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STEPWISE
REACTIVATION OF
NIGERIAN NATIONAL PAPER MANUFACTURING CO.
IWOPIN PAPER MILL

REPORT ON THE
PRELIMINARY TECHNICAL
AND FINANCIAL ASSESSMENT
(PHASE I REPORT)

for

UNIDO

VIENNA, AUSTRIA

by

HANS RAHM INGENIEURPLANUNG AG

Männedorf/Zürich, Switzerland

in cooperation with

GOPA Consultants, Bad Homburg, Germany

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UNIDO/NIGERIA
Stepwise
Reactivation of Iwopin Paper Mill
Phase I Report
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SUMMARY - PHASE I REPORT -

This report covers the result of the investigations carried out by HANS RAHM INGENIEURPLANUNG AG, in cooperation with GOPA CONSULTANTS, on behalf of UNIDO (proj. SI/NIR/89/804), on the reactivation of the NIGERIAN NATIONAL PAPER MANUFACTURING CO.LTD (NNMPC).

In this Phase I the emphasis is laid on the aspects of stepwise rehabilitation of the project and the resulting technical and financial implications. In this sense, three models for reactivation have been defined, in brief, as follows:

Model A: Paper converting plant only, with power supply from the existing diesel generators, producing paper in sheets from purchased rolls.

Model B: One paper machine and the converting plant. Power supply with additional diesel generator capacity, steam for process from a new package boiler, water treatment plant. Paper would be produced from purchased pulp.

Model C: The whole mill including the pulp mill.

Both Models A and B are technically feasible. Model C has not yet been valuated in detail, in Phase I.

The financial aspects, however, show that only Model B is viable:

With a budget of approx. US \$ 45'000'000.- for fixed investments, and US \$ 20'000'000.- for working capital (high estimates, may be reduced), and under the assumption that all costs and expenses incurred upto now are regarded as sunken costs, the FIRR (financial internal rate of return) on the additional investment is 16%.

This is considered to be quite favorable. It would be a sound basis to start the mill operation, with only limited additional investment. It provides a basis to create a return on investment which would, in turn, generate the confidence that NNMPC is able to run the mill, and which would be a sound basis to continue the reactivation, to finally reach Model C, the integrated pulp and paper mill, including the forestry operations.

A resumption of the project on basis of model B is therefore recommended, in the forthcoming Phase II of the advisory services.

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1. INTRODUCTION TO PHASE I REPORT

The United Nation Industrial Development Organisation, Vienna, Austria (UNIDO) has entrusted Hans Rahm Ingenieurplanung AG, Männedorf/Zürich, Switzerland (HRAG) to provide "High Level Advisory Service on the Reactivation of the NIGERIAN NATIONAL PAPER MANUFACTURING COMPANY LTD., - Iwopin Paper Mill."

In the "Phase I", HRAG's work consists of a preliminary technical and economic assessment of the situation of NNPMC and the mill, and a specification of the technical and financial implications of a stepwise activation of the project.

UNIDO, in their "Terms of Reference" (vide Annex A-1), recommended the stepwise approach to the rehabilitation, and in this first phase of the assessment, two models A and B of a partial operation of the mill have been studied. The whole mill's rehabilitation (Model C) is only superficially covered by the Phase I Report, as the establishment of fairly reliable investment costs was impossible to achieve within the approximately 2 months time available for preparing the preliminary Phase I Report.

HRAG cooperates with the firm COPA, Bad Homburg, Germany for the preparation of the report sections on local input data and costs and the economic and financial analysis.

The Table of Contents for the Phase I Report has been structured to suit the requirements of the final report.

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2. STATUS ANALYSIS

2.1 Consumption of Printing and Writing Paper

The annual writing and printing paper requirements of Nigeria in 1990 are estimated to be 110'000 t/a (vide table in Annex A-2.1).

The assumed capacities for Model A (35'000 t/a) and for Model B (50'000 t/a) are thus well below the annual requirements, which are, at present, almost 100% imported.

(to be more detailed in Phase II/III)

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2.2 Raw Material Base for Printing and Writing Paper

2.2.1 Imported Pulp

"Model B" provides for the manufacturing of paper from imported pulp.

Pulp of various brands is presently imported already by the other 2 Nigerian paper mills.

The following CIF Lagos prices have been used for the Phase I Report:

Bleached longfibered kraft pulp:	US \$ 840.-/a.d.t
Bleached shortfibered kraft pulp:	US \$ 790.-/a.d.t

(to be complemented/adapted in Phase II)

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2.2.2 Wood(1) Pulpwood Potential

No detailed investigations have been carried out by HRAG/GOPA within the framework of the Phase I Report.

According to information obtained from NNPMC, the Federal Dept. of Forestry, FORMECU, in Ibadan, and the Parsons and Whittemore report of 1987, sufficient plantation wood (*Gmelina arborea*) is available to sustain the pulp mill operation later on.

(to be complemented in Phase II)

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2.2.3 Chemicals and Additives

The chemicals and additives required for the production of printing and writing paper comprise:

- alum
- rosin size
- starch
- china clay
- papermaking additives, like
dye
retention aid
defoamer
optical brightener, ect.

The table in Annex A-2.3 provides the relevant information on the sources and prices of the above chemicals and additives.

The pulping chemicals for Model C have not been investigated in Phase I of the study.

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2.2.4 Packaging

Packaging material is supplied by the Nigerian Paper Mill in Jebba. In March 1990 the ex-factory price for 125 g/m² wrapping paper was Naira 10,943 per t or Naira 11,250 per t free Iwopin paper mill.

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2.3 The National Nigerian Paper Manufacturing Co.Ltd

2.3.1 Ownership

Owners of the Iwopin paper mill are the Federal Government, the States of Oyo, Ondo and Ogun. The following table provides the relevant details on the allocation of shares and the actual paid-up capital:

Share holder	Shares	Capital Paid-up 1000Naira	Actual Paid up Capital 1000Naira	Call-in-arrears 1000Naira
Fed. Govern.	70%	98,000	98,000	0
Oyo State	10%	14,000	6,269.7	7,730.3
Ondo State	10%	14,000	6,269.7	7,730.3
Ogun State	10%	14,000	6,269.7	7,730.3
Total	100%	140,000	116,809.1	23,190.9

Source: Iwopin Paper Mill

The Federal Government assumes that it covered the call-in-arrears and therefore recognizes the following distribution of shares:

Share holder	Shares	Actual Paid up Capital 1000Naira
Fed. Government	88%	121,190.9
Oyo State	4%	6,269.7
Ondo State	4%	6,269.7
Ofua State	4%	6,269.7
Total	100%	140,000

The original status of the 70/10/10/10 distribution has legally not been forfeited, since no deadline was given to the State Government to completely pay up their share capital. The balance sheet considers therefore the additional payment by the Federal Government of Naira 23'000'000 as additional loan.

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2.3.2 Organization, Management and Manpower

As the mill is not able to run in its present status, it is quite obvious that no organisation, management and manpower exists to do so.

The present set-up of manpower is illustrated in Annex A-2.3.

For Models A and B, the qualification and the number of personnel required have been estimated, for the purpose of providing the respective input to the economic calculations (vide paragraph 4, of this report).

More details will have to be developed during Phase II of the project.

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2.3.3 Financial Status

to follow in Phase II

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2.4 Condition and Status of NNPMC Facilities

2.4.1. Machinery and Equipment

Physical conditions of plant equipment

The HRAG/GOPA visit in March 90 could, in essence, confirm the statements expressed in the Parsons and Whittemore (P&W) study that the visible condition of the equipment is better than what would have been expected. It reflects, no doubt, the quality of materials and workmanship of the works already done, the efforts of the custodians and the fact that substantial part of equipment is under cover. No systematic mothballing, however, have been undertaken.

More important for a possible start-up of equipment is the internal condition. Short of a detailed physical inspection and testing at this stage, only educated speculations can be made on this subject, resulting in a rather wide band of uncertainty. Particular fields of concern are:

- Corrosion of gears, roller or ball bearings etc, due to moisture entering the equipment by "breathing" when the ambient temperature changes, and sometimes enhanced by electrolytic action when non-ferrous materials are in contact with steel. As temperature fluctuations are not large at the site and the ambient air relatively free of corrosivity, it is unlikely that material damage took place.
- Corrosion of electric equipment. In particular, contacting surfaces in low voltage and low power control circuits, such as mechanical relays and switches, can develop nonconducting layers when idle, leading to (sometimes dangerous) failures in the control functions which are often very time-consuming to detect.
The suppliers of papermaking and converting equipment who were contacted, expressed, unanimously, concern about the internal condition of control panels and proposed to renew such equipment offhand rather than suggesting to recondition it. (This is reflected in the high estimate for cost of preparation for startup in models A and B.)

