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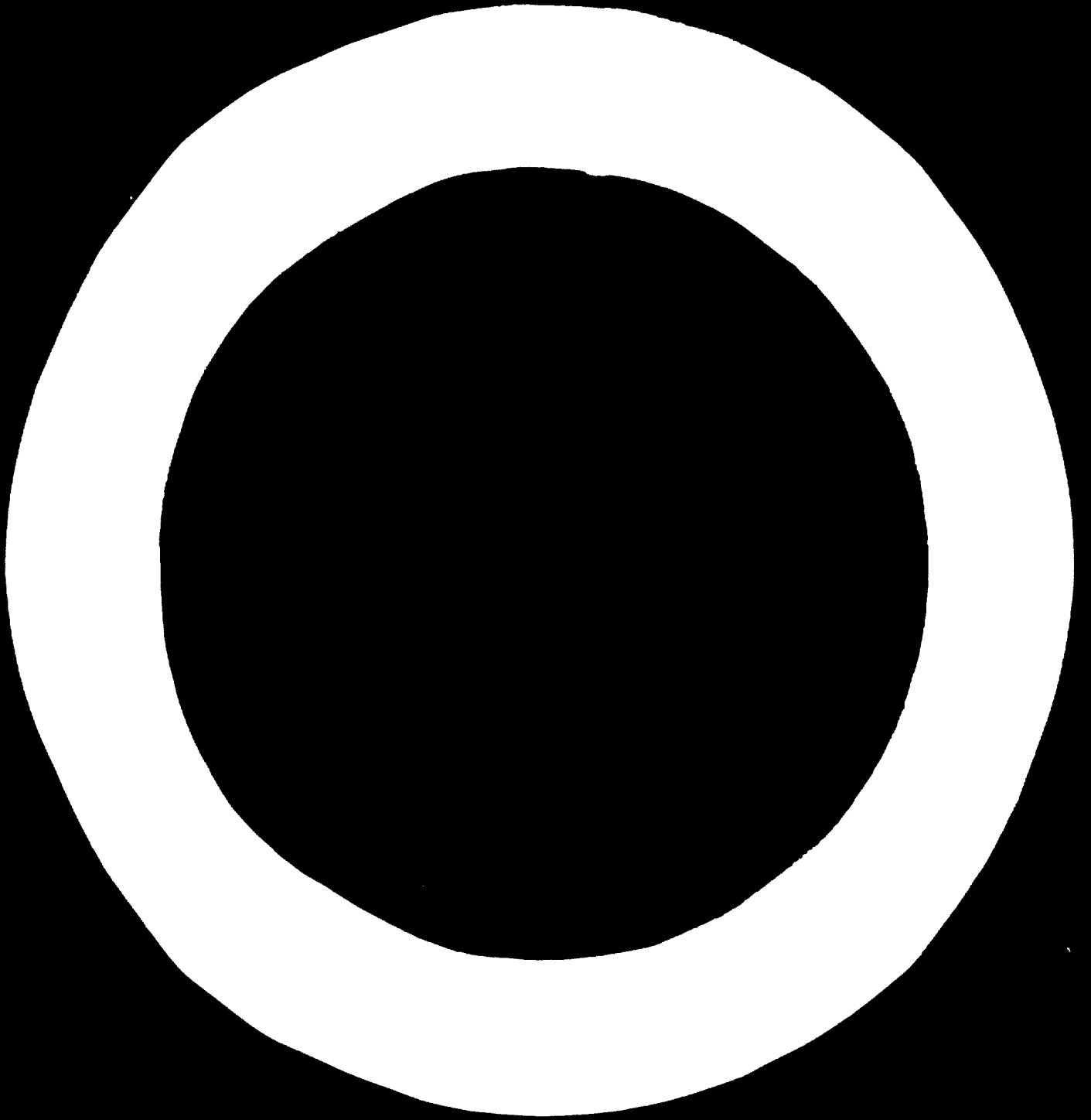
**EXTRACTS OF  
INDUSTRIAL  
FEASIBILITY STUDIES**

