, but with no success. It was therefore decided to perform only laboratory bleaching trials, as laboratory tests would provide a comprehensive overview of the achievable quality. The unfortunate consequence of this decision is that only a preliminary estimation of the bleaching costs was done by the laboratory (Addendum C.2), while the more realistic evaluation of the costs foreseen in the Appraisal Report would certainly have benefited the project.

The expected outputs for the market trials are as follows:

- A report on the responses of firms who have participated in the survey;
- An analysis of the responses as an input into the feasibility study, conclusions and recommendations.
- The establishment of market contacts for the expected production of pulpable fibre.

A letter was sent in August 2003 to the 15 specialty paper mills and to the four reinforcement mills identified in the market study in order to re-establish contact and re-raise their interest in sisal (see list in Annex 5). A brief overview of the project was attached to the letters.

Mr. Shamte, from Katani Ltd. visited several mills in Europe; Dr. W. Khayrallah the mills in North America and Ms. R. Viegas Assumpçao the ones in Brazil. The visits to the mills in North America and in Brazil were not particularly constructive, as the mills would be interested only in the case that a stable production was available.

The information to be gathered from the European mills visited by Mr. Shamte included:

- The quality of the fibre and the pulp and their properties.
- Comparison with other fibres/pulp - wood and non-woods like abaca, flax, hemp, jute.
- Utilization of sisal pulp in the manufacture of various products – current and future possibilities.
- Prices for sisal fibre and pulp in comparison with wood and non wood fibers/pulps – current and trend.
- Sources of information on sisal and various other pulps.

- Possibilities of investment in fibre and pulp operations in Tanzania.

It was considered necessary to include in the list of firms to be visited the two pulp and paper mills in Tanzania of Kibo in Moshi and MPM of Mufindi for their experiences in the fibre and pulp production and trade; and Wigglesworth and Co. in the UK (the largest sisal fibre and products merchants in the world who also deal in abaca, jute and in pulp); and Sealand (General Exporters) Limited who are the principals of Kibo.

Of the 11 European mills in the shortlist, two (Lohjan Paper Oy Lohja - Finland and Gruenperga Spezialpapierfabrik GmbH of Borstendorf – Germany) did not respond and were eventually removed from the list of mills to be visited. Since the Project program necessitated that the Market Study Report be finalized by the end of September 2004, and since for most of Europe the period between mid July and early September is mostly the holiday period, it was necessary that the market visits to the mills in Europe were undertaken by mid July at the latest.

As described in Addendum C.2, sisal fibre samples were produced by the hammer mill from leaf material from the CEPS trials at Hale. The pulping conditions were as follows:

- Active alkali – 12% Sodium Hydroxide
- Additive – Anthraquinone - 0.1%
- Heating time to maximum temperature – 90 minutes
- Maximum temperature – 173°C
- Cooking time – 90 minutes
- Dilution rate – 1 dry fibre:4 white liquor

The cooking report produced the following results of the unbleached pulp:

- Digester Kappa – 16.5
- Beater Kappa – 9.6
- Poacher Kappa – 9.1
- Freeness (CSF) – 670
- Brightness – 43.1 to 45.3
- Parenchyma – 4.5 %

Because of the delays in extracting and pulping the fibre the results of the bleaching trials were not available at the time of the visits to the mills.

A follow-up to the visits was to be done by Katani Ltd. by sending to the mills copy of the bleaching report prepared by the Pulp and Paper Research Institute and samples of the standard sheets of ECF and TFC bleached sisal pulp.

III.2.1 Mills and firms visited and discussions held

1) CELESA (Celulosa de Levante, S.A.)
P.O. Box 76,
Carretera C-42, Km.8.5,
43500 Tortosa,
SPAIN.
Contact: Mr. Rodolfo Ripol
Deputy General Manager and Purchasing Director; and

Mr. Joan Arques – Assistant to Mr. Ripol.
Tel: + 34 1977 440795; Fax: + 34 1977 440803
E-Mail: rripol@celesa_pulp.com

This 50-year old firm produces pulp and paper from a variety of fibres - wood, sisal, abaca, flax, hemp and jute. They market their pulp products to different parts of the world. They are reportedly the largest single user of sisal for pulping in Europe (about 8,000 tonnes), which is about 19% of their overall production. From their experience and analysis of non-wood fibres, abaca has the best properties especially in terms of length of staple fibre, while flax, hemp and sisal are broadly equivalent. Sisal is superior on porosity when compared to abaca. When compared to wood pulp, sisal has superior qualities in all the important factors of porosity, freeness, strength and tear. Sisal can be used in almost all the same applications of soft wood pulp and substitute in flax and hemp but the key is the price. Sisal is seen as being very expensive and therefore used only in those areas where its qualities are very superior or, in many cases, to mix with other pulps. They wanted a larger sample of the pulp to test although they were very conversant with the sisal qualities.

2) JR CROMPTON LIMITED
12th Floor, Sunlight House,
Quay Street,
Manchester M3 3JZ
ENGLAND.
Contact: Mr. Stephen P. Pegler, Commercial Trading Manager
Tel: + 44 161 8176526; Fax: + 44 161 817 6509; Mob: + 44 7770 773041
E-Mail: spegler@crompton.co.uk

SIMPSON CLOUGH PAPER MILL,
Ashworth Road, Heywood,
Lancashire 0L10 4BE
ENGLAND.
Contact: Ms. Joyce Alston, Fibre Development Manager
Tel: + 44 161 817 6574; Fax: + 44 1706 624944
E-Mail:jalston@crompton.co.uk

This firm stopped pulping sisal fibre in 2001 and now buys pulp when needed. They mainly produce tea bag papers and coffee filters. They were of the opinion that sisal's advantage is consistency in all its properties but abaca has a superior length and overall properties. In many cases however, paper manufacturers use a blend with wood pulps mostly because of price factors and availability. The current price of NBSK is in the range of US$ 640 – US$ 680 CIF UK ports. They reckon there is an increase of 7-9% in paper production per annum and they are increasing their capacity. They took the view that in order to increase utilization, sisal has to be competitive in price and availability.

3) AHLSTROM
Mount Sion Works,
Sion Street, Radcliffe,
Manchester M 26 0SN

ENGLAND
Contact: Mr. Stuart Nixon, Pulp Mill Manager, Fibre Composites Division and Mr. David Lamb – Purchasing Manager
Tel: + 44 161 725 5333/5320; Fax: + 44 161 724 9113
E-Mail: stuart.nixon@ahlstrom.com

This mill is part of the sixth largest specialty paper maker with operations in different parts of the world. Their turnover in specialty paper was €1.5 billion in 2003. They produce a whole range of products including fibre composites, tea bags, coffee filters, and sausage paper. They reckon there is a growth market of 5-6% and China is an important factor in the future. They share the opinion that abaca is preferred because of its properties and that sisal's prices are too high at the moment. They emphasize that it is important for sisal to concentrate on niche markets for the moment because of price and quantum of production.

4) PAPIERFABRIK NETSTAL AG
Industrie Kleinzaun
Postfach 206,
CH-8754 Netstal,
SWITZERLAND
Contact: Mr. Hansjoerg Spoerri, Director
Tel: + 41 55 640 4433; Direct: + 41 55 640 4435; Fax: + 41 55 640 3849
E-Mail: hansjoerg.spoerri@pfn.ch
Website: www.swiss-paper.com

This paper mill of more than 150 years is the second largest producer of coffee filters in Europe with a production of 15,500 tonnes a year. It also produces a variety of other technical, industrial and specialty papers including automobile filters and masking tape. Sisal is especially good for filters. The main problem with sisal is the price and sometimes the regularity of supply. Their opinion is for sisal pulp to concentrate in niche markets.

5) PAPIERFABRIK WATTENS G.m.b.H.-
Ludwig-Lassl-Strasse 15
A-6112 Wattens.
AUSTRIA.
Contact: Mr. Christian Angerer, Manager Purchasing
Tel: + 43 5224 595-333; Fax: + 43 5224 595-330
E-Mail: tbg.wat.ek2@tirol.com

This mill is a Member of Trierenberg Holding, which produces cigarettes and specializes in cigarette paper. The Group has a number of pulp and paper mills. They buy pulp, including sisal pulp but were considering to start producing their own sisal pulp. They produce other pulps, like straw pulp. Wood pulp prices have ranged between US$ 630 and US$ 680 and sisal pulp between US$ 1,800 and US$ 2,300 depending on quality. They have bought flax and hemp pulp for as low as US$ 1,450 and this can be used as a substitute in many of the utilizations of sisal pulp. They have produced 40,000 tonnes of cigarette paper. The most important quality in sisal

pulp is porosity. They consider sisal pulp from African sisal to be superior when compared with Brazilian sisal pulp but because of price they blend the various pulps.

6) INSTITUTO POLIGRAFICO e ZECCA DELLO STATO S.P.A.,
Stabilimento di Foggia,
Via Leone XIII, 333
71100 Foggia
ITALY.
Contacts: Ing. Angelo Cioce, Production Director,
Tel: + 39 881 796111; Fax: + 39 881 777529
E-Mail:a.cioce@ipzs.it
Mr. Giuseppe D'Itria
Tel: + 39 881 796816
E-Mail: g.ditria@ipzs.it

This mill belongs to the Italian Government and produces various items for them. They buy mostly wood pulp due to cost implications and produce about 40,000 tonnes of different products. They do not use sisal pulp because it is too expensive. They made extensive trials and tests in pulping a large number of fibres using a five-tonne per day pilot plant based on the NACO process. This pilot plant is now closed and put up for sale.