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- Deterioration by ageing of certain elastomers, such as covers of press and transfer rolls in the papermaking machines and some converting equipment, rubber and plastic hoses, etc. The paper machine manufacturer expressed the opinion that after about 10 years the elastomeric roll covers would have become unsuitable and proposed to supply new covered rolls. For this reason, the new cost estimate for preparing a paper machine for startup is considerably higher than suggested in the P&W study.

Erection

In general, a large part of the main mechanical equipment has been erected, whereas the secondary or auxiliary equipment and machinery has not or to a very limited extent only. Details on the individual status of erection by mill sections is contained in Annex A-2.4. The NNPMC's summary of completion of erection is judged to give the right order of magnitude, as follows:

- Mechanical equipment	45%
- Piping	10%
- Tanks	75%
- Electrical, incl. motors	17%
- Instrumentation	none
- Insulation	none
- Refractory and lining	none

Completeness of supply

As far as the completeness of supply is concerned, the results of the detailed investigation carried out by P&W in 1987 have been found to be the correct basis for the judgement on the status, with a few components received since those investigations, such as the liquefaction equipment for the electrolytic plant, various control equipment components, boiler tubing.

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2.4.2 Buildings and Civil Work

The general status of construction of the mill buildings and structures is considered to be rather complete. Only minor items (some stairs, platforms, railings and interior finishing for control rooms) are missing.

Equipment foundations are mostly there, the grouting of the erected equipment is, however, generally missing (exception: Papermachines).

Lining of concrete chests is missing, as well as the piping nozzles etc.

Building ventilation is not installed.

The effluent lagoon still requires its lining, and, to an extent, repair work on the earthen walls.

The conditions of the buildings is also judged favourable: The roofs appear to be essentially rainwater tight, as only a few signs of water damage was visible on equipment.

The administration building requires a general overhaul and of course, the complete office equipment must be provided.

2.4.3 Infrastructure

The infrastructural items (housing, transport connections, water intake and effluent disposal) were not investigated in detail within the scope of this Phase I assessment. (A general overview of the status is given in a NNPMC tabulation in Annex A-2.4).

Generally it was found that the results of the P&W investigations about the status and the reconditioning requirements can be confirmed by the HRAG/GOPA observations.

This means that the reactivation of the townsite, or at least parts thereof, is an absolute necessity for the project reactivation, as no other possibilities for accommodation of foreign and local staff for erection, commissioning and startup exists in the vicinity of the mill.

It further means that the water intake system needs to be completed, whereas only minor improvement appears to be required for the road to and within the mill (stabilisation of surfaces).

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3. CONCEPT AND STRATEGY FOR REACTIVATION OF IWGPIN PAPER MILL

3.1 Propositions to Date

After the suspension of construction, 1983, two studies were made to determine the feasibility of reactivating the Iwopin project.

The first was a comprehensive appraisal by Parsons & Whittier Lyddon Ltd., presented in June 1987, the second was in the form of a proposal by Stothert Management Ltd. (the technical partners in the initial phase) to complete the mill and realise its full potential.

In both studies the opinion is expressed that the project is (still) technically and financially sound. It must be stressed, however, that in both cases the return of investment is based on the new capital required for the completion only, and all the investment and other cost up to now, i.e. US \$ 335'000'000, is regarded as "sunken" cost.

The capital requirement assessed in both studies is substantial: US \$ 136'000'000 + Naira 204'000'000 for P&W, and US \$ 194'000'000 + Naira 304'000'000 for Stothert.

A brief analysis of the reasons for the differences shows that Stothert's estimates contain considerably higher costs for pre-construction, construction, erection and management, thereby more than offsetting P&W's substantially higher estimate for mill equipment to be purchased.

P&W proposes, in view of the fact that the plant's technology and sophistication of equipment and systems reflected the state of the art of the late seventies, to introduce newer techniques in a number of cases.

The financial statements in the studies are based on different annual paper production: P&W uses 65'000 ft/a, Stothert 92'000 ft/a. This difference is not explained.

P&W proposes, as an alternative, to raise the paper mill capacity to 100'000 ft/a for better viability.

3.2 Selection and Evaluation of Alternatives

(The following is preliminary, and may be altered or abandoned in Phase II of the HRAG/GOPA investigations).

Besides the total plant reactivation approach (as presented by P&W and Stothert), and the stepwise, or phased schedule outlined further down under 3.3, other alternatives have been contemplated, with the following results:

- Liquidation of NNPMC and sale of the equipment, piecemeal or in groups, to other interested parties outside Nigeria:

By all practical experience, considering the basic difficulty in finding suitable buyers, the secondhand value, for unused equipment over 10 years old, would not be more than approx. 15% of the original value. This loss, plus the losses involved by abandoning the buildings and structures, as well as the infrastructural facilities etc. - even if the slim chance of selling it to other interested industries would materialize - is considered too extreme to pursue this alternative seriously.

- Liquidation NNPMC, and sale of part of the equipment to one or both other Nigerian mills:

As all mills in Nigeria are State owned, this would not mean any commercial benefit. It would mean taking the money from one pocket to the other, plus the additional cost of dismantling and reerection, plus new buildings at the new site.

- Liquidation of NNPMC, and sale of the whole mill in situ to an existing, large pulp and paper manufacturer with international activities in production and sales:

This alternative would mean the privatization of the whole enterprise, and leaving it to the new owner to complete and operate the mill, presumably including the forestry operation.

This could be an interesting option, if the reactivation approach as outlined further down (3.3) would not be sufficiently attractive, or would not materialize, due to other reasons.

- A variation to selling the mill may be its leasing to an international pulp and paper manufacturing company.

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- As far as the stepwise approach is concerned, the individual operation of the caustic-chlorine electrolytic plant has been suggested earlier.

This is, however, not recommended by HRAG/GOPA to be investigated in further detail, for the following reasons:

- Additional equipment would have to be purchased, which afterwards, when the whole mill is running, would not be required anymore: An evaporator, to concentrate caustic soda to the required level for sale, and a 15t/d chlorine liquefaction unit, as the present one has only approx. 25% (5t/d) of the capacity of the electrolytic plant.

Furthermore, pressure tanks and bottles to safely store and distribute the liquid chlorine, along with maintenance facilities, would be required.

- The power requirements (connected load approx. 7.0 MVA) demand the hog fuel (or oil) boiler to be finished, the condensation turbo generator set to be made operative, besides the general services like water supply (for feed water, electrical distribution etc.).

- The electrolytic plant erection work has not been started yet. The additional costs to do so would be considerable as compared to the complementary erection work, required for the departments suggested under 3.3 below.

3.3 Technical and Organisational Concepts

HRAG/GOPA's conceptual approach of the partial rehabilitation of the mill resulted in the followed 3 models:

Model A: Operation of the paper converting plant with power supply from the existing diesel generators, producing paper in sheets from purchased rolls.

Model B: Operation of one paper machine including stock preparation and the converting plant. Power supply would be from a new large diesel generator, steam for process from a new low pressure package boiler, water from the water treatment plant. Paper would be produced from purchased pulp.

Model C: The whole mill including pulp mill is reactivated.

The 3 models may be consecutively implemented, but for the purpose of the Phase I Report, only the model A and the model B are assessed.

Model C will be further investigated in the consecutive phase II.

3.3.1 Production Program

For Model A, the paper to be purchased from abroad is in rolls. A wide range of writing and printing papers may be produced, in accordance with the market demand in Nigeria.

For the purpose of the economic calculations the following 2 grades were assumed to be the dominating ones, according to the findings of the brief market assessment:

- White bond (woodfree) 60g/m²
- Bank paper (woodfree, white and coloured) 45g/m².

For the time being, no differentiation has been made between large size reams and cut-size (A4 and A3) reams, although the cut-size is expected to result in a higher sales price than the large size sheets.

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For Model B, i.e. one of the paper machines working, using purchased pulp, 2 Different grades of paper are assumed to be produced:

- Grade I, the lower price "wood containing" writing and printing papers without surface treatment, and
 Grade II, the top quality "woodfree" papers, with a size press surface treatment.