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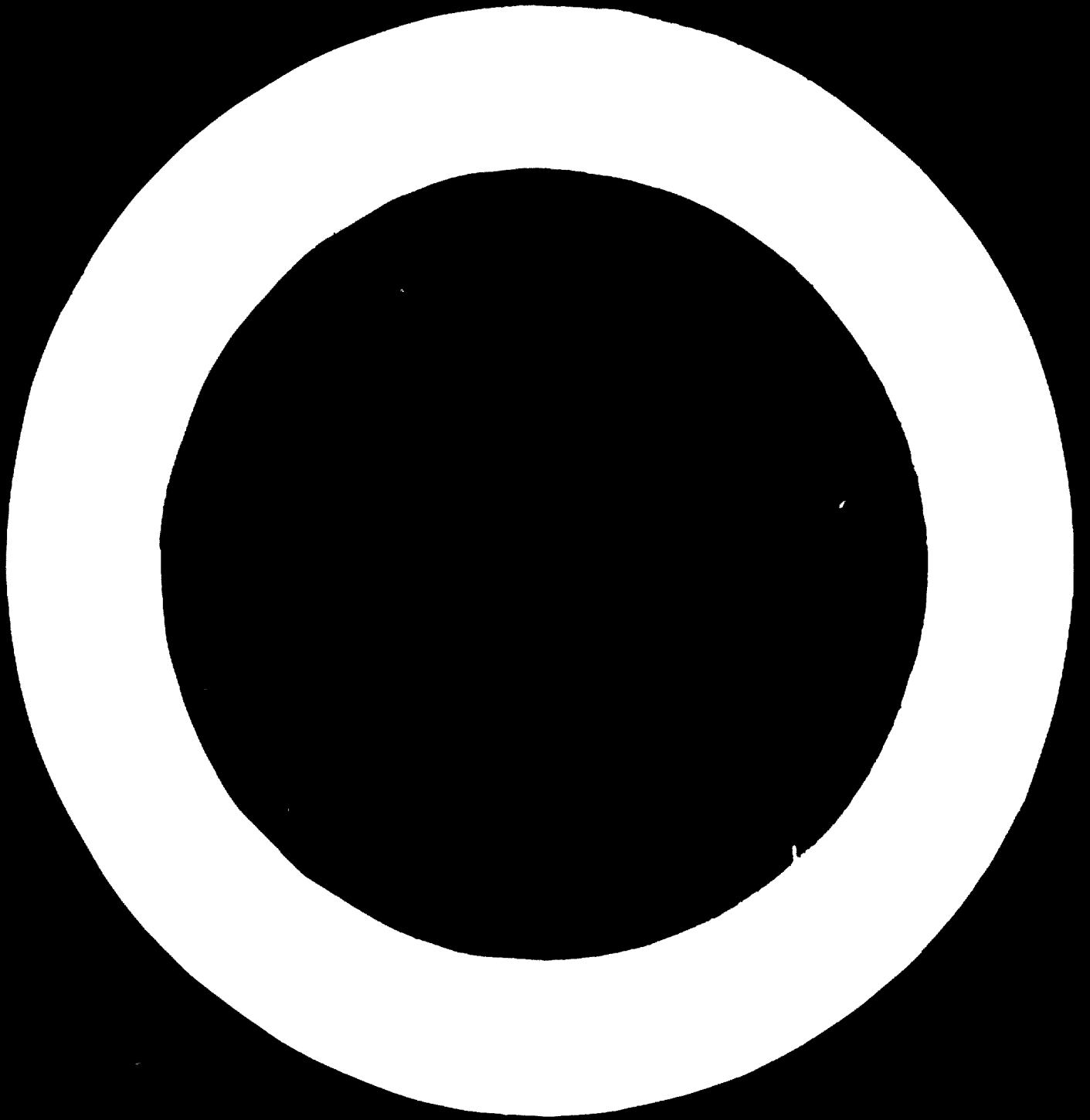
**Volume I**