7) CARTIERA di SANTARCANGELO s.r.l.
Via Bornaccino, 1166
47822 Santarcangelo di Romagna (RN),
ITALY
Contact: Ing. Alvise Bolzonella, Executive Director
Tel: + 39 541 350811; Fax: + 39 541 350828
E-Mail: alvise.bolzonella@santarcangelo.cr.it
www.santarcangelo.cr.it

This mill was closed down in June 2004 and the machinery put up for sale. The Mill was dedicated to recycling tetrapacks by separating the paper from the plastics and then extracting the aluminium and also making pulp and different paper products. They stopped production due to competition mostly from the Far East and were considering setting up operations there. Their laboratory was closed so they could not give an assessment of the sisal fibre and pulp samples sent to them.

8) M-real PSM SA
1227, rue Pasteur - CS 40319
FR 60723 Pont Sainte Maxence
FRANCE
Contact: Dr. Carole Clement, R&D Laboratory Manager
Tel: + 33 344 704200; Fax: + 33 344 704267
E-Mail: carole.clement@m-real.com
Mr. Lars Gadda, R&D Vice President, M-real, Finland

This Group, with headquarters in Finland produces a variety of products in different countries in the world. The operation in France was therefore unable to offer a lot of

information and referred the matter to their headquarters but upon contacting them we did not get feedback from the tests made on the samples sent to them.

9) CORDIER SPEZIALPAPIER GmbH [Headquarters]
Jaegerthal 6
D-67098
Bad Duerkheim
GERMANY
ILLIG'SCHE PAPIERFABRIK,
Rheinstrasse 38,
D-64367 Muhltal,
GERMANY.
Contact: Ms. Ursula Ellebruch, Quality Controller
Tel: + 49 6151 5098-18; Fax: + 49 6151 5098-88
E-Mail: ursula.ellebruch@cordier-paper.de

This Group produces a variety of specialty papers for different utilizations. They found the sample of pulp to be of acceptable quality. They buy sisal pulp only when necessary from customer specification but find it prohibitive because of cost implications.

10) SEALAND (GENERAL EXPORTERS) LIMITED
78, New Oxford Street
London WC1A 1AH
ENGLAND
Contacts: Mr. P.N. Mittal, Director
Tel: + 44 20 7580 8663; Fax: + 44 20 7580 8662
E-Mail: mittal@sealand.co.uk
Mr. H. Shah

This company is the headquarters and owners/marketing agents for the Kibo Pulp and Paper Mill in Moshi Tanzania. They reaffirmed that they had more market for their pulp (about 4,500 tonnes per annum) than they could supply at the moment and were considering investing to increase capacity and modernize the machinery. Supply of sisal fibre had been the major constraint. This had not been helped by contamination of the pulp. In addition to producing pulp for export, they also recycle paper for their own match production and paper for sale locally, which sometimes caused the contamination due to the input. They were prepared to consider a joint venture with a sisal fibre supplier.

11) WIGGLESWORTH & CO. LIMITED
69, Southwark Bridge Road
London SE1 0NG
ENGLAND
Contact: Mr. J. Harris, Managing Director
Tel: + 44 20 7940 6000; Fax: + 44 20 7403 3232
E-Mail: jharris@wigco.co.uk
Mrs. Paula Brazier, Director
E-Mail: pbrazier@wigco.co.uk

This company is the largest marketer of sisal and sisal products in the world and also markets other natural fibres like abaca and jute. They have a large worldwide network of suppliers and agents in different parts of the world built up in over nearly a century of dealing with sisal products. They supply these fibres to pulping plants but also market pulp. They advised that at the moment sisal should concentrate in specialized and niche markets because the price is prohibitive. There are numerous utilizations for sisal and developments in the Far East, especially China, which promises to open up markets for these various fibres and products. They cautioned that if sisal prices went higher then sisal would lose its competitiveness and different producers of pulp and other sisal products would switch to substitute fibres. A delicate balance had to be maintained between supply and demand. They have a website and produce a newsletter which provides information on what is happening to the different fibres/products.

12) MPM LTD.
Private Bag
Mafinga
TANZANIA
Contact: Mr. Malimi, Lab Manager

This mill is based in the southern highlands of Tanzania and is under rehabilitation after being privatized recently. It is located in an area where there is ample supply of wood. They produce wood pulp and a variety of papers. It is expected to re-start production before the end of the year. They have good laboratory facilities and have been doing some tests on sisal pulp. We discussed market outlook for the pulp and paper industry locally in Tanzania and in the Region.

13) KIBO MATCH GROUP
P.O. Box 416
Moshi, TANZANIA
Contacts: Mr. S.B. Nag, Financial Controller
Mr. B. Chiwanza, Pulp and Paper Mill Manager
Tel: + 255 27 2754221; Fax: +255 27 2752020
E-Mail: kmglfc@kilinet.co.tz

This Group has a pulp and paper mill, which produces bleached and unbleached sisal pulp but also recycles paper. They also own a match factory. They reaffirmed information given by their principal company - Sealand - based in London-UK [4.10 above] and re-emphasized the quality aspect. They believed the pulp market to be much larger than they could produce at the moment and felt the African market would offer major expansion opportunities in the future. Steady and reliable supply of sisal fibre was their main constraint, despite offering premium prices, which in some instances were even higher than the fibre export market.

Dr. W. Khayrallah contacted the mills in North America. Knolton Specialty Paper Inc. was contacted by phone and declared no interest in receiving him; the mill in Turner Falls (Esleeck Manufacturing Co. Inc) was not interested in sisal at this time but requested to be kept informed of any future commercial production of pulp from

Tanzania. A meeting was held in Montreal with Scott Paper Ltd., the mill was interested and contacts shall be kept in the future regarding commercial operations.

Ms. R. Assumpçao visited Lwarcel Mill in Brazil. The mill was very familiar with sisal and it was therefore familiar with the properties of the material.

IV. Lessons learned

IV.1 Development lessons

The objectives identified in the Appraisal Report were broadly met, even though phase 2 and phase 3 were to a certain extent merged. Despite the many critics the market study was performed following the agreed Terms of Reference. A need for a more intensive market survey of China, South East Asia, Middle East and Africa was identified towards the end of the project, after the market trials.

The properties of sisal and its potential use in specialty paper production are broadly recognized, even though it emerged clearly that it is difficult to attract the interest of commercial mills if no constant supply can be guaranteed. Therefore at the project level satisfactory results were achieved, which should be confirmed once commercial operations are possible.

Preliminary indications on the price that the market would pay for sisal were also obtained; these were used in the feasibility analysis study for a FEX plant prepared by Katani Ltd. The production and trade in specialty pulp and paper is very secretive and figures given by the mills visited are only general indicators.

Ideally it would have been important to work with a commercial mill in the bleaching trials and therefore strengthen the contacts between the project and the mills. As mentioned in Addendum C.2, this was not possible.

IV.2 Operational lessons

The time lag between the preparation of the market study and the market trials was longer than expected because of the many delays in the selection of the extraction technology and therefore in the preparation of the material for the trials. As pointed out in the introductory note to this report, the negative consequence of these delays is that the projections prepared at the time of the market study were out-of-date at the time of the market trials and of the preparation of the feasibility study. Nevertheless it should be stressed once again that the overview of the market and the contacts developed were the bases on which the trials developed.

V. Conclusions and recommendations

The main conclusions and lessons learned are:

- There are numerous specialty utilizations for sisal pulp in bank notes, electrolyte paper, oil and fuel filters, coffee filters, tea bags, cigarette papers, stencil paper, etc. Many paper makers use a blend of various pulps to take advantage of the properties of each fibre and their respective prices.

- The production and trade in specialty pulp and paper is very secretive and figures given are only general indicators. In some of the productions like bank notes and security paper, the mills are very security conscious and in most cases information is not given at all. In some instances, verbal information was given on the understanding that it would not be reported in a public paper. There are virtually no worldwide projections available and therefore future market potential for specialty pulp is normally an extrapolation of the past production/consumption. It is estimated that the current market is about 250,000 ADMT and has been growing at the rate of 5%-6% per annum in the last four years. This includes all types of pulps going into specialty uses - abaca, flax, hemp, jute, cotton, wood pulp and sisal. Of these, the current production of sisal pulp is 45,000 tonnes and growing at the same rate mentioned above. The fibre needed to produce this pulp is around 90,000 tonnes.

- The prices for unbleached and bleached sisal pulp are in the ranges of US$ 1,200 – US$ 2,300 per ADMT, CIF Europe depending on quality and source.