The furnish for Model B-concept is as follows:

Grade I: "wood containing" paper:

additives total	100 kg
total fibre	840 kg od
TMP (60%)	505 kg od $\hat{=}$ 560ad
Chemical pulp, LF (40%)	335 kg od $\hat{=}$ 375ad

Grade II: "woodfree", surface-sized paper:

additives total	100 kg
total fiber	840 kg
of which	
30%=LF	250 kg od= 280ad
70%=SF	590 kg od= 655ad

Both grades: Moisture content 6% 60 kg

As far as production quantities are concerned, the following base assumptions apply:

For Model A: 35'000 ft/a, based on the fact, that total market volume for writing and printing papers in Nigeria is estimated to be 110'000 ft/a in 1990, i.e. approx. 1/3 would be covered by NNMP.

For Model B: the papermachine capacity, at 100% efficiency, according to the specifications of the supplier, Escher Wyss, is 200t/d, or in 340 d/y, 68'000 t/y. A rather conservative 73% capacity utilization has been used, to arrive at 50'000 ft/y, whereby the split of 35'000 ft/y in sheet form, and 15'000 ft/y in rolls has been made.

(More assumptions require verification in Phase II of the investigations).

3.3.2 Reactivation of Production Lines Models A and B

In general it is deemed advisable, in order to save on expenditures for realisation of the models developed in this study, to make use, as much as practicable, of equipment from other mill departments (pulp mill, recovery, etc.) in case of need. This would be particularly valid for general purpose equipment such as pumps, motors, electric equipment, instrumentation, (control)valves, etc.

It goes without saying that such a procedure must be well controlled and administrated, so that at a later revitalisation of the pulp mill (Model C) the parts can be reordered.

Another advantage is that further deterioration by non-use of those parts is avoided.

The production line rehabilitation of Model A and Model B may be described as follows:

Model A: Converting of purchased (imported) paper in rolls

- Unfinished paper is purchased in rolls of various width and diameters as required and is converted as follows:

For producing paper in sheets and reams, the Jagenberg sheet cutters are used. After cutting the sheets are stacked in reams (500 sheets), then wrapped in wrapping paper on the Lamb ream wrappers and hence labeled and dispatched.

- For producing paper in cut-size (small size) sheets, narrow paper rolls, either imported as such or produced from wider imported rolls on a slitter (Goebel), are transferred to the cut-size lines consisting of E.C.Will-sheeters and Pemco-packers, then palletized and dispatched.

- Culled rolls can be "salvaged" on the Goebel slitter/rewinder.

Special small orders in sheets can be made to size on the guillotine cutters, using air tables for ease of handling the paper stacks (reams).

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- Trim generated at the roll slitter and sheet cutters is pneumatically removed, and, along with imperfect sheets, etc. collected at a bale press for pressing into bales for sale.

- Knives for slitters, cross cutters and the guillotine cut size sheeters are to be regularly sharpened on special grinding equipment in the maintenance department.

Model B: Producing Writing and Printing Paper on one of the two Paper Machines

Fibrous base material is purchased as short and long fibered woodcontaining and woodfree pulp.

Model B can be a logical sequence to Model A, whereby the purchase of foreign paper can be gradually reduced as the paper production increases.

- Purchased pulp in grades as required is dispersed (slushed) in (recycled) process water in the pulpers. The pulp suspension is then treated in refiners (beating) for optimum paper making properties. A number of chests are available for intermediate storage, homogenizing and blending of the pulp suspension.

- Paper additives, required to give the paper specific qualities (starch, size, fillers, shade or colour) are prepared in the additive preparation plant.

- Various pulp qualities, broke (recycled production waste) and additives are blended in the correct proportions to form the papermaking stock.

- After final cleaning in rotary screens and hydrocyclones, and addition of certain agents to prevent foaming and fouling in the stock and water circuits and to enhance retention, the paper stock is made into the sheet on the paper machine. This machine consists of a wire section, where the paper web is formed, a press section where the web is dewatered by pressing, and the drying section, where the moist web is dried to an (endless) paper sheet.

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- Paper from the paper machine is rolled onto reel spools and then transformed to a slitterrewinder for producing

- a - custom sized rolls
- b - rolls for sheet cutters
- c - rolls for cut size cutters

- For these operations paper cores are required, made from kraft paper. For internal roll transport, a Kleinewefers shuttle car system is available.

- Custom sized rolls are wrapped, the heads covered, weighed and marked for shipping (Lamb) and dispatched. Rolls for sheet cutters and for cut-size sheeters proceed as described under Model A.

- Paper cores for paper rolls and for internal use are manufactured on the paper core making machinery (Guschky-Toennesmann), using purchased kraft or bogus kraft (e.g. from Jebba) and glue. Paper rolls are cut to roll size on a core cutter and notcher.

- Trim generated at the roll slitters and sheet cutters is pneumatically removed and, along with imperfect sheets, etc. returned to the paper mill for re-use as fibrous material ("broke").

For special properties, e.g. for offset printing, the paper can get a surface treatment on the size press which is incorporated in the dryer section of the paper machine.

For the purpose of this model, two basic paper qualities are assumed

- a) wood containing writing and printing paper, representing a cheap economy paper for mass products like schoolbooks, exercise books, computer paper, non-durable publications etc., and
- b) wood free writing and printing paper for quality products like offset printing paper, stationary, copying paper, books, ledgers. This grade will produced with surface sizing.

3.3.3 Reactivation of Utilities and Services, Model A and B

The general approach for model A and B with respect to the provision of the utilities and services is not to complete the complex steam and power generation units, as this would result in too high capacity and costs in relation to the type of operation envisaged for these models.

Instead, it is proposed that additional diesel generator capacity and a new package boiler for process steam will be installed.

This equipment may be kept or sold after the whole mill (Model C) has been completed.

As far as the individual utility units are concerned, the following arrangements are being proposed:

WATER SUPPLY

For Model A: The water consumption is so low in comparison with the design capacity, that either

- a) the water supply is covered by other sources, e.g. wells (using clearwell as fire water source) or
- b) the existing pumps are replaced by more suitable ones (e.g. from the pulp mill inventory) and the clarification stage bypassed, so that only filtration is applied (plus chlorination of potable water). A decision on this must be postponed to a more detailed survey.

For Model B: A process water supply capacity of 600-1000 m³/h must be foreseen.

This quantity can be handled by one lagoon pump with reduced impeller (or by a suitable smaller pump from the pulp mill inventory).

For clarification, 1/2 - 1 Pulsator will be sufficient. To suit the lower throughput, some modifications at one Pulsator may be required, in order to keep flow conditions in line with the design parameters. Pulsators must be kept in continuous operation for proper functioning.

For filtrating, a suitable set of filter bays can be selected to suit the lower capacity.

The diesel engines for driving one lagoon water pump, one process water pump and the clearwell fire pump, must be operational.

EFFLUENT DISPOSAL

For Model A: There is virtually only sanitary effluent, to be handled in septic tanks, in the townsite.

For Model B: The effluent of the paper mill has only little BOD load. It is sufficient to apply mechanical treatment in the clarifier only for fiber and filler removal. The aerated basins need not to be taken into operation. Permission must be sought to return the effluent (temporarily) into the lagoon at a suitable location.

POWER SUPPLY

For Model A: The existing diesel generator sets are sufficient to provide the electric power.

For Model B: The relatively low steam and power demand do not justify the high cost of taking into operation a power boiler or a package boiler and a turbo-generator.

Instead, it is proposed that power will be supplied by the existing 4 diesel sets, complemented by about 5MW diesel power from one or two additional diesel gensets.

Generation and distribution will be on the 3,3 kV level, feeding 3,3 kV/415 V transformers and the operational 415 V distribution centers, and 3,3 kV motors, where necessary. Diesel oil will be supplied from the existing diesel oil storage tanks.

An alternative to the purchase of the diesel set(s) could be a leasing arrangement. The leasing period would be defined by the time required until model C, the whole mill's rehabilitation, leads to the operation of the existing steam turbines.

STEAM SUPPLY

For Model A: No steam supply is required.

For Model B: As mentioned under power supply, the relatively low LP. steam demand of model B does technically not justify the operation the existing steam and power plant and the high cost its completion.

Instead , a new low pressure package boiler with a capacity of about 25t/h steam is proposed to supply the paper machine drying section with steam.