**UNITED NATIONS**



**EXTRACTS OF INDUSTRIAL FEASIBILITY STUDIES**



United Nations Industrial Development Organization, Vienna

Industrial Planning and Programming Series, No. 7

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**EXTRACTS OF  
INDUSTRIAL  
FEASIBILITY STUDIES**

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**Volume I**



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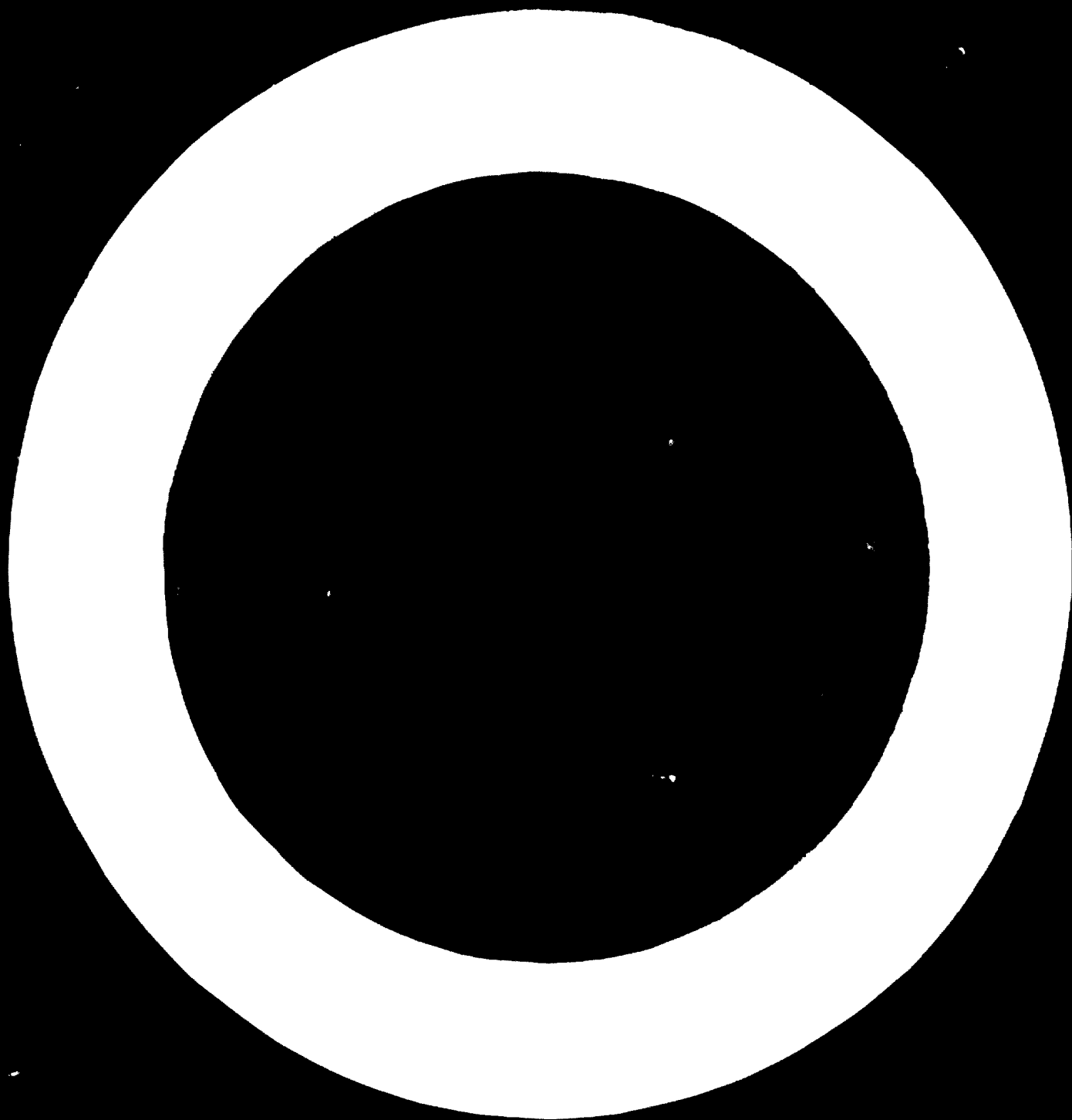
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## INTRODUCTION

This is the first issue of *Extracts of Industrial Feasibility Studies*, a series dealing with reference data for planning industrial projects. It provides techno-economic information of general reference value, extracted from the material being generated and accumulated in the process of pre-investment appraisal of industrial projects in various developing countries. In an attempt to salvage the scattered but ever growing stockpiles of industrial feasibility studies, the utility of which is normally extremely short-lived despite the high cost of their preparation, the *Extracts* go a few steps further than the conventional "cataloguing" of these documents. Namely, each extract provides an analytical summary of the technical substance of a relatively well-documented feasibility study, condensed for a certain range of uses connected with industrial project planning.