- The current market for BKS as reinforcement pulp is about 15 million ADMT per annum and growing at times by up to 9% per annum in the last seven years. The market potential for sisal reinforcement pulp is very high but prohibitive because of the price and the [un]reliable availability of large quantities of fibre. The aspect ratio and tear and tensile index, which are key properties for reinforcement pulps, are better for sisal than for softwood pulp. Mills indicated that they would pay a premium of a maximum of 12% over BKS. In order for sisal pulp to make inroads in the reinforcement pulp market, the price of sisal pulpable fiber will have to be reduced without compromising the final pulp quality. The current market price for BKS is around US$ 650 per ADMT delivered to the paper mill. To compete, it is estimated that the price of sisal pulp has to be around US$ 750 per ADMT.

- Investment in small pulp mills is possible if the target is a niche specialty pulp market. These mills can be as small as five ADMT per day and still be profitable. Any investment targeting the reinforcement pulp market has to be of much larger tonnage because potential buyers need assurance of supply and economies of scale become critical in reducing the cost.

- China, India and South East Asia are becoming increasingly important both as major markets and as producers of pulp. Some mills in Europe are

contemplating relocation to areas of sources of fibre and where the costs of energy and labour are more favorable than in Europe.

- There is a need to conduct a more intensive market survey of China, South East Asia, Middle East and Africa. These are emerging markets and their needs for paper products are expanding at a faster rate than the traditional European or North American markets. There is scant published market information on these markets.

- A number of contacts were established with potential customers for sisal pulpable fibre and sisal pulp. There is a demand for sisal pulpable fibre, sisal pulp and paper products. To meet this demand, producers need to develop market linkages in the various markets. Contacts were also established with pulp equipment suppliers for possible future development of pulping operations.

Annex 1. Raw material consumption by region and by grade

Raw material consumption for paper and board production per region (million tonnes) for 1995 and 2000											
Region		**Year**	**1995**					**2000**				
		Pulp	**BKS**	**UKP**	**Other**	**MIN**	**Total**	**BKS**	**UKP**	**Other**	**MIN**	**Total**
Europe		Total	10.50	4.42	52.50	9.54	76.96	11.14	4.47	60.15	11.10	86.86
		Market	7.14	0.35	7.99	9.54	25.02	7.33	0.99	9.60	11.10	29.03
		Integrated	3.36	4.07	44.51		51.94	3.81	3.48	50.55		57.83
North America		Total	15.01	22.27	60.04	8.76	106.07	15.52	25.14	63.73	9.50	113.88
		Market	3.92	0.01	3.60	8.76	16.29	4.07	0.00	4.35	9.50	17.92
		Integrated	11.08	22.26	56.44		89.78	11.44	25.14	59.38		95.96
Latin America		Total	0.97	1.67	7.72	0.80	11.16	1.29	1.93	10.08	1.07	14.37
		Market	0.71	0.10	1.24	0.80	2.86	0.90	0.15	1.84	1.07	3.96
		Integrated	0.25	1.57	6.48		8.30	0.39	1.78	8.24		10.41
Asia	**China**	Total	0.87	0.60	23.09	1.00	25.56	1.60	0.74	27.64	1.47	31.45
		Market	0.57	0.35	0.57	1.00	2.49	1.04	0.46	1.19	1.47	4.16
		Integrated	0.30	0.25	22.52		23.07	0.56	0.29	26.44		27.29
	Japan	Total	2.81	1.79	23.27	3.62	31.48	2.95	1.87	25.08	4.24	34.14
		Market	1.73	0.32	2.07	3.62	7.72	1.90	0.38	2.90	4.24	9.42
		Integrated	1.08	1.47	21.21		23.75	1.05	1.49	22.18		24.72
	Other Asia	Total	1.29	1.00	18.64	1.17	22.09	2.20	1.45	29.07	2.12	34.84
		Market	1.27	0.60	3.97	1.17	7.00	2.16	0.85	6.48	2.12	11.61
		Integrated	-0.02	-0.40	14.68		15.09	0.04	0.60	22.60		23.24
	Sub total Asia	Total	4.96	3.38	65.00	5.79	79.13	6.74	4.07	81.79	7.83	100.43
		Market	3.56	1.27	6.60	5.79	17.22	5.09	1.69	10.57	7.83	25.19
		Integrated	1.40	2.11	58.40	0.00	61.91	1.65	2.37	71.22	0.00	75.24
Australasia		Total	0.31	0.38	2.58	0.14	3.41	0.42	0.42	3.21	0.32	4.36
		Market	0.24	0.08	0.06	0.14	0.52	0.36	0.09	0.25	0.32	1.02
		Integrated	0.07	0.31	2.52		2.90	0.06	0.33	2.95		3.35
Total		Total	31.74	32.12	187.84	25.03	276.73	35.11	36.02	218.95	29.83	319.90
		Market	15.57	1.81	19.49	25.03	61.90	17.75	2.92	26.62	29.83	77.12
		Integrated	16.17	30.31	168.35	0.00	214.84	17.35	33.10	192.34	0.00	242.79

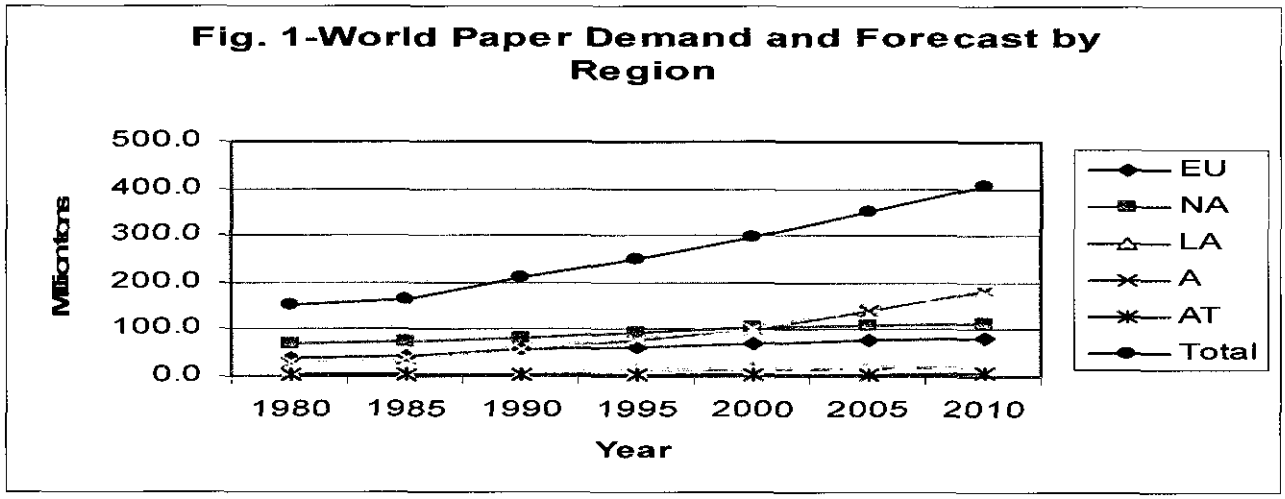
Raw material consumption for paper and board production per region (million tonnes) for 2005 and 2010												
Region		**Year**	**2005**					**2010**				
		Pulp	**BKS**	**UKP**	**Other**	**MIN**	**Total**	**BKS**	**UKP**	**Other**	**MIN**	**Total**
Europe		Total	11.39	4.81	65.02	12.40	93.62	11.78	4.41	70.93	13.86	100.97
		Market	7.65	1.76	10.60	12.40	32.40	7.91	2.01	12.20	13.86	35.98
		Integrated	3.75	3.05	54.42		61.21	3.87	2.40	58.73		64.99
North America		Total	15.50	27.41	67.31	10.37	120.58	14.62	28.67	70.22	11.09	124.60
		Market	3.81		5.34	10.37	19.52	3.57		7.17	11.09	21.82
		Integrated	11.70	27.41	61.96		101.07	11.06	28.67	63.05		102.77
Latin America		Total	1.80	2.23	12.95	1.56	18.53	2.51	2.49	16.53	2.25	23.78
		Market	1.32	0.20	2.88	1.56	5.95	1.92	0.12	4.19	2.25	8.48
		Integrated	0.48	2.04	10.06		12.58	0.59	2.37	12.34		15.30
Asia	**China**	Total	3.08	1.18	40.54	2.68	47.48	5.06	1.78	55.03	4.55	66.42
		Market	1.97	0.67	2.18	2.68	7.51	3.21	0.92	3.35	4.55	12.04
		Integrated	1.11	0.51	38.36		39.97	1.85	0.86	51.68		54.39
	Japan	Total	3.00	1.89	25.90	4.64	35.42	3.01	1.87	26.24	4.90	36.02
		Market	2.00	0.43	4.18	4.64	11.25	2.07	0.44	4.51	4.90	11.92
		Integrated	1.00	1.46	21.71		24.17	0.94	1.43	21.73		24.10
	Other Asia	Total	3.27	2.22	44.81	3.13	53.43	4.48	3.22	64.71	4.23	76.64
		Market	3.18	1.23	9.16	3.13	16.71	4.38	1.73	12.51	4.23	22.84
		Integrated	0.09	0.99	35.65		36.72	0.10	1.49	52.21		53.80
	Sub-total Asia	Total	9.35	5.29	111.24	10.45	136.32	12.55	6.87	145.98	13.68	179.08
		Market	7.15	2.33	15.53	10.45	35.46	9.66	3.09	20.37	13.68	46.80
		Integrated	2.19	2.96	95.71	0.00	100.86	2.89	3.78	125.61	0.00	132.28
Australasia		Total	0.44	0.43	3.68	0.40	4.94	0.52	0.43	4.11	0.53	5.59
		Market	0.39	0.09	0.33	0.40	1.21	0.47	0.09	0.46	0.53	1.55
		Integrated	0.05	0.34	3.35		3.74	0.04	0.34	3.65		4.03
Total		Total	38.48	40.16	260.19	35.17	374.00	41.97	42.87	307.76	41.42	434.01
		Market	20.31	4.37	34.69	35.17	94.54	23.52	5.31	44.38	41.42	114.64
		Integrated	18.17	35.79	225.50	0.00	279.45	18.44	37.56	263.38	0.00	319.38