This boiler will be fired with fuel oil from the existing fuel oil supply system.

As an alternative, the existing package boiler could be, completed and activated as a low pressure boiler, in case this is technically feasible.

However, in order to be on the safe side, a new package boiler has been accounted for in the reactivation investment budgets.

3.3.4 Buildings and Civil Works

For Model A: Very little work is expected to be required on the converting plant and the warehouse buildings, only repair work such as tightening leaks in the roof, some sidings and door replacement may have to be carried out. Paving of roads around the converting area is considered necessary to avoid dust.

For Model B: The civil works portion provides for the patch-up work on the paper machine hall, all the floors and chests (incl. lining) and other structures for process machinery (incl. grouting), railings etc. The raw water pumping station needs clean-up and repair work; the primary effluent clarifier appears to require only minor repair. The pumping station of the effluent will need a protective roof. The new diesel generator set, as well as the new package boiler will be located on new concrete platforms, and in a simple shack type structure.

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The townsite, at least parts of it, is to be renovated, repaired, refurbished and connected to water supply, effluent disposal and electricity.

3.3.5 Organizational and Manpower Requirements

The personnel to operate the departments covered by Model A and B must be recruited and trained. Furthermore, the management (operational, purchasing, sale, accounting etc.) has to be established, i.e. the present management has to be reinforced.

Preliminary estimates of personnel requirements were made. In summary, they are as follows:

Model A: Converting operation incl. utilities:

Supervision	3
Skilled and semiskilled labour	39
Unskilled labour	36
<hr/>	
Total	78

Model B: Papermaking, Converting and Utilities:

	Paper- making	Conver- ting	Uti- lities	Total
Supervision	6	2	8	16
Skilled and semiskilled	36	39	93	168
Unskilled	8	36	39	83
<hr/>				
Total	50	77	140	267

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3.3.6 Tentative Schedule for Implementation

As no reliable information on the time required for basic, non-technical decisions and possible financing negotiations are available at the time of the preparation of this report, the following preliminary schedule starts upon the signing of the financing agreement.

The schedule is applicable for both models:

Activity	month from financing contract
1. Contracts with vendors to establish detailed rehabilitation budget	0.5
2. Site survey by main vendors	1.5
3. Contracts with vendors for rehabilitation and additional equipment	2.5
4. Period for rehabil. work and add. equipment supply	
4.1 Housing and civil works	3.5
4.2 Equipment rehabilitation	5.5
4.3 New equipment supply	8.5
4.4 Shipment, erection completed	10.0
5. Start-up and commissioning completed	11.0

This schedule requires an effective project management and relatively short delivery times.

Some time may be gained by ordering the new, and the larger part of the rehabilitation equipment very early, i.e. before the scheduled 2.5 months for activity have elapsed.

Including 1 month for contingencies, 1 year should be counted on for implementation of either model, whereby Model A may be somewhat (1-2 months) less time consuming and Model B may need some more time. For the financial plan, the investments spending for Model B has been conservatively spread over 2 years.

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4. ASSESSMENT OF IMPACT OF REACTIVATION

4.1 Method of Approach and Main Assumption, Phase I

The financial assessment takes into account the proposed technical and organizational concept and follows the tentative implementation plan (vide 3.3.6).

All calculations are made at 1990 constant prices. Inflationary effects may be judged upon by the sensitivity analysis.

The assessment of the re-activation is further based on 340 working days per annum and a three shift operation. Average capacity utilisation has been assumed at 85% for Model A and 73% for Model B.

4.2 Investment Costs and Financing

4.2.1 Investment Costs

The investment costs for re-activating Iwopin Paper Mill following the alternatives of Model A and Model B are summarized in the tables in Annex A-4.2. They consist mainly of

- pre-operational expenses
- fixed investment and
- working capital requirements

The estimated capital expenditure for the additional machinery and equipment includes price and quantity contingencies of 15%. The price for major facilities have been established on the basis of quotations from the machinery suppliers. Import duty has not been applied as NNPMC is a State owned company. This complies to current Nigerian practice. Costs of civil works and local inputs follow the estimate of The Parsons and Whittemore Organization of 1987.

The projected working capital requirements are based on the following conditions:

- | | |
|---------------------------|---------|
| - local material stock | 1 month |
| - imported material stock | 3 month |
| - work in process | 10 days |
| - finished goods | 1 month |
| - trade debtors | 30 days |
| - trade creditors | 30 days |

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4.3 Financial Analysis

4.3.1 Revenues and Costs

(for details refer to Annex 4.3)

(1) Revenues

Sales revenues are based on the current average CIF Lagos prices for printing and writing paper, i.e.

- For paper in reels US \$/ ft 1'200
- For paper in sheets US \$/ ft 1'200

The sales volume is calculated by elimination changes of stocks from the planned production output. The effects of the current 15% import duty rate on imported paper in reels and sheets have been investigated separately.

(2) Costs

The financial analysis considers the following unit costs of the major materials (for further details refer to Annex 4.3)

Model A

- Paper in reels US \$/ ft 1'200

Model B

- Bleached long fiber chemical pulp US \$/ ft 840
- Bleached short fiber chemical pulp US \$/ ft 790
- China clay US \$/ ft 616
- Size US \$/ ft 1'455
- Alum US \$/ ft 500
- Starch US \$/ ft 866

The present 10% duty rate on the import of chemical pulp has not been accounted for. Their effects have been examined separately together with the equivalent paper prices.

The projected payroll estimate of Iwopin Paper Mill includes salaries and wages as well as all social benefits as assumed by the mill's management. Its tentative break down according to departments is given below:

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Department	Payroll (1000 Naira p.a.)
General Manager's Office	383.6
Production	3210.0
Maintenance	147.8
Administration	1408.4
Finance	1093.7
Commerce	654.8
Total	8163.3

The expences for power generation have been based on the following specific requirements:

Model A

- 20 kWh / ton of converted paper

Model B

- 800 kWh / ton of finished paper

- 2.5 t of steam / of finished paper

The forecast of the diesel and heavy fuel oil consumption for generating power and steam considers an average rate of 0.3 kg Diesel/ kWh and 1 t heavy fuel oil/ 14.0t of steam.

The personnel costs to provide the necessary maintenance and repair services have been included under salaries and wages. Spare parts and consumables for the production machinery are estimated at US \$ 40.-/ ton finished paper.

The contribution margin (excluding direct labour) has been analysed for Model A and B below. It reveals a negative contribution in the case of Model A and a positive margin of US \$ 343.-/ ton for Model B. (Details vide Annex A-4.3)

4.3.2 Net Present Value and FIRR

The calculation of the net present value (NPV) and the financial rate of return (FIRR) follows the assumption and method outlined below:

- the calculations apply the sunken cost approach
- the time period for the analysis is 14 years. It includes one year for implementing the measures proposed for Model A and two for Model B.
- the calculation is done in real terms based on 1990 prices

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- at the end of the projection period, the accumulative built-up working capital is assumed to be recovered in cash

- the residual value of the plant is considered to be zero. This is rather conservative since the expected machinery life of the main machinery and equipment is over 20 years

- the net present value is computed for a discount rate of 10%.

(1) Base Case

The input data for calculating the base case are contained in Annex 4.3. The cashflow for computing the NPV and FIRR is also provided in Annex 4.3. The result is a clear vote for Model B. NVP and FIRR are listed below.