The readers who are already acquainted with UNIDO's *Profiles of Manufacturing Establishments*<sup>1</sup> will note that the *Extracts* and the *Profiles* are twin series of reference data for industrial programming, sharing a common broad objective: to assist the technical personnel and experts engaged in such activities as the evaluation of shortcomings and potentials of existing industries and planned projects, preliminary assessment of new investment opportunities, preparation of technical and economic feasibility studies, and evaluation of offers from potential suppliers in developing countries. In contrast to the *Profiles*, which are based on direct observations from actually operating industrial units, the *Extracts* draw upon the well-informed imagination of those who attempt to formulate details of new industrial facilities to be installed. In both publications, stress is not placed so much on "technological norms" for production engineering as on the images of economic activity units that operate or are expected to operate under various socio-economic and regional conditions. As the *Profiles* and the *Extracts* have a similar descriptive framework and the information they contain is complementary, they may be used to even greater advantage together.

<sup>1</sup> Volume I (ID/SER.E/4; United Nations publication, Sales No. 67.II.B.17); Volume II (ID/SER.E/5; United Nations publication, Sales No. 68.II.B.15); Volume III (ID/SER.E/6; United Nations publication, Sales No. 71.II.B.12).

### *Source material for the Extracts*

Each extract is compiled in a standard form established specifically for this purpose. Preferably, each of the techno-economic feasibility studies to be selected and digested into this form should be a "good" study, in the sense:

That it presents a well-designed investment project, properly adapted to the conditions prevailing in the given developing country or region; and

That it is prepared so as to permit a comprehensive, balanced and thoroughly critical evaluation of the given project.

The first qualification will assume importance particularly if the extracts are to be utilized as a source of information on "programming norms", for pre-investment planning purposes. However, if the extracts are to be useful as an instrument for practical training in industrial project evaluation, the second qualification will be far more important, since a balanced, critical evaluation of a poorly designed investment proposal would be more valuable than an incomplete evaluation of a well-designed project.

In fact, however, many "well-documented" pre-investment studies devote more to technical details of plausible project designs than to a critical assessment of the socio-economic priorities to be accorded to given projects. This is often the case with the studies contracted to professional engineering consulting groups. Full evaluation of projects in terms of their "national profitability" and implementation priorities will, as a rule, be made after such studies have been documented, and that part of the decision-makers' task is seldom eligible for documentation except in the form of internal (often confidential) memoranda. The choice of source materials for the extracts will thus tend to be based on their utility primarily in terms of the first qualification mentioned above. Those who are concerned with the guidelines for socio-economic cost/benefit analysis of development projects in general are invited to consult other sources, the ID/SER.H series in particular among the UNIDO publications.<sup>2</sup>

<sup>2</sup> *Evaluation of Industrial Projects* (United Nations publication, Sales No. E.67.II.B.23). *Guidelines for Project Evaluation* (United Nations publication, Sales No. E.72.II.B.11).

As will be clear from the lay-out in the standard form, a "well-documented" feasibility study usable for the purpose of the extracts is one that gives a complete picture of an industrial investment project, in a reasonable degree of detail, with respect to:

(a) Markets for each particular product-line considered;

(b) Technical specification of proposed factories (that is, consideration of possible alternative technologies);

(c) Estimation of investment costs (preferably with an explicit indication of the factors determining the equipment prices applicable to a given region or locality);

(d) Analysis of the potential cost-price behaviour as anticipated under given local conditions;

(e) Financial and technical co-operation arrangements likely to be available for implementation of the project;

(f) Profitability assessment with due consideration of the feasible time schedule for project implementation and capacity utilization.

Such feasibility studies differ from the so-called "opportunity" studies or "pre-feasibility" studies, which refer to a less advanced stage of project preparation, on the one hand, and, on the other, from the "blueprints" for project engineering, which are drawn up as projects move into their actual construction phase.

Since most feasibility studies entail commercial secrecy and often copyrights, "neutralization" of the information contained in each source material is crucial for the compilation of extracts for general dissemination. Countries and institutions involved in the preparation of the original studies should not be mentioned. In some cases, even the continent in which the projects under study are to be located may not be disclosed. Both skill and care need to be exercised in satisfying the "neutrality" condition. Whether or not the projects under study were ever implemented should not be questioned for the purpose of the *Extracts*, even though it could offer an effective criterion for defining what are "good" feasibility studies.

Studies prepared some years ago, although the technological data may be obsolete in some respects, might none the less be found to have a high reference value in other respects. The *Extracts* are by no means meant to be a foolproof collection of "project models". But rather, they are meant to provide comparative reference points to help in the critical evaluation of specific project ideas as envisaged under given socio-economic conditions. Thus, some of the old material stored

in the archives of industrial development institutions—studies which were once used and have since been shelved—may be revived to better purpose through the *Extracts*.