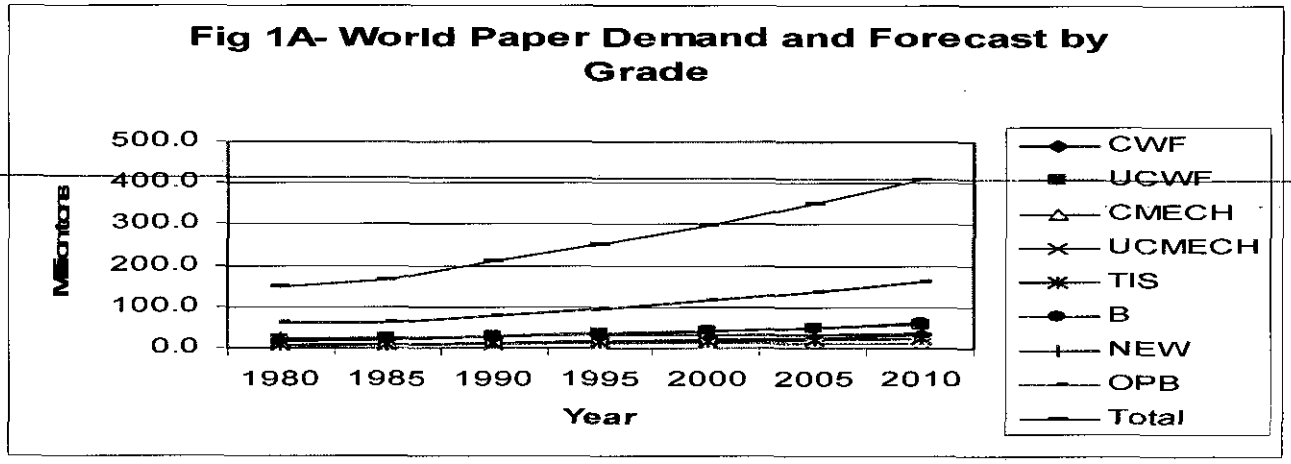
Raw material consumption by paper grade (1000 tonnes) for 1995 and 2000											
	Year	1995					2000				
Paper	Pulp	BKS	UKP	Other	MIN	Total	BKS	UKP	Other	MIN	Total
Coated woodfree	Total	2693		7938	6450	17081	3388		10108	8071	21567
	Market	2070		3765	6450	12285	2337		5043	8071	15451
	Integrated	623		4173		4796	1051		5066		6117
Uncoated woodfree	Total	7385		22736	8382	38503	8236		27051	9643	44930
	Market	3144		5052	8382	16578	3693		6698	9643	20034
	Integrated	4241		17685		21926	4543		20354		24897
Coated Mechanical	Total	4040		4362	5595	13997	4052		6155	6744	16951
	Market	2483		99	5595	8177	2532		681	6744	9957
	Integrated	1557		4263		5820	1520		5474		6994
Uncoated Mechanical	Total	1975	120	8607	2663	13365	2127	118	9783	3050	15078
	Market	1091		28	2663	3782	1206		391	3050	4647
	Integrated	884	120	8579		9583	921	118	9392		10431
Tissue	Total	2460		13645		16105	2668		16623		19291
	Market	1617		4786		6403	1774		6171		7945
	Integrated	*843*		*8859*		*9702*	*894*		*10452*		*11346*
Board	Total	7537	1524	27811	1739	38611	8365	1809	32147	2110	44431
	Market	2670	735	2943	1739	8087	3085	960	3787	2110	9942
	Integrated	4867	790	24867		30524	5281	849	28360		34490
Newsprint	Total	2435	331	32279		35045	2696	398	35144		38238
	Market	695	33	169		897	991	35	150		1176
	Integrated	1740	298	32110		34148	1705	363	34994		37062
Others	Total	3217	30144	70460	200	104021	3563	33691	81950	210	119414
	Market	1803	1039	2642	200	5684	2130	1922	3701	210	7963
	Integrated	1414	29105	67818		98337	1433	31769	78247		111449
Total	Total	31742	32119	187838	25029	276728	35095	36016	218961	29828	319900
	Market	15573	1807	19484	25029	61893	17748	2917	26622	29828	77115
	Integrated	16169	30313	168354	0	214836	17348	33099	192339	0	242786
Paper Production						**260400**					**301100**
Efficiency						0.94					0.94

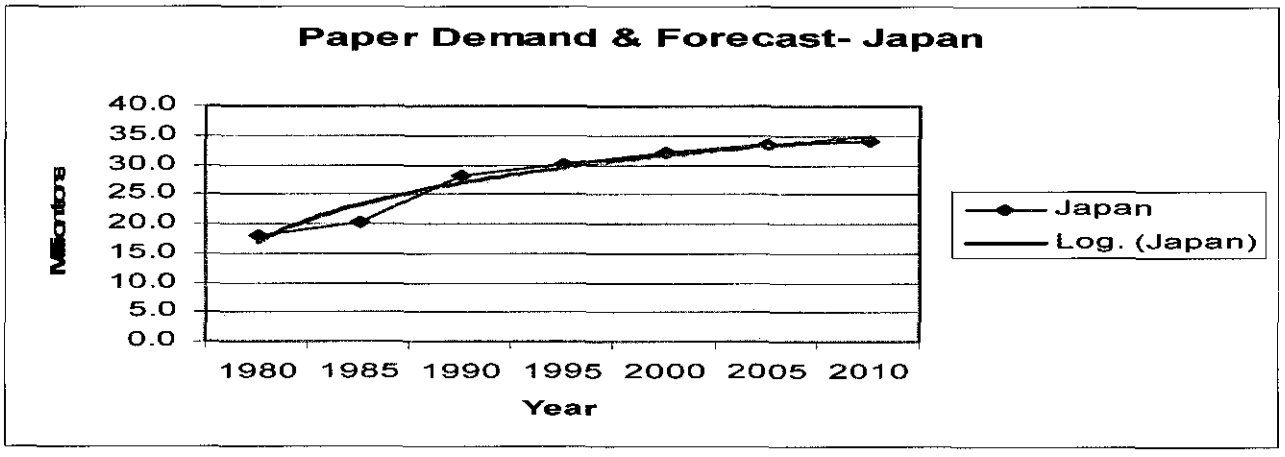
Raw material consumption by paper grade (1000 tonnes) for 2005 and 2010											
	Year	2005					2010				
Paper	Pulp	BKS	UKP	Other	MIN	Total	BKS	UKP	Other	MIN	Total
Coated woodfree	Total	4174		12898	10215	27287	4853		16166	12654	33673
	Market	2713		6877	10215	19805	3174		9325	12654	25153
	Integrated	1460		6022		7482	1679		6840		8519
Uncoated woodfree	Total	8925		31900	10991	51816	9169		35811	12531	57511
	Market	4181		7868	10991	23040	4707		9351	12531	26589
	Integrated	4744		24032		28776	4461		26461		30922
Coated Mechanical	Total	3877		7806	7617	19300	4181		9457	8663	22301
	Market	2450		949	7617	11016	2752		1376	8663	12791
	Integrated	1427		6857		8284	1429		8081		9510
Uncoated Mechanical	Total	2357	118	10848	3519	16842	2760	118	11969	4092	18939
	Market	1440		502	3519	5461	1790		619	4092	6501
	Integrated	917	118	10347		11382	970	118	11350		12438
Tissue	Total	2851		20259		23110	2851		24599		27450
	Market	1957		7716		9673	1940		9889		11829
	Integrated	895		12542		13437	911		14710		15621
Board	Total	9202	2154	39175	2523	53054	10128	2559	47253	3040	62980
	Market	3616	1237	4746	2523	12122	4256	1581	6273	3040	15150
	Integrated	5586	917	34429		40932	5872	978	40979		47829
Newsprint	Total	2969	407	36070		39446	3338	423	38019		41780
	Market	1325	35	541		1901	1759	35	1214		3008
	Integrated	1644	372	35529		37545	1579	389	36806		38774
Others	Total	4126	37477	101226	308	143137	4688	39769	124483	440	169380
	Market	2629	3095	5490	308	11522	3143	3694	6336	440	13613
	Integrated	1497	34383	95734		131614	1544	36075	118146		155765
Total	Total	38481	40156	260182	35173	373992	41968	42869	307757	41420	434014
	Market	20311	4367	34689	35173	94540	23521	5310	44383	41420	114634
	Integrated	18170	35790	225492	0	279452	18445	37560	263373	0	319378
Paper Production						**352000**					**408500**
Efficiency						0.94					0.94