Financial Indicator	Model A	Model B
NVP (at 10%)	negative	21'926.00 US \$
FIRR	negative	16%

(2) Sensitivity Analysis

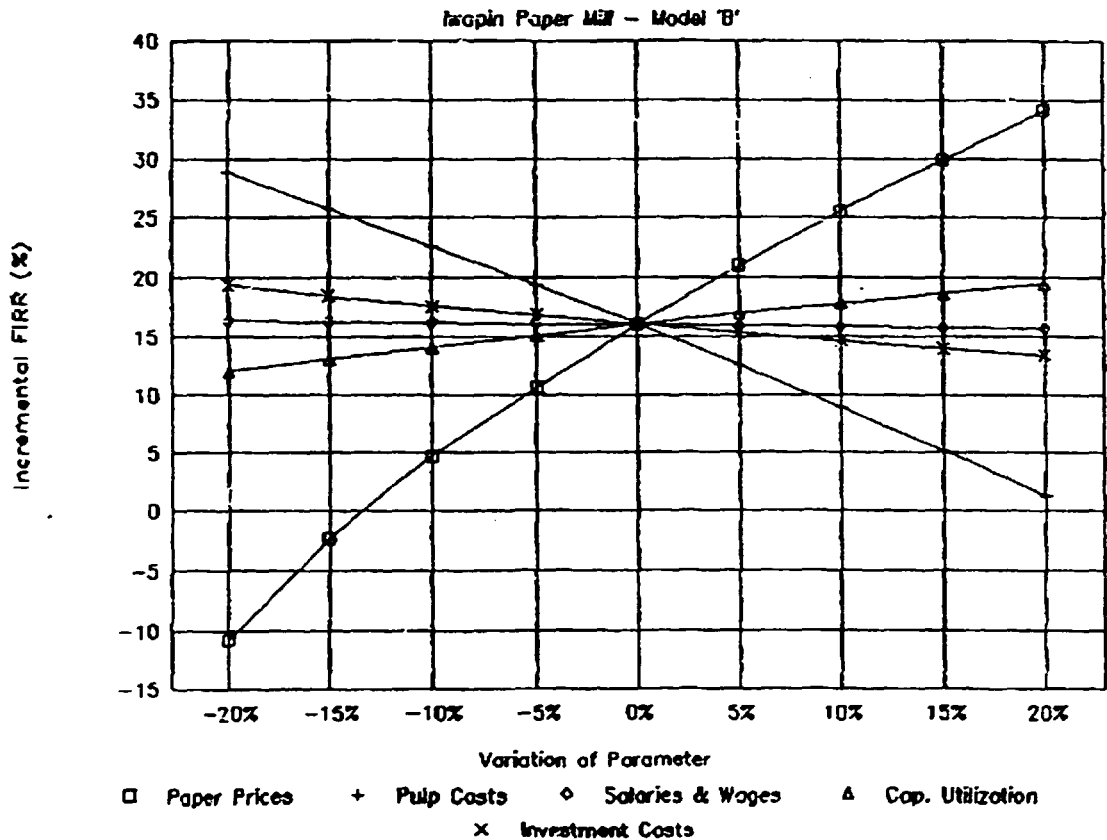
In addition to the calculation of the FIRR for normal conditions (base case) the effects of reduced/increased pulp costs as well as declining paper prices and capacity utilization rates have been analyzed for Model B. The financial rates of return are given in Annex A-4.3.

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The results of the sensitivity analysis may be illustrated as follows:

SENSITIVITY ANALYSIS



- the FIRR reacts highly sensitively to changes in the paper prices and pulp costs
- changes in the capacity utilization have a moderate impact on the profitability
- a variation of the salaries and wages or the additional investment costs affects the rate of return only marginally.

Further to the above analysis the effects of the current import duty rates on pulp and paper products have been investigated. In case these duties are applied, the pulp costs increase by 10% and the paper price by 15%. Based on this assumption the FIRR increases to 23.4% and the corresponding NPV at 10% discount rate to about US \$ 55'000'000.

5. CONCLUSIONS

The investigations concerning the stepwise reactivation of the Iwopin Paper Mill Project lead to the following conclusions:

- Technical aspects

Both Model A (converting only, 35'000 t/a) and Model B (one paper machine, converting and part of the auxiliary plants, 50'000 t/a) are technically feasible.

A preliminary review shows that also Model C, i.e. the operation of the complete mill as originally planned, is technically feasible.

The exploitation of the electrolytic plant only, to produce chemicals (caustic soda and chlorines) for sale, does not appear to be feasible. It would require the completion of the entire power generation system of the mill, which is the least complete and therefore the most capital demanding section of the mill. Furthermore, it would require substantial amounts of additional equipment which would be superfluous after Model C is in full operation.

- Financial aspects

Model A (converting only) does not appear feasible, the NVP and the FIRR are negative.

Model B, on the other hand, shows an interesting FIRR of 16% on the new investment. It is concluded that Model B is a proper basis for the project reactivation.

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6. RECOMMENDATIONS

The above conclusions lead to the following recommendations:

- A) Consolidation of the findings in Phase I. This requires a more detailed checking of the capital requirements for Model B, because it is felt that the estimates for additional capital, as obtained from major equipment vendors, are on the very safe side, - due to uncertainties about the condition of equipment -. Verification by means of detailed investigation of the "non-visible" areas like large bearings, gearboxes, electrical and instrumentation equipment etc. is therefore indicated.
- B) Further investigation of Model C as the "final step" of the project reactivation to the same degree of detail as of the assessment for Model A and B in this Phase I Report.
- C) Commence Phase II of the advisory services, including completion of the financial analysis for Models B and C.

Männedorf, 15.6.90

Report prepared by



R. Stoff (GOPA)

R.J. Schut (HRAG)



H. Rahm (HRAG)

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A N N E X E S

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ANNEX A-1 - Terms of Reference -

The original specification of contractor's (HRAG) responsibility reads as follows:

"The main task to be completed by the contractor will be a comprehensive technical and economic assessment of the Iwopin Paper Mill with recommendations to determine the viability of reactivating the project as originally planned. This will be achieved through;

- (i) Evaluation of the proposed design and structure of the various plans, inspection of plants and assessment of technical requirements to complete construction of the mill.
- (ii) Review and assessment of plants for the structure and civil engineering works including cost estimate to complete construction.
- (iii) Assessment of the plant's capacities on the basis of availability of raw materials.
- (iv) Evaluation of the organizational structures of the Iwopin Paper Mill to determine whether they are viable, given the existing economic and financial constraints now being experienced by the Government.
- (v) Evaluation of the financial requirements including analysis of debt service ratio, total debt coverage to determine investment cost, projected annual investment expenditures, working capital requirements, etc. to complete and put into operation the Iwopin Paper Mill.
- (vi) Assessment of alternative options available to the Government including the possibilities of extending equity participation to nationals and neighbouring states and sale of some plants, machinery and equipment.
- (vii) Prepare a report on the basis of the above, with specific recommendations on the reactivation of the Iwopin Paper Mill."

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Also, UNIDO recommended to study whether a stepwise approach to the completion of the plant is feasible, by slating that

"the Government should endeavor to finish and put into operation; (i) the paper converting plant with national or international partners to produce sheeted printing paper and writing paper from imported rolls, (ii) the caustic soda/chlorine plant. It was also recommended that the Government should assess the viability of selling one of the Escher-Wyss paper machines or leasing them to interested partners in neighbouring states preferably Cellucam in Cameroon."

Further, by agreement between UNIDO and HRAG, the assessment work of HRAG has been subdivided into phases:

Phase I of the work of HRAG is covered by this report and it basically consists in collection of sufficient local data and information to assess, in a preliminary approach,

- whether the stepwise approach is a feasible way to get certain mill operations started.
- whether the project has a chance to be economically viable, and
- whether the organizational structures of the mill are viable.

Phase II of HRAG's work would then cover the rest of T.O.R. section (i) to (vii). The exact scope of phase II would be determined according to the outcome of Phase I.

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ANNEX A-2.1

Domestic Consumption of Printing and Writing Paper 1990

Paper Grade	Grammage (gsm)	Consumer		Annual Requirement (mt p.a.)	Import Price CIF Lagos (US\$) March 1990		Source
		Name	Location		Reel	Sheet	
White Bond Paper	60 - 80	Apex Mill	Lagos	15,000	900	950	Finland or Brazil
	60 - 70	Orward Paper Mill Ltd.	Lagos	7,000	920 979	970 1029	Finland Brazil
		Onoleyo Printing Ltd	Ono State	4,000			
		Star Paper Mills		4,000			
		Star Modern Paper Mill		6,000			
		Other Printers and Publishers		54,000			
	Subtotal				90,000		
Bank Paper	40 - 50	Ape Mill	Lagos	6,000	1,100	1,150	Finland or Brazil
	45, 50	Orward Paper Mill Ltd.	Lagos	3,000	1,200	1,250	Brazil
		Orward Stationeries		2,000			
		Other Printers		9,000			
Subtotal				20,000			
Total				110,000			

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ANNEX A-2.2

Sources and Prices of Chemicals

Chemicals	Source			Price March 1990 (Naira/t.)		
	Import	Local	If "Local" Supplier	CIF Lagos US\$/t	Ex-factory	Cost at Iwopin H.
Sodium Carbonate (Na ₂ CO ₃)	x			200 - 300		3.600
Caustic Soda & 100% (NaOH)	x					5000-6000
Sulphuric Acid & 100% (H ₂ SO ₄)		x	Drury Industries, Lagos		(2.900) 3.050	(2.950 ²) 3.100
Lime Stone (CaCO ₃)		x	Marble Industry at Ajaokuta		450 (ex mine)	780
Sodium Silicate Liquid		x	John Edge & Company (Nig.) Ltd., Lagos			2.800