It would be highly desirable to decide on a definitive plan for this series with regard to the types of industry to be covered. As in the case of the *Profiles*, however, this is likely to be rather impracticable within the limitations of the resources available for this programme. Many fields of industry and types of project are of interest for the developing countries. As the stock of available source materials increases, the coverage of the *Extracts* will also grow. It would be rewarding indeed to study two or more directly comparable cases envisaged under different regional constraints. But the *Extracts* are intended as a source for practical application and not for comparative analyses of project-planning methodologies. It is important that they have an established place in the international clearing-house for industrial information, to be kept up by UNIDO as a continuing long-term programme, drawing upon voluntary contributions from countries and institutions and guided by the expressed interests of the developing countries in regard to both their coverage and content.

#### *Volume I as a pilot set*

This first volume contains 24 extracts covering various branches of industry. Some are based on *ad hoc* contributions from outside, and some draw on the material generated from UNIDO's technical assistance operations. The compilation of these cases proceeded without a strict plan as to the types of project to be included, since the exercise had to be undertaken before a sufficient number of "good" candidate studies had been accumulated in the files of the UNIDO secretariat. The selection of the cases in this volume does not therefore follow any special theme. The main purpose is to acquaint the public with the method, and to invite suggestions and contributions from a broader range of sources than those so far involved in this programme.

The particular format of the extracts presented here may be regarded as only tentative. In an attempt to demonstrate what exactly could be done to neutralize the substance of each source material, an effort was made to retain as much detail as possible that would be of analytical interest to industrial project planning. The standard form used seems to represent just about the least truncated version that would be acceptable for the purpose of the extracts. For the continuation of this series, a somewhat less detailed presentation might be considered.

The nature of the information entered under the various headings and items in the standard form is explained in the technical notes below.

#### *Main uses of the Extracts*

As explained elsewhere,<sup>3</sup> the *Extracts* are expected to be put to practical use mainly in two ways:

(a) When new investment ideas are analysed in a preliminary way, before committing resources for fully fledged feasibility studies;

(b) When other feasibility studies or offers from potential suppliers need careful technical evaluation, with attention to possible variations in project designs and in cost estimates under different regional conditions.

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<sup>3</sup> A preliminary note on this new series was published in *Industrialization and Productivity Bulletin*, No. 17 (United Nations publication, Sales No. E.71.II.B.8), pp. 17-19.

There may also be occasions when information contained in pre-investment studies proves useful even in assessing the performance of actual factories.

Apart from the utility of the published *Extracts*, their standardized framework may serve in itself as a check list for the evaluation of the completeness and consistency of a given feasibility study. Some high-level officials in governmental development administration have shown an interest in introducing this type of summarization in their respective offices. *Pro forma* summarization and transcription of voluminous feasibility-study documents require a thorough reading and comprehension of the substance and may in fact be helpful in locating errors in calculation and inconsistent assumptions in the original studies, which might otherwise pass unnoticed. The work may also prove a highly effective exercise in self-training for the technical staff concerned with industrial programming.

## INTRODUCTION

La présente publication est la première livraison d'une série intitulée *Extraits d'études de faisabilité industrielle*, dont le but est de fournir des données utilisables pour la planification des projets industriels. Elle contient des renseignements technico-économiques qui proviennent d'études effectuées pour évaluer des projets industriels dans divers pays en voie de développement. Le nombre de ces études de faisabilité industrielle va sans cesse croissant, mais elles sont dispersées et leur période d'utilisation est généralement très courte, malgré leur coût élevé. Pour prolonger leur vie utile, nous avons cru devoir ne pas nous borner à en dresser un simple catalogue; chaque *Extrait* présente donc un résumé analytique du contenu technique d'une étude de faisabilité relativement bien documentée, condensée en vue d'un certain nombre d'utilisations liées à la planification des projets industriels.

Les lecteurs qui connaissent déjà les *Profils d'établissements industriels* de l'ONUDI<sup>1</sup> constateront que les *Extraits* et les *Profils* sont deux séries jumelles de données utilisables pour la programmation industrielle dans les pays en voie de développement, dont l'objectif général est le même: aider les techniciens et les experts dans des domaines tels que l'évaluation des insuffisances et des potentiels des industries existantes et des projets prévus, l'évaluation préliminaire des investissements envisagés, l'élaboration d'études techniques et économiques de faisabilité et l'évaluation des offres des fournisseurs. A la différence des *Profils* qui sont basés sur l'observation directe d'unités industrielles déjà en service, les *Extraits* utilisent les prévisions et estimations des techniciens chargés d'établir les plans des nouvelles installations industrielles. Les deux séries de publications ne visent pas tant à fournir des «normes technologiques» applicables à l'organisation de la production qu'à donner des exemples d'unités économiques qui fonctionnent ou fonctionneront dans des contextes géographiques et socio-économiques variés.