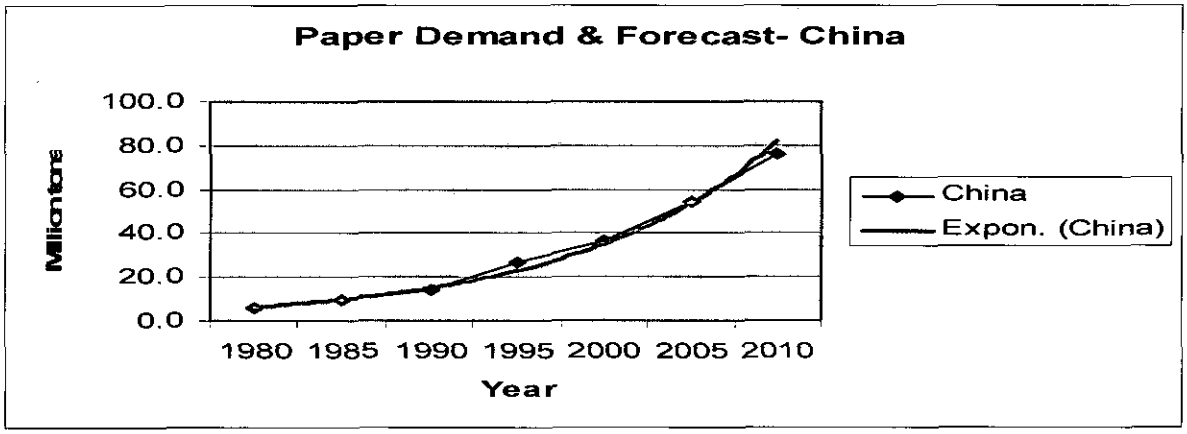
Annex 2. Paper demand and paper production – Graphs