Sources and Prices of Additives

Additives	Source			Price March 1990 (Naira/t.)		
	Import	Local	If "Local" Supplier	CIF Lagos	Ex-factory	Cost at Iwopin H.
Alum		x	Drury Industries, Lagos		3.900 ³) 4.500 ⁴)	3.950 ³) 4.550 ⁴)
Rosin Size	x		West Germany	2.100DM/t		11.500
Starch (cassava or maize basis)		x	there are many lokal suppliers		5.950 - 6.950	6.000 - 7.000
	(x)			no import due to duty rate of 200%		
China Clay (Talcum Powder)	x			3.850		4.870
Wrapping Paper (125g)		x	Nigerian Paper Mill		10.943	11.250

1) incl. duty and transport to mill

3) kibbles

4) chips or powder

2) 850 Naira/ton have to be added every fifth time
for plastic jerry cans

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ANNEX A-2.3

Employment of Iwopin Paper Mill

	November 1987	February 1990
Management ¹⁾	2	2
Engineering, Workshop, Garage	14)))))))))) 31
Utility	9	
Drawing Office	5	
Electrical Workshop	15	
Civil Works	9	
Production/Warehouse	3	
Transport	16	
Accounts	8	3
Stores/Purchasing	11	7
Personnel	12	11
Medical	3	2
Security	31	40
Fire Brigade	15	11
Secretary	2	-
Lagos Office	9	11
Total	164	129

Source: Iwopin Paper Mill 1) incl. chief accountant

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ANNEX A-2.4

STATUS OF INSTALLATION ACTIVITIES UNDER
M & E CONTRACT (162-150)
 (UPTO JUNE, 1983)

Recvd
22.3.90

1.0 EQUIPMENT INSTALLATION

Particulars	Withdrawal from store	Set on foundation	Initial alignment and levelling.	Final alignment and grout	Checkout and test
(a) Estimated total (tons)	12,519	12,519	12,519	12,519	12,519
(b) Installation status (as on 30/6/83)(Tons)	8,161	7,601	7,046	5,895	116
(c) Balance - Installation (Tons)	4,058	4,918	5,473	6,624	12,403

2.0 PIPING & ACCESSORIES Details attached under Annex.I are being summarised below:

2.1 C. S. Piping - (above 50mm dia.)

- (a) Estimated total = 29,452 Metres
- (b) Installed = 500 Metres
- (c) Balance installation = 28,952 Metres

2.2 S.S. Piping - (above 50mm dia.)

- (a) Estimated total = 32,177 Metres
- (b) Installed = 300 Metres
- (c) Balance installation = 32,177 Metres

2.3 Steam (65/12/4.5 Bar) Piping (above 50mm dia.)

- (a) Estimated total = 766 Metres
- (b) Installed = 66 Metres
- (c) Balance installation = 700 Metres

2.4 All piping & Fittings below and upto 50mm dia.
 (To be supplied and installed by M&E Contractor)

- (a) Estimated total = 80,000 Metres
- (b) Installed = 100 Metres
- (c) Balance installation = 79,900 Metres

2.5 Hangers

- (a) Estimated total = 9,387 Nos.

(b) Installed = 42 Nos.

(c) Balance installation = 9,345 Nos

Of the total requirement, 147 hangers for Power group steam piping are supplied by owner. Rest of the quantity to be supplied and fabricated by M&E Contractor

3.0 TANKS

3.1 Tanks for site assembly and erection:

Particulars	Withdrawal from stores	Shake out Material & Check	Erect tank Plates	Weld out	Check out Test
(a) Estimated Total (Tons)	1,487	1,487	1,487	1,487	1,487
(b) Installation (as on - 30/6/83)(Tons)	1,420	1,387	1,193	592	NIL
(c) Balance installation (Tons)	67	100	294	895	1,487

3.2 Tanks (Shop Fabricated) Erection:

Particulars	Withdrawal from stores	Set on foundation.	Grout	Check out and test.
(a) Estimated total (Tons)	89	89	89	89
(b) Installation status (as on 30/6/83)(Tons)	51	46	43	NIL
(c) Balance - Installation (Tons)	38	43	46	89

4.0 INSULATION:

(a) Total estimated quantity = 47,301 sq.metres

(b) Installed = NIL

(c) Balance installation = 47,301 sq.Metres

5.0 REFRACTORY:

- (a) Total estimated quantity = 320 tons
- (b) Installed = NIL
- (c) Balance installation = 320 tons

6.0 THIN LINING:

- (a) Total estimated quantity = 157,320 sq.metres
- (b) Installed = 800 sq.metres
- (c) Balance installation = 156,520 sq.metres

7.0 INSTRUMENT PANELS & CONSOLE:

- (a) Total estimated quantity = 75 Nos.
- (b) Installed = NIL
- (c) Balance installation = 75 Nos.

8.0 INSTRUMENT CABLE, WIRING & TUBING:

- (a) Total estimated quantity = 2,663 Nos.
- (b) Installed = NIL
- (c) Balance installation = 2,663 Nos.

9.0 TRANSFORMERS & SWITCHGEARS:

Particulars	Withdrawl from stores	Instal Completely	Check out and test
(a) Estimated total (Nos.)	243	243	243
(b) Installation status (as on 30/6/83)(Nos.)	207	205	NIL
(c) Balance Installation(Nos.)	36	38	243

NOTE:- In addition to above, the control panels supplied alongwith the equipments are to be installed by the contractor.

10.0 MOTORS:

- (a) Total estimated quantity = 938 Nos.
- (b) Installed = 27 Nos.
- (c) Balance installation = 911 Nos.

11.0 LIGHTING & POWER OUTLETS:

- (a) Total estimated quantity = 5,189 Nos.
- (b) Installed = 921 Nos
- (c) Balance installation = 4,265 Nos.

NOTE:-

- (i) Only Lighting fixtures to be supplied by the owner. All necessary wiring and conduiting shall be supplied and installed by contractor.
- (ii) For out door lighting poles, cables etc. shall be supplied and installed by the contractor.
- (iii) All lighting distribution panels and lighting transformers shall be supplied by the owner but installed by the contractor.
- (iv) All power outlets including welding outlets shall be supplied by the owner.
- (v) All switch, sockets for indoor lighting shall be supplied and installed by the contractor.

12.0 POWER CABLES & TRAYS

Particulars	Withdrawl from stores	To instal support	To instal cable-tray	To pull Cable	Connections	Check and te
(a) Total - estimated (Metres)	17,890	17,890	17,890	17,890	17,890	17,890
(b) Installation status as on 30/06/83 (Metres)	3,980	3,980	3,980	NIL	NIL	NIL
(c) Balance - installation (Metres)	13,910	13,910	13,910	17,890	17,890	17,890

NOTE:-

- (i) Only cable trays and all types of cables shall be supplied by the owner.
- (ii) All Cable trays supports to be supplied and installed by the contractor. Supports for cables branching off from main cable trays to motors/equipments/control panels etc shall be supplied and installed by the contractor.
- (iii) The quantities (running length) of cable trays are shown. Estimated quantity of diff. types of cables are as follows:-

(a)	1 KV Power Cables	-	211,000 metres
(b)	5 KV Power Cables	-	10,000 "
(c)	11KV Power Cables	-	9,000 "
(d)	600V Control Cables	-	239,000 "

Total - 482,000 metres

- (iv) All cable glands and cable lugs, wherever necessary shall be supplied by the contractor, including cable jointing or termination kits for HV & LV cables.
- (v) All local push button stations shall be supplied and installed by the contractor.

Annexure - I
PENDING JOBS - CONTRACT 162-150

WORK CATEGORY: PIPING. (ABOVE 50 MM Ø)

' ALL MILL AREAS '

Total Quantity		ACTIVITY DESCRIPTION					
Description	Meters	Prepare Spool Drawing (Meters)	Withdraw from Store (Meters)	Fabrication (Meters)	Instal Pipe & Fittings (Meters)	Weld out (Meters)	Testing (Meters)
CS Up to 150	20,470	20,250	20,250	20,250	20,250	20,250	20,470
CS Above 150	8,982	8,732	8,732	8,732	8,732	8,732	8,982
SS Up to 150	14,629	14,629	14,629	14,629	14,629	14,629	14,629
SS Above 150	17,818	17,548	17,548	17,548	17,548	17,548	17,818
Power Group Piping	766	700	700	700	700	700	766

NOTE: All Pipes; Valves and Fittings of 50mm Ø and below will be supplied and installed by M & E Contractor. Estimated Quantity = 80 000 Meters.