Les *Profils* et les *Extraits* contenant des données complémentaires présentées suivant des plans

analogues, leur utilisation conjuguée semble particulièrement souhaitable.

### *Sources utilisées pour les Extraits*

Chaque extrait est établi conformément à un modèle spécialement conçu à cette fin, chaque étude de faisabilité technico-économique résumée satisfaisant autant que possible aux critères suivants:

Presenter un projet d'investissement bien conçu et bien adapté aux conditions existantes dans le pays ou la région en voie de développement considéré;

Permettre une évaluation globale, équilibrée et très critique du projet.

Le premier critère est particulièrement important si le résumé doit être utilisé comme source d'informations sur les «normes de programmation» servant pour des études de préinvestissement. Mais si l'on recherche un moyen pratique de formation en vue de l'évaluation des projets industriels, c'est le deuxième critère qui sera de beaucoup le plus important, car une évaluation équilibrée et critique d'un projet d'investissement médiocrement conçu sera en ce cas plus utile que l'évaluation incomplète d'un projet bien conçu.

En fait, beaucoup d'études de préinvestissement «bien documentées» sont plus axées sur les détails techniques de projets théoriquement satisfaisants que sur les priorités socio-économiques à accorder aux investissements envisagés. Il en est souvent ainsi dans les études confiées à des sociétés d'ingénieurs-conseils. En règle générale, l'évaluation complète des projets en fonction des critères de «rentabilité nationale» et des priorités de réalisation est faite après la constitution de la documentation utilisée pour les études de faisabilité et, pour cette partie de leur tâche, les responsables n'utilisent guère pour se documenter que des mémorandums intérieurs, souvent confidentiels. Les études de faisabilité à partir desquelles sont établis les *Extraits* seront donc plutôt choisies en fonction du premier des deux critères mentionnés ci-dessus. Les lecteurs qui chercheraient des directives pour l'analyse des coûts et des avantages socio-économiques des projets de développement auront donc intérêt à consulter

<sup>1</sup> Volume I (ID/SER.E/4; publication des Nations Unies, numéro de vente: 67.II.B.17); volume II (ID/SER.E/5; publication des Nations Unies, numéro de vente: 68.II.B.13); volume III (ID/SER.E/6; publication des Nations Unies, numéro de vente: 71.II.B.12).

d'autres sources et notamment, parmi les publications de l'ONUDI, la série ID/SER. H<sup>2</sup>.

L'examen du modèle utilisé pour les extraits montrera qu'une étude de faisabilité « bien documentée », utilisable aux fins de la présente publication, est une étude qui donne un tableau complet d'un projet d'investissement industriel, avec suffisamment de détails sur chacun des points suivants:

a) Débouchés existant pour chacune des fabrications envisagées;

b) Caractéristiques technologiques des usines envisagées (c'est-à-dire examen de plusieurs solutions possibles);

c) Estimation des coûts d'investissement (de préférence avec indication précise des facteurs qui influent sur les prix de l'équipement dans une région ou une localité donnée);

d) Analyse de l'évolution probable des prix de revient compte tenu des conditions locales;

e) Coopération financière et technique prévue pour l'exécution du projet;

f) Evaluation de la rentabilité compte tenu du temps que demandera vraisemblablement la réalisation du projet et du degré d'utilisation de la capacité installée.

Ces études de faisabilité diffèrent d'une part des études dites « d'opportunité » ou de « pré-faisabilité » qui ont trait à un stade moins avancé de l'élaboration du projet et, d'autre part, des plans d'exécution qui sont établis au stade de la mise en œuvre du projet.

Etant donné que le secret commercial s'applique à la plupart des études de faisabilité et que le droit de reproduction est souvent réservé, une « anonymisation » des informations contenues dans les études à partir desquelles on établit des extraits destinés à une diffusion générale est indispensable. Les pays et les institutions qui ont participé à la préparation des études ne doivent pas être mentionnés. Dans certains cas, on n'indiquera même pas le continent où le projet étudié doit être réalisé. Assurer cet « anonymat » des informations exige de l'habileté et de la prudence. Il n'est pas indispensable qu'un projet ait été exécuté pour qu'un extrait soit tiré des études préalables, bien que l'exécution puisse constituer un bon critère pour le choix des études de faisabilité à exploiter.