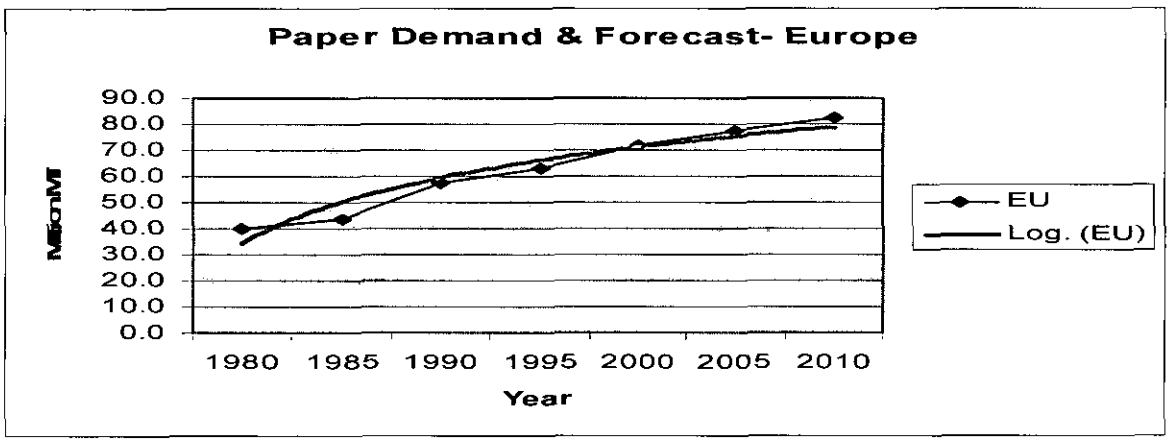
Paper Demand

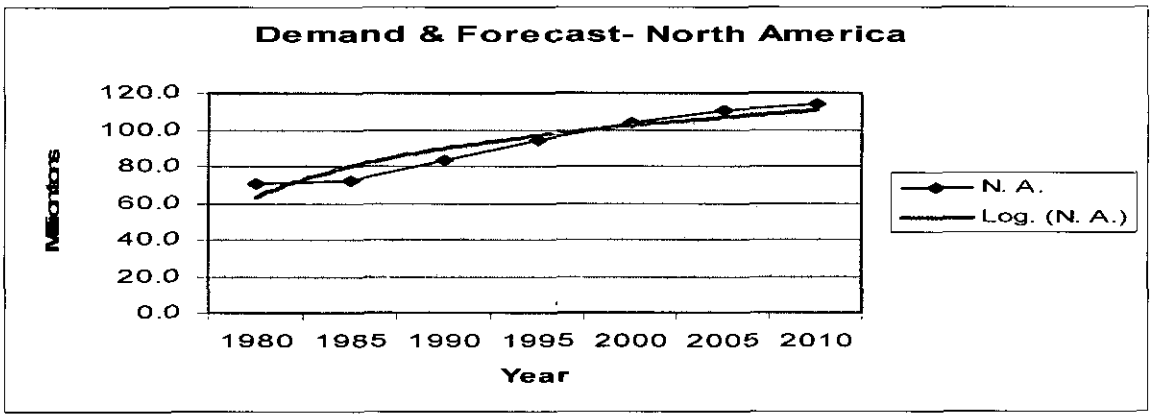


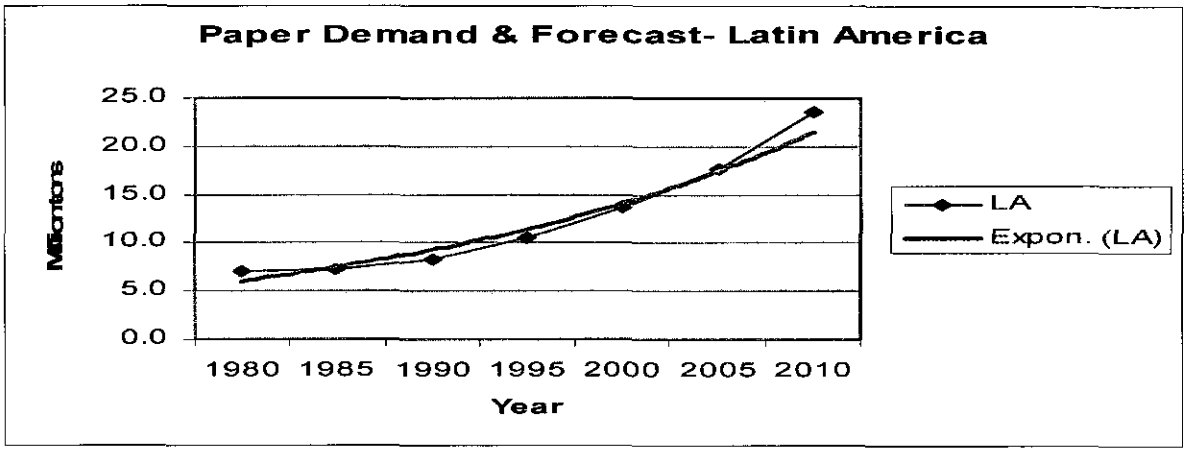


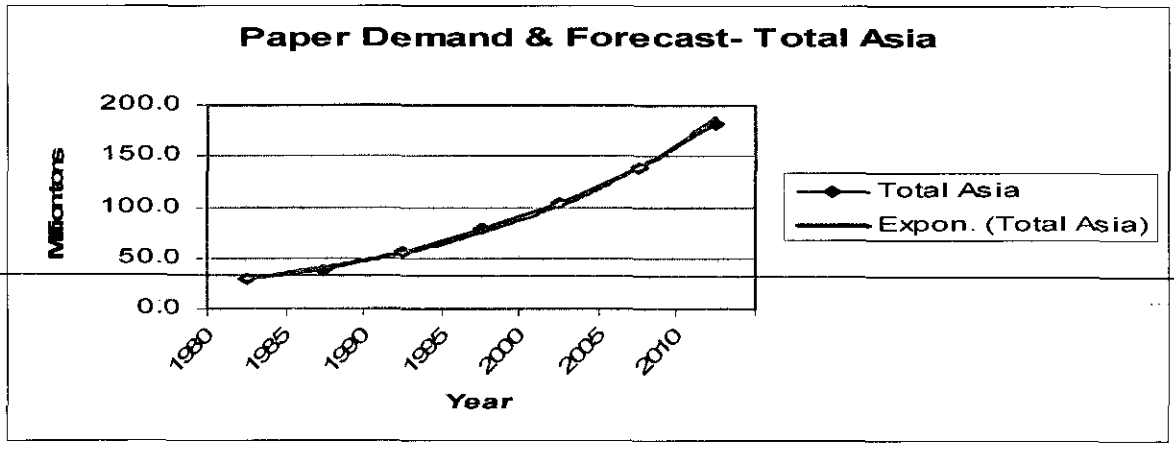


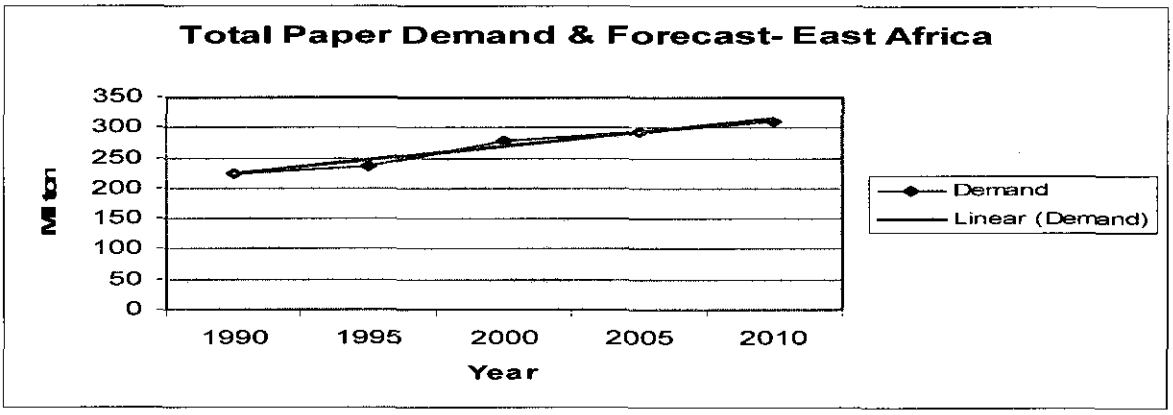

Paper Demand & Forecast- China
Millions
100.0
80.0
60.0
40.0
20.0
0.0
1980 1985 1990 1995 2000 2005 2010
Year
China
Expon. (China)


Paper Demand & Forecast- Europe
MillionM
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
1980 1985 1990 1995 2000 2005 2010
Year
EU
Log. (EU)

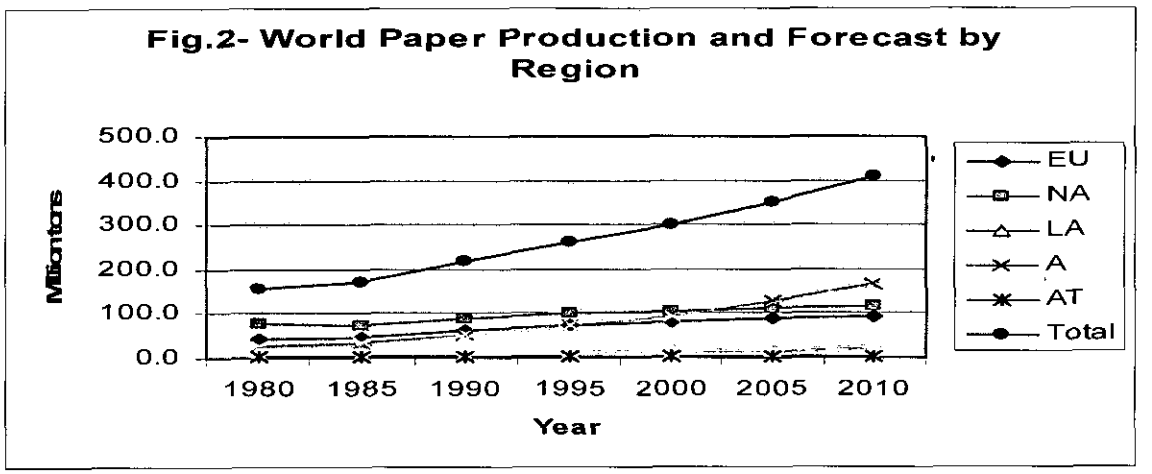

Demand & Forecast- North America
Millions
120.0
100.0
80.0
60.0
40.0
20.0
0.0
1980 1985 1990 1995 2000 2005 2010
Year
N. A.
Log. (N. A.)

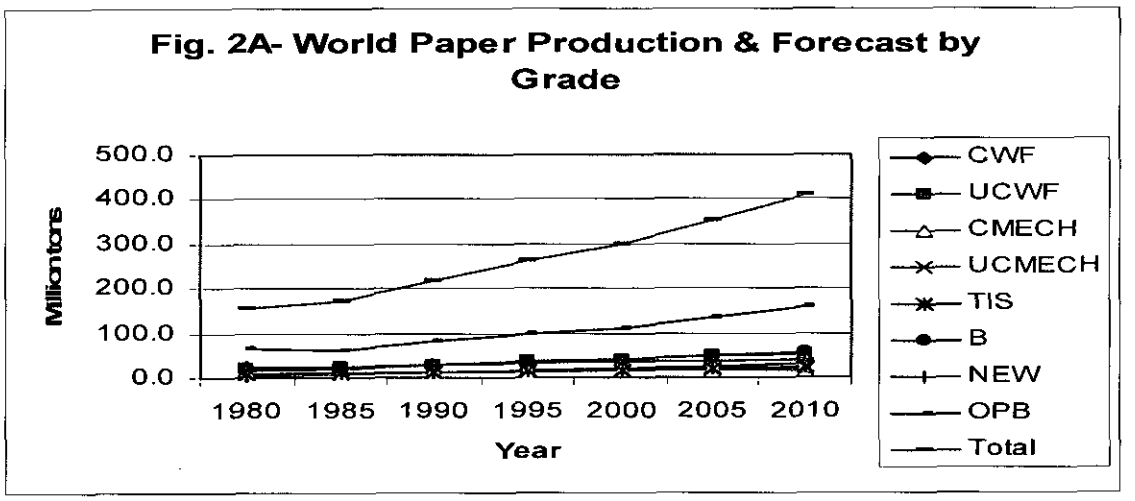

Paper Demand & Forecast- Latin America
25.0
20.0
15.0
10.0
5.0
0.0
Millions
1980 1985 1990 1995 2000 2005 2010
Year
LA
Expon. (LA)

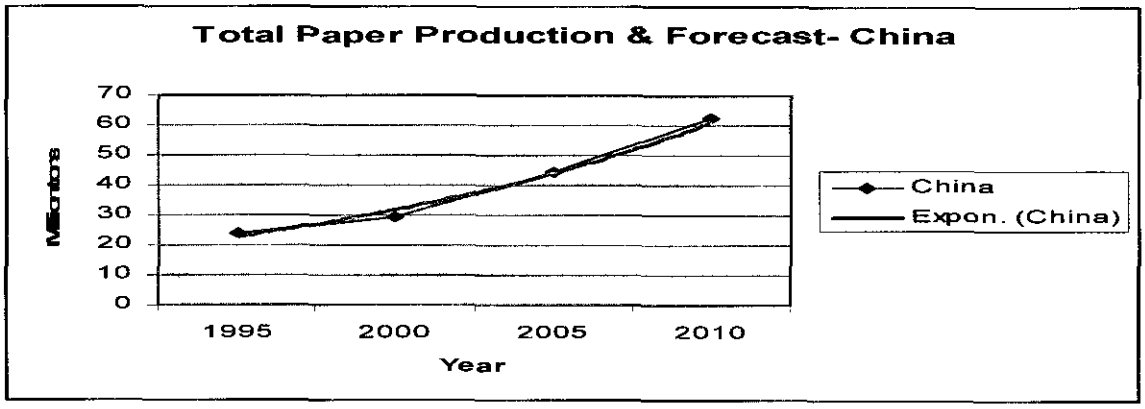

Paper Demand & Forecast- Total Asia
200.0
150.0
100.0
50.0
0.0
Millions
1980 1985 1990 1995 2000 2005 2010
Year
Total Asia
Expon. (Total Asia)

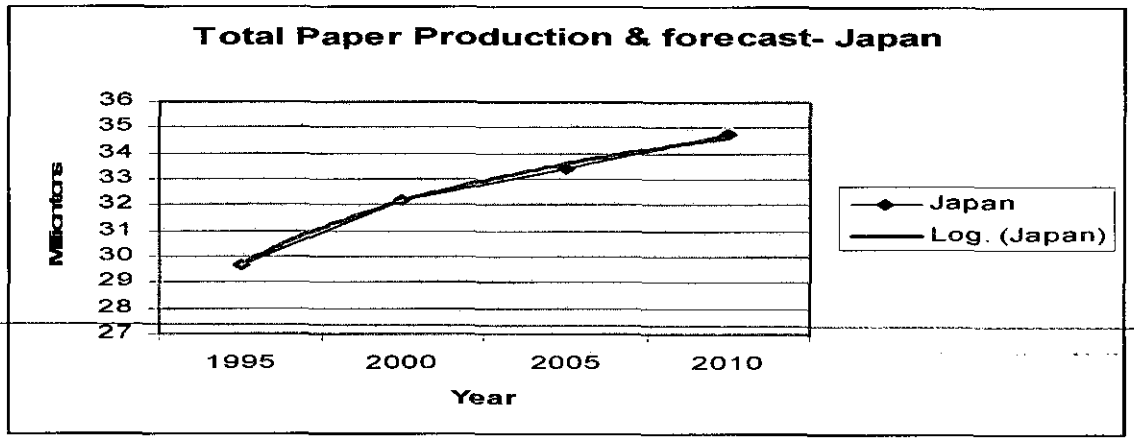

Total Paper Demand & Forecast- East Africa
350
300
250
200
150
100
50
0
Million
1990 1995 2000 2005 2010
Year
Demand
Linear (Demand)