STATUS REPORT HOUSING ESTATE

RESIDENTIAL BUILDINGS

3 - Bedroom Duplex	-	183	Nos
Bachelor Quarters	-	27	"
Management 'A' Bungalow	-	5	"
Management 'B' Bungalow	-	26	"
Motel Charlets	-	7	"
Motel Central Facilities			
(Not yet completed, 70% completed)	-	1	No.

NON RESIDENTIAL BUILDINGS

Nursery & Primary School	-	66%	completed
<u>Hospital complex</u>			
(a) Administrative/Diagonistic and Emergency Blocks	-	94%	"
(b) Ward (Male, Maternity and Isolation)	-	98%	"
(c) Cafeteria & Laundry	-	70%	"
(d) General store	-	100%	"

HILL SITE

1. Administrative Block
2. Training Building
3. Temporary Main Office

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ANNEX A-4.2

INVESTMENT COST ESTIMATES

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ANNEX A-4.2. - Investment Cost Estimates -

1. Equipment cost estimate

	Model A		Model B		
	US \$	1000N	US \$	1000N	
Stock preparation	-	-	150'000	50	
Paper mill	-	-	6'530'000	100	
Converting	1'900'000	100	2'200'000	100	
Steam production	-	-	385'000	100	
Power supply	50'000	30	400'000	100	
Water supply	67'000	30	67'000	30	
Effluent disposal	-	-	23'000	80	
Maintenance	1'000'000	50	2'000'000	100	
Communications	280'000	25	1'000'000	50	
Administration services	110'000	75	220'000	150	
Fire protection	170'000	25	220'000	25	
Laboratory, tech. contr.	60'000	-	340'000	50	
Pumps & agitators	-	-	110'000	-	
Piping	110'000	25	1'400'000	200	
Electrical	760'000	100	1'400'000	200	
Instrumentation	110'000	20	1'480'000	100	
Tile lining	-	-	-	-	
Gratings, etc.	-	-	720'000	160	
Mobile equipment	1'200'000	-	1'700'000	-	
Subtotal equipment	5'817'000	480	20'425'000	1'595	
Spare parts, etc.	700'000	50	2'700'000	200	
Freight	610'000	-	2'300'000	-	
Duties	-	3'600	-	14'000	
Total equipment	7'127'000	4'130	25'425'000	15'795	
		*)		*)	

*) Naira's 1987 basis (5.5N = 1 US\$)

Notes: Major cost components have been estimated with vendors input obtained in April/May 90. Other cost elements were calculated from P&W estimates, after critical review of such data and corresponding adoptions to the cost '90 level.

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- A-4.2.-2 -

ANNEX A-4.2. 2. Civil works cost estimate* - Mill

	Naira model A	Naira model B	
Earthwork	6'000	12'000	
Reinforced concrete	30'000	240'000	
Tiling	-	100'000	
Structural & ancill. steel	260'000	3'000'000	
Siding & masonry	75'000	300'000	
Roofing	133'000	300'000	
Flooring	15'000	165'000	
Internal finishing	70'000	250'000	
Apertures	60'000	90'000	
Lighting & L.V.Services	35'000	80'000	
Painting & decoration	35'000	70'000	
Structure & civil general	550'000	1'100'000	
Subtotal	1'304'000	6'007'000	
Contractor preliminaries	400'000	1'500'000	
Furniture	200'000	400'000	
Contingencies	100'000	300'000	
Total civil works, mill	2'004'000.-	8'207'000.-	

Note: * Civil costs for this Phase I estimates were preliminarily calculated using P+W cost elements of their '87 report, with the adaptations required for models A and B.

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- A-4.2.-3 -

ANNEX A-4.2. 3. Civil works cost estimate - Townsite

	model A (1)	model B (2)	
Houses & bungalows	5'825'000	10'850'000	
Emergency ward	200'000	200'000	
Water supply system	30'000	35'000	
Roads and drainage	1'500'000	1'750'000	
Electrification	200'000	250'000	
Total N	7'755'000	13'085'000	

- 1) Model A: 50% of houses, bachelors quarters, bungalows incl. ancillaries and services, no school, only emergency ward, no motel
- 2) Model B: All houses and bachelor quarters, 50% of the bungalows, incl. ancillaries & services, no school, no motel, only emergency ward.

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- A-4.2.-4 -

ANNEX A-4.2. 4. Erection cost estimate

	Model A		Model B		
	1000\$	1000N	1000\$	1000N	
Management & supervision	900	180	2'700	520	
Erectors, commiss. eng.	850	30	2'550	80	
Tradesmen, specialists	280	700	940	2'040	
Indirect & other labour	-	500	-	1'560	
subtotal manpower	2'030	1'410	6'190	4'200	
Camp operation	-	200	-	560	
Townsite cost	-	500	-	1'560	
Catering	-	500	-	1'680	
Medical & social serv.	20	60	65	180	
Fares & travel expenses	120	120	340	330	
subtotal pers. services	140	1'380	405	4'310	
Erection equipment	289	250	2'000	850	
" materials	45	150	180	660	
" consumables	35	150	125	630	
Temporary buildings	-	-	-	-	
Duties & levies	-	200	-	1'000	
Freight clearance	-	50	-	200	
subtot. equip. & material	360	800	2'305	3'330	
Lagos office expenses	30	250	80	800	
Communications	30	100	90	270	
Site office expenses	10	75	30	200	
Insurance	30	120	95	330	
Mobilisation & demobil.	170	175	600	600	
Overheads	200	400	940	1'380	
subtotal offices etc.	470	1'120	1'835	3'580	
Total erection	3'000	4'710	10'735	15'420	

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- A-4.2.-5 -

ANNEX A-4.2.

5. Total investment cost

	Model A		Model B		
	1000\$	1000N	1000\$	1000N	
Equipment	7'127	4'130	25'425	15'800	
Engineering	150	70	350	120	
Civil work (millsite)		2'000		8'200	
Erection	3'000	4'710	10'735	15'420	
subtotal mill site	10'277	10'500		39'540	
Townsite & infrastruc.		7'760		13'100	
Total	10'277	18'260	36'510	52'640	

Table: Investment Plan in '000.- USD MODEL B

Factory: Ivopin Paper Mill															
Investment	Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Pre-operational Expenses															
Engineering Consultancy		350.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Management Consultancy		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Training		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pre-operational Expenses		350.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fixed Investment															
Buildings and Civil Works		1,935.0	1,935.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Machinery and Equipment		29,485.0	12,417.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Furniture & Office Equipment		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vehicles and Boats		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Machine Tools		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fixed Investment		31,420.0	14,352.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Working Capital Change															
Material in Stock		0.0	0.0	12,572.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Finished Goods Stock		0.0	0.0	4,745.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Work in Process Stock		0.0	0.0	1,489.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trade Debtors		0.0	0.0	5,287.6	661.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trade Creditors		0.0	0.0	4,190.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Working Capital Built Up		0.0	0.0	19,904.0	661.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL INVESTMENT		31,770.0	14,352.0	19,904.0	661.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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ANNEX A-4.3

Financial Analysis

INPUT DATA - FINANCIAL ANALYSIS

P-5108/03.6-1

Annex A-4.3

-A-4.3-1-

Factory: Iwopin Paper Mill 'Mod B'