Même si les données technologiques qu'elles contiennent sont périmées à certains égards, les études rédigées il y a quelques années peuvent

fournir des éléments de référence très utiles. Les *Extraits* ne sont pas un recueil de « projets modèles » à imiter en toute sécurité. Leur but est de fournir des points de comparaison et de faciliter ainsi l'évaluation critique de projets spécifiques envisagés dans des conditions socio-économiques données. Ainsi, une partie de la documentation accumulée dans les archives des institutions de développement industriel — en l'espèce, des études rangées dans des cartons après avoir servi — pourra en ressortir et connaître, grâce aux *Extraits*, un regain d'utilité.

Il aurait été souhaitable de dresser au départ la liste des types d'industries que doit couvrir cette nouvelle publication, mais, comme pour les *Profils*, cela n'est guère possible compte tenu des ressources limitées dont on dispose pour ce programme. Nombreux sont les secteurs industriels et les types de projets qui intéressent les pays en voie de développement. A mesure que s'accroîtra dans les *Extraits* la documentation exploitable le nombre des sujets traités ira lui aussi en augmentant. Il serait évidemment intéressant de pouvoir comparer plusieurs études relatives à des projets analogues, mais se situant dans des contextes régionaux différents. Mais les *Extraits* sont destinés à des usages pratiques et non à l'analyse comparée des méthodes de planification des projets. Il faudra qu'ils aient leur place dans le programme du Centre international d'échange de renseignements industriels que l'ONUDI va créer à titre permanent, faisant appel aux contributions volontaires des pays et des institutions et répondant, pour ce qui est de leur contenu et de leur portée, aux vœux exprimés par les pays en voie de développement.

#### *Le Volume I est un volume pilote*

Ce premier volume contient 24 extraits relatifs à différentes branches de l'industrie. Certains s'appuient sur des études provenant de l'extérieur et communiquées à l'ONUDI à cette fin, et d'autres sur des travaux effectués pour des opérations d'assistance technique de l'ONUDI. Le choix des matières n'a pas résulté d'un plan rigoureux, le Secrétariat de l'ONUDI ne possédant pas dans ses dossiers, au moment où le travail a dû être entrepris, un nombre suffisant d'études utilisables. Le choix des cas présentés ne répond donc pas à une sélection systématique. Le but essentiel était de faire connaître la méthode et d'inciter d'autres organismes que ceux qui ont déjà prêté leur concours pour ce premier volume à formuler des suggestions et à envoyer des contributions.

<sup>2</sup> *Evaluation of Industrial Projects* (publication des Nations Unies, numéro de vente: E.67.II.B.23). *Guidelines for Project Evaluation* (publication des Nations Unies, numéro de vente: E.72.II B.11).

La longueur des extraits figurant dans le présent volume ne signifie pas nécessairement que les articles des volumes à venir auront le même développement. Voulant démontrer ce qu'il était possible de faire pour « anonymiser » les informations contenues dans chacune des sources utilisées, nous nous sommes efforcés de conserver le plus grand nombre possible de détails présentant un intérêt analytique pour la planification de projets industriels. Le modèle uniforme utilisé représente probablement la version la moins condensée qu'il soit possible de donner dans des extraits. Une présentation un peu moins détaillée pourrait être envisagée pour les volumes suivants.

La nature des renseignements fournis sous les différentes rubriques du modèle uniforme est expliquée dans les notes techniques ci-après.

### *Principales utilisations des Extraits*

Comme il a été dit dans une note préliminaire publiée à leur sujet<sup>3</sup>, les deux principales utilisations pratiques des *Extraits* devraient être les suivantes :

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<sup>3</sup> « Extraits tirés d'études de faisabilité industrielle », *Industrialisation et Productivité, Bulletin n° 17* (publication des Nations Unies, numéro de vente: F.71.II.B.8), pages 17 à 19.

a) Faciliter l'examen préalable de nouveaux projets d'investissement, avant d'engager des ressources dans des études approfondies;

b) Faciliter l'évaluation technique de projets d'études de faisabilité ou des offres de fournisseurs, compte tenu du fait que la conception et le devis d'un projet peuvent varier suivant les conditions régionales.