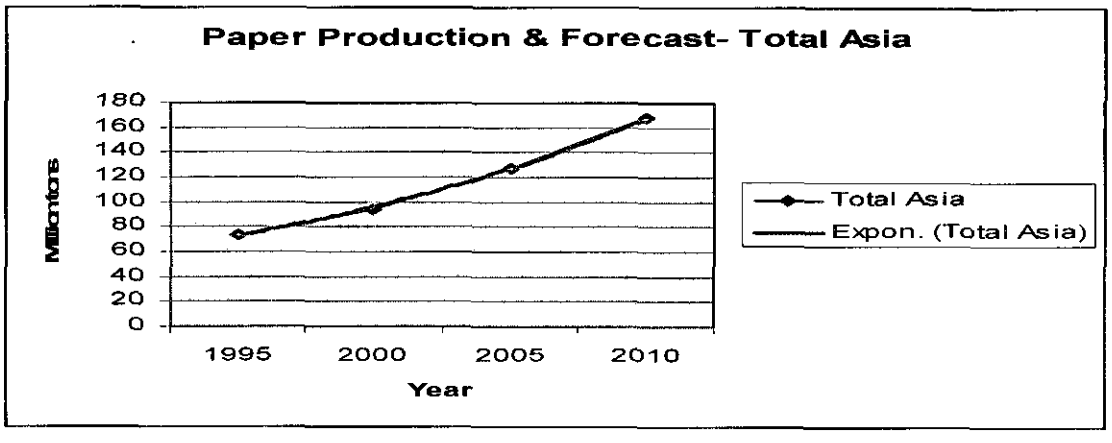
Paper Production

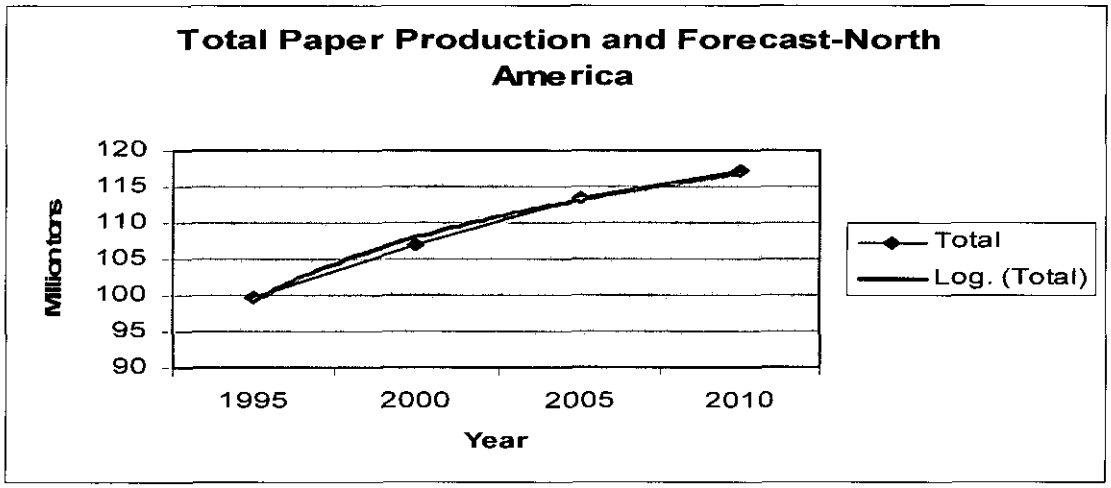


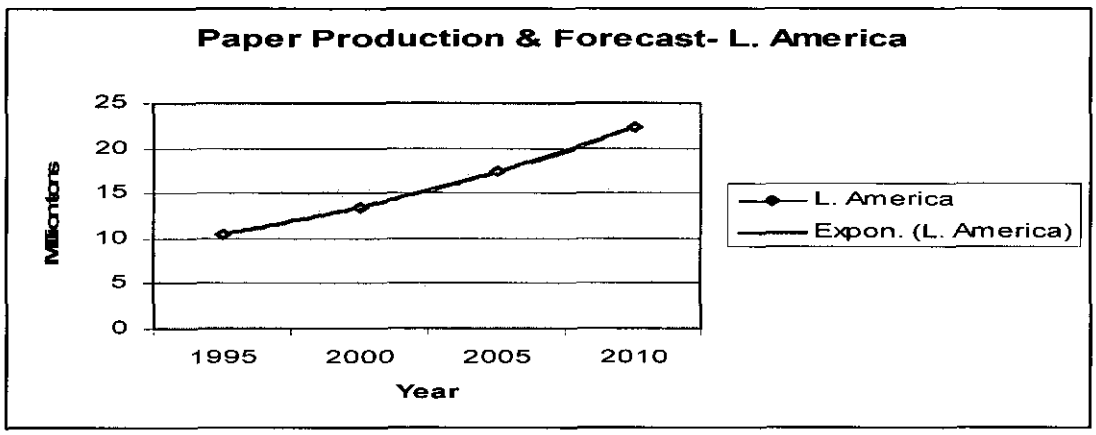


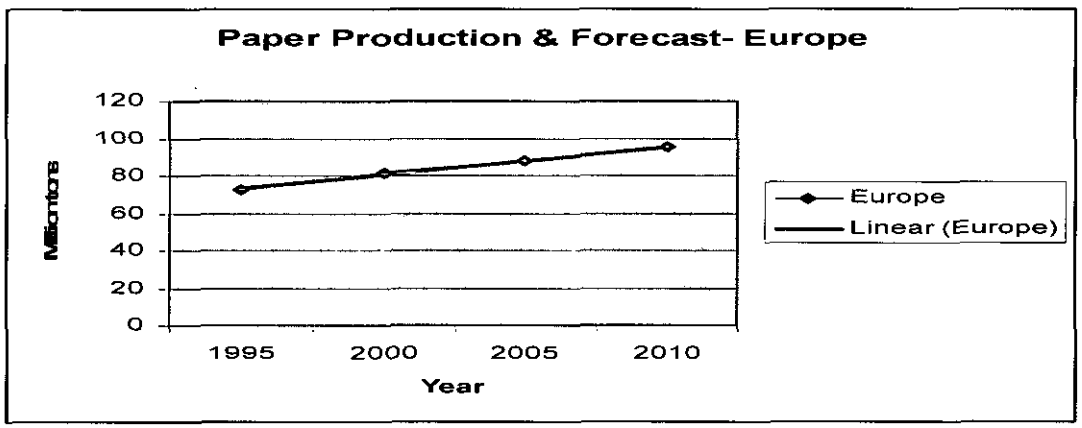

Total Paper Production & Forecast- China
Millions
70
60
50
40
30
20
10
0
1995
2000
2005
2010
Year
China
Expon. (China)

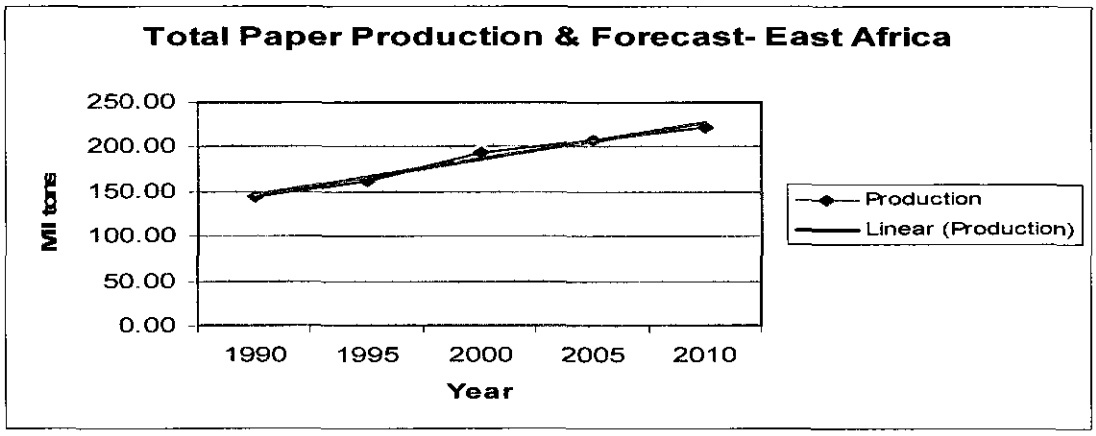

Total Paper Production & forecast- Japan
Millions
36
35
34
33
32
31
30
29
28
27
1995
2000
2005
2010
Year
Japan
Log. (Japan)


Paper Production & Forecast- Total Asia
Millions
180
160
140
120
100
80
60
40
20
0
1995
2000
2005
2010
Year
Total Asia
Expon. (Total Asia)


Total Paper Production and Forecast-North America
Millions tons
120
115
110
105
100
95
90
1995
2000
2005
2010
Year
Total
Log. (Total)


Paper Production & Forecast- L. America
Millions
25
20
15
10
5
0
1995
2000
2005
2010
Year
L. America
Expon. (L. America)


Paper Production & Forecast- Europe
Millions
120
100
80
60
40
20
0
1995
2000
2005
2010
Year
Europe
Linear (Europe)


Total Paper Production & Forecast- East Africa
250.00
200.00
150.00
100.00
50.00
0.00
Mil tons
1990
1995
2000
2005
2010
Year
Production
Linear (Production)