90/6/13/RST

FINANCIAL ANALYSIS IN 1000 US\$

Exchange Rate March 1990: 1US\$ =

1
7.9 Naira

	Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Printing and Writing Paper															
Capacity (mt per shift)		67													
Capacity Utilization		0%	0%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%
Working Days per Year		340													
Number of Shifts		3													
Production (1000 mt)		0.0	0.0	57.8	57.8	57.8	57.8	57.8	57.8	57.8	57.8	57.8	57.8	57.8	57.8
Sales in Reels (1000 mt)		0.0	0.0	15.4	17.3	17.3	17.3	17.3	17.3	17.3	17.3	17.3	17.3	17.3	17.3
Sales in Sheets (1000 mt)		0.0	0.0	36.0	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5
Product Mix															
o Paper in Reels		30%													
o Paper in Sheets		70%													
o Paper Quality: wf=1, wc=2		1													
Working Capital Requirements															
Local Material Stock (month)		1													
Imported Material Stock (month)		3													
Work in Process (days)		10													
Finished Goods Stock (month)		1													
Trade Debtors (day)		30													
Trade Creditors (days)		30													
Ex-Factory Prices															
Paper in Reels	US\$/mt	wf	wc												
Paper in Sheets	US\$/mt	1200	1100												
	US\$/mt	1250	1150												
Material Costs															
Pulp	US\$/t mat.		kg/ft		Material Costs (US\$/ft)										
o Bl LF Chemical Pulp (ad)		wf	wc	wf	wc										
o TPF Pulp		840	375	235.2	315.0										
o Bl SF Chemical Pulp (ad)		620	590	0.0	365.8										
o Bl SF Chemical Pulp (ad)		790	655	0	517.5	0.0									
Chemicals and Additives															
o China Clay		616	85	95	52.4	58.5									
o Size		1455	7	7	10.2	10.2									
o Alum		500	12	12	6.0	6.0									
o Starch		886	45	12	39.9	10.6									
Wrapping Material					9.0	9.0									
Total Material Costs				870.1	775.1										
Cost of Personnel (1000 Naira p.a.)															
General Manager's Office			383.6												
Production			3,210.0												
Maintenance			1,417.8												
Administration			1,408.4												
Finance			1,093.7												
Commerce			654.8												
Total Cost of Personnel			8,168.3												
Number of Personnel			550												

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Operational Costs	I				
Utilities	I				
o Power	I	800.0	kWh/ft	0.3 kg Diesel/kWh	240.0 kg diesel/ft
o Steam	I	2.5 t	steam/ft	14.0 t steam/t oil	178.6 kg fuel oil/ft
o Fuel Oil	I	424	Naira/t		
o Diesel	I	375	Naira/t		
	I				
Insurance Premium (1000 Naira p.a.)	I				
- Paper Mill	I	4200			
- Barges	I	900			
- Vehicles	I	300			
- Housing Estate	I	200			
	I				
Depreciation Rates (linear depr)	I				
Buildings	I	4%			
Machinery & Equip 1.Year	I	5%			
Machinery Equip after 1.Year	I	5%			
Furniture & Office Equip.	I	20%			
Vehicles	I	20%			
Loose Tools	I	25%			
Pre-investment	I	33%			
	I				
Repair and Maintenance	I				
Buildings	I	1%			
Machinery and Equipment	I	40	US\$/ft		
Vehicles	I	3%			
Boats	I				
	I				

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-A-4.3-3-

ANNEX A-4.3

Model A

	I	
Analysis of Contribution Margin	I	US \$ / ft
1. Revenues	I	
o Paper in Reels	I	0.0
o Paper in Sheets	I	1,250.0
o Sale of Paper Cut-offs	I	24.0
Total Revenues	I	1,274.0
2. Costs	I	
o Materials	I	1,305.0
o Power	I	0.3
o Steam	I	0.0
o Direct labour	I	
Total Costs	I	1,305.3
Contribution Margin	I	(31.3) -2%

Model B

	I	US \$ / ft	
Analysis of Contribution Margin	I	wf	wc
1. Revenues	I		
o Paper in Reels	I	360.0	330.0
o Paper in Sheets	I	875.0	805.0
Total Revenues	I	1,235.0	1,135.0
2. Costs	I		
o Materials	I	870.1	775.1
o Power	I	12.9	12.9
o Steam	I	8.5	8.5
o Direct labour	I		
Total Costs	I	891.4	796.5
Contribution Margin	I	343.6 28%	338.5 30%

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ANNEX A-4.3

-A-4.3-4-

CASH FLOW FOR FIRR BEFORE TAXATION (1000 US\$)

Factory: Iwopin Paper Mill **MODEL 'B'**

Item	I	Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Cash Inflow	I															
Sales Revenue	I		0.0	0.0	63,451.6	71,383.0	71,383.0	71,383.0	71,383.0	71,383.0	71,383.0	71,383.0	71,383.0	71,383.0	71,383.0	71,383.0
Residual Value (Year 12)	I														0.0	0.0
Working Capital	I														0.0	20,564.9
Cash Inflow	I		0.0	0.0	63,451.6	71,383.0	71,383.0	71,383.0	71,383.0	71,383.0	71,383.0	71,383.0	71,383.0	71,383.0	71,383.0	91,947.9
Cash Outflow	I															
Investment	I															
Preinvestment Expenses	I		350.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fixed Investments	I		31,420.0	14,352.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Change in Working Capital	I		0.0	0.0	19,904.0	661.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal	I		31,770.0	14,352.0	19,904.0	661.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Operations	I															
Materials	I		0.0	0.0	50,289.8	50,289.8	50,289.8	50,289.8	50,289.8	50,289.8	50,289.8	50,289.8	50,289.8	50,289.8	50,289.8	50,289.8
Salaries, Wages, Uniforms, Med. Exp.	I		189.1	189.1	1,170.0	1,170.0	1,170.0	1,170.0	1,170.0	1,170.0	1,170.0	1,170.0	1,170.0	1,170.0	1,170.0	1,170.0
Repair & Maintenance	I		67.7	67.7	2,400.9	2,400.9	2,400.9	2,400.9	2,400.9	2,400.9	2,400.9	2,400.9	2,400.9	2,400.9	2,400.9	2,400.9
Other Operational Cost	I		278.6	278.6	3,083.7	3,083.7	3,083.7	3,083.7	3,083.7	3,083.7	3,083.7	3,083.7	3,083.7	3,083.7	3,083.7	3,083.7
Subtotal	I		535.3	535.3	56,944.4	56,944.4	56,944.4	56,944.4	56,944.4	56,944.4	56,944.4	56,944.4	56,944.4	56,944.4	56,944.4	56,944.4
Overheads	I															
Administration	I		9.4	9.4	222.2	222.2	222.2	222.2	222.2	222.2	222.2	222.2	222.2	222.2	222.2	222.2
Selling & Distribution	I		0.3	0.3	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Other Overheads	I		21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8
Subtotal	I		31.5	31.5	302.5	302.5	302.5	302.5	302.5	302.5	302.5	302.5	302.5	302.5	302.5	302.5
Net Assets Existing Plant	I		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cash Outflow	I		32,336.9	14,918.9	77,150.9	57,907.8	57,246.9	57,246.9	57,246.9	57,246.9	57,246.9	57,246.9	57,246.9	57,246.9	57,246.9	57,246.9
NET CASH FLOW	I		(32,336.9)	(14,918.9)	(13,699.3)	13,475.2	14,136.1	14,136.1	14,136.1	14,136.1	14,136.1	14,136.1	14,136.1	14,136.1	14,136.1	34,701.1
FIRR	I		16.0%													
NET PRESENT VALUE AT 10 %	I		21,926.6													

Table : SENSITIVITY ANALYSIS FOR FIRR

Factory: Iwopin Paper Mill	I	Variation of Parameter								
		I	-20%	-15%	-10%	-5%	0%	5%	10%	15%
Paper Prices	I	(10.8)	(2.2)	4.7	10.7	16.0	20.9	25.6	29.9	34.1
Pulp Costs	I	28.9	25.8	22.6	19.4	16.0	12.5	9.0	5.2	1.2
Salaries and Wages	I	16.3	16.2	16.2	16.1	16.0	15.9	15.8	15.8	15.7
Capacity Utilization	I	12.0	13.1	14.1	15.1	16.0	16.9	17.8	18.6	19.4
Investment Costs	I	19.3	18.4	17.6	16.8	16.0	15.3	14.6	14.0	13.4

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- A-5 -

ANNEX A-5 Units and Abbreviations

a	=	year
d	=	day
w	=	week
mo	=	month
kg	=	kilogram
t	=	metric ton (1000 kg)
ft	=	finished ton (paper at 94% dry content with wrapper)
ad	=	air dry (for pulp, defined as 90% dry content)
od	=	oven (or bone) dry, 100% dry content
LF	=	Long fiber (for softwood pulp)
SF	=	Short fiber (for hardwood pulp)
BL	=	Bleached
WC	=	Wood containing (paper)
WF	=	Wood free (paper)
TMP	=	Thermo-mechanical pulp