Annex 3. Summary of the questionnaire results

Table 1. Positive answers for reinforcement pulp (from Annex 6 to Market Study)

Country	Mills interested in the sisal project				Total number of mills that answered
	To receive information only No of mills	To receive data No. of mills	To evaluate fibre samples No. of mills	To evaluate pulp sample No. of mills	
Austria	4	0	2	4	6
Belgium	2	1	1	1	4
Great Britain	15	5	4	7	25
Czech Republic	3	0	0	0	2
France	15	5	2	4	25
Finland	3	2	0	0	8
Germany	14	3	0	2	46
Greece	1	0	0	1	3
Italy	1	1	1	1	1
Netherlands	6	0	1	3	8
Norway	1	1	1	1	2
Spain	2	2	0	0	3
Sweden	3	2	0	0	11
Switzerland	1	1	0	0	1
Turkey	1	1	0	0	1
Ukraine	1	1	0	0	1
Europe	**73**	**25**	**12**	**24**	**147**
Canada	5	2	1	2	10
United States	6	5	2	1	16
North America	**11**	**7**	**3**	**3**	**26**
Australia	1	0	0	1	1
New Zeeland	1	1	1	1	1
Australasia	**2**	**1**	**1**	**2**	**2**
Total	**86**	**33**	**16**	**29**	**175**

Table 2. Positive answers for specialty pulp (from Annex 6 to Market Study)

Country	Mills interested in the sisal project					
	Purchased pulp ADTPY[1]	Information No. of mills	Data No. of mills	Fibre sample No. of mills	Pulp sample No. of mills	Total number of mills that answered
Austria	25,000	1	1	1	1	5
Belgium	35,000	1	1	0	1	3
Great Britain	54,000	7	7	2	7	21
Finland	130,000	2	2	1	2	4
France	55,000	1	1	0	1	14
Germany	34,000	6	6	2	7	24
Hungary	0	0	0	0	0	2
Italy	3,700	1	1	1	1	8
Lithuania	0	0	0	0	0	2
Netherlands	27,000	2	2	0	2	9
Norway	0	0	0	0	0	2
Spain	2,500	1	1	0	1	8
Switzerland	72,000	3	3	2	4	8
Turkey	30,000	1	1	0	0	2
Europe	**468200**	**26**	**26**	**9**	**27**	**112**
Indonesia	0	0	0	0	0	2
Philippines	0	0	0	0	0	1
Taiwan	2,000	1	1	0	1	2
Asia	**2,000**	**1**	**1**	**0**	**1**	**5**
Costa Rica	0	0	0	0	0	1
Brazil	45,000	3	3	2	3	3
South America	**45,000**	**3**	**3**	**2**	**3**	**4**
Canada		0	0	0	0	2
United States	371,300	15	15	4	16	37
North America	**371,300**	**15**	**15**	**4**	**15**	**39**
Total	**886,500**	**45**	**45**	**15**	**46**	**160**

1- Not all mills informed the amount of purchased pulp. Figures are indicative.

Annex 4. References

FAO Statistics on Pulp and Paper, 1999.

FAO Statistics on Jute, Kenaf, Sisal, Abaca, Coir and Allied Fibres, June 2001 and March 2004.

R. W. Hurter., *Sisal Fibre: Market Opportunities in the Pulp and Paper Industry*, CFC/FAO Technical Paper No. 14, 2000.

Sevenhuijsen Associates, *Final Report on Market Study* - Phase 1 and annexes, 2000.

Annex 5. List of contacted mills

SPECIALTY PAPER MILLS

1. Mr. W. Niki
Papierfabrik Wattens GmbH
Ludovig Lassl-Strasse 15
Postfach 19, A-6112 Wattens,
AUSTRIA
Tel. No: 00043 (5224) 5950 Fax No: 00043 (5224) 52474

2. Mr. R. Pitkanen
Director, Lohjan Paper Oy
FIN – 08100 Lohja,
FINLAND
Tel. No: 000358 (20) 414141 Fax No: 000358 (17) 414140

3. Mr. J. Schmidt
Managing Director
Gruenperga Spezialpapierfabrik GmbH
Fabrikweg 1, D-09579 Borstendorf,
GERMANY
~~Tel No: 00049 (37294) 18-0 Fax No: 00049 (37294) 18-201~~

4. Mr. L. P. Recchia
Research Manager
Instituto Poligrafico e Zecca dello,
Stato Stabilimento di Foggia
Viale Leone XIII 333, 1-71100 Foggia,
ITALY
Tel. No: 00039 (881) 796111 Fax No: 00039 (881) 777529
(Note: no pulping carried out any more)

5. H. J. Sporri
Managing Director
Papierfabrik Netstal AG,
Industrie Kleinzaun
Postfach 206, CH-8754 Netstal,
SWITZERLAND
Tel No: 00041 (55) 640433 Fax No: 00041 (55) 6403849

6. Mr. R. Posey
General Manager
CSPP Columbus Specialty Paper Products Inc
785 Frebis Avenue,
Columbus OH 43206,
UNITED STATES OF AMERICA
Tel No: 0001 (614) 4434821 Fax No: 0001 (614) 4436919
(Note: the letter and the samples sent were returned, the phone was disconnected and it was not possible to contact the company)

7. Mr. F. Dean
Purchasing Manager
Knolton Specialty Paper Inc
213 Factory Street
Watertown, NY 13601,
UNITED STATES OF AMERICA
Tel No: 0001 (315) 7820600 Fax No: 0001 (315) 7827517

8. Mr. M. Subramanian
Director of Technology
Mosinee Paper Corporation,
Mosinee Specialty Papers
901 Manchester Avenue
Middletown, OH 45042,
UNITED STATES OF AMERICA
Tel No: 0001 (513) 4205300 Fax No: 0001 (513) 4205324

9. Ms. Sarah Hughes
Director,
Lwarcel Celulose e Papel Ltda
Rodovia Marechal Rondon km 303.5
Lencois Paulista SP 18680,
BRAZIL
Tel No: 00055 (142) 631628 Fax No: 00055 (142) 63042

10. Mr. A. Trecenti
Industrial Director
Lwarcel Celulose e Papel Ltda
Fabrica Penapolis,
Avda. Antonio Veronese
490 J. Brasilia,
Penapolis, SP 16300,
BRAZIL
Tel No: 00055 (186) 520730 Fax No: 00055 (186) 520605

11. Mr. D. Morris
Purchasing Manager
J. R. Crompton Ltd
Elton House, Wellington Street,
Bury, Lancs BL8 2AS,
GREAT BRITAIN
Tel No: 00044 (161) 7972645 Fax No: 00044 (161) 7975314

12. Mr. W. V. Paton
Director,
Dexter Corporation, Non-woven Materials
Chirnside Mill Duns

Chirnside, Berwickshire,
SCOTLAND TD11 3JU
Tel No: 00044 (1890) 818303 Fax No: 00044 (1890) 818256

13. Ms. U. Ellenbrush
Quality Control Manager
Illig'sche Papierfabrik GmbH (Cordier)
Postfach 130110, Rheinstrasse 38
D-64241 Darmstadt,
GERMANY
Tel No: 009 (6151) 5098-0 Fax No: 009 (6151) 5098-88

14. Mr. Ch. Blanker
President,
Esleeck Manufacturing Co. Inc
P. O. Box 717, Turners Falls, Ma 01376,
UNITED STATES OF AMERICA
Tel No: 0001 (413) 8634326 Fax No: 0001 (413) 8633196

15. Mr. Rodolfo Ripol
Director Fabrica
CELESA (Celulosa de Levante S.A.)
Apartado Postal 76
Carretera Comarcal 237, Km 4.5
43500 TORTOSA, SPAIN
Tel NO: 000341 (977) 440795 Fax No: 000341 (977) 440803

REINFORCEMENT PULP MILL CONTACTS

1. Mr. M. Dubuc
Pulp Buyer
Scott Paper Ltd
Eastern Manufacturing Division Crabtree Mills
P. O. Box 500
JOK IBO Crabtree Mills,
CANADA
Tel No: 0001 (514) 7543506 Fax No: 0001 (513) 7544598

2. Ms. C. Clement
Laboratory Manager
MODO Paper PSM
1227 Rue Pasteur, B. P. 319
F-60723 Pont Ste. Maxence Cedex,
FRANCE
Tel No: 0003 (3) 447004200 Fax No: 44704132

3. Mr. P. Fuschini
Executive Director
Cartiera di Santacangelo S.r.l.

Via Fosse Andreatini 3
1-47824 Poggio Berni RN,
ITALY
Tel No: 00039 (541) 626229 Fax No: 00039 (541) 621403

4. Mr. M. Cashmore
Marketing Manager
Tasman Pulp & Paper Co. Ltd
Fletcher Challenge House,
810 Great South Road,
P. B. 92114
Penrose, Auckland,
NEW ZEALAND
Tel. No: 0064 (9) 5259000 Fax No: 0064 (9) 5713927

Printed in Austria
V.05-91191—June 2006—200

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Telephone: (+43-1) 26026-0, Fax: (+43-1) 26926-69
E-mail: unido@unido.org, Internet: http://www.unido.org