Les renseignements contenus dans les études de préinvestissement peuvent même parfois servir à évaluer les résultats obtenus par des usines existantes.

L'utilité des *Extraits* ne se limite pas aux informations qu'ils contiennent puisque le plan suivant lequel ils sont rédigés peut servir à vérifier si une étude de faisabilité est complète et cohérente. Certains hauts fonctionnaires d'organismes gouvernementaux de développement ont jugé qu'il y aurait intérêt à introduire ce type de résumés dans leurs services. Résumer selon un modèle uniforme de volumineuses études de faisabilité exige une lecture attentive et un effort d'analyse et peut même aider à déceler des erreurs de calculs et des hypothèses non fondées qui autrement seraient passées inaperçues. Ce travail peut aussi constituer un moyen très efficace d'autoformation pour le personnel des services techniques de programmation industrielle.

## ВВЕДЕНИЕ

Данный документ является первым изданием *Выдержек из предпроектных исследований в промышленности* — серии документов со справочными данными для планирования промышленных проектов. В нем содержится технико-экономическая информация, имеющая общий справочный характер и взятая из документации, выпускаемой и собираемой в процессе предынвестиционной оценки промышленных проектов в различных развивающихся странах. Как попытка собрать разбросанный, но постоянно возрастающий объем предпроектных исследований в промышленности, полезность которых, как правило, крайне недооценена, несмотря на высокие расходы, затрачиваемые на их подготовку, *Выдержки* являются более совершенными, чем обычное „составление каталогов“ по этим документам. А именно, каждая выдержка дает краткий аналитический обзор технической сущности относительно хорошо документированного предпроектного исследования, изложенного в сжатой форме для определенных областей применения, связанных с промышленным планированием проектов.

Читатели, которые уже знакомы с *Профилями ЮНИДО по производственным предприятиям*<sup>1</sup>, заметят, что *Выдержки* и *Профили* являются аналогичными сериями справочных данных для промышленного программирования и имеют одну общую широкую цель: помочь техническому персоналу и экспертам, занятым в таких видах деятельности, как оценка недостатков потенциальных возможностей действующих отраслей промышленности и запланированных проектов, предварительная оценка новых возможностей инвестирования, подготовка технико-экономических предпроектных исследований и оценка предложений от возможных поставщиков в развивающихся странах. В противоположность *Профилям*, которые составлены на основе непосредственных наблюдений за фактически действующими промышленными установками, *Выдержки* используют идеи хорошо информированных специалистов, пытающихся подробно обосновать вновь создаваемые промышленные предприятия. В обеих публикациях упор делается не столько на „технологические нормы“ производственного процесса, сколько на конкретных моделях объектов экономической деятельности, которые находятся в эксплуатации или, как ожидают, будут введены в эксплуатацию в различных социально-экономических и региональных условиях. Поскольку *Профили* и *Выдержки* имеют аналогичную структуру изложения, а содержащаяся в них

информация является взаимодополняемой, то их совместное использование может принести еще большую пользу.

### *Исходный материал для Выдержек*

Каждая выдержка составляется по стандартной форме, созданной специально для этой цели. Желательно, чтобы каждое из технико-экономических предпроектных исследований, которое должно отбираться и излагаться по данной форме, было „хорошим“ исследованием, т.е. чтобы:

оно представляло собою хорошо разработанный в области инвестирования проект, должным образом отвечающий условиям, преобладающим в данной развивающейся стране или районе; и

его содержание позволяло провести всеобъемлющую, сбалансированную и тщательно подготовленную критическую оценку данного проекта.

Первое условие приобретет важность особенно в случае, если выдержки должны будут использоваться в качестве источника информации по „нормам программирования“ в целях предынвестиционного планирования. Однако если выдержки должны стать полезным инструментом практической подготовки кадров в области оценки промышленных проектов, то второе условие будет значительно более важным, поскольку сбалансированная критическая оценка слабо составленного предложения по инвестированию оказалась бы более ценной, чем неполная оценка хорошо составленного проекта.

Однако на деле во многих „хорошо документированных“ предынвестиционных исследованиях уделяется больше внимания техническим деталям планов вероятных проектов, чем критической оценке очередности социально-экономических задач, которая должна быть установлена на данных проектах. Так зачастую обстоят дела с исследованиями, проводимыми по контрактам с профессиональными инженерами консультирующими группами. Полная оценка проектов в смысле их „национальной выгоды“ и осуществления в порядке очередности будет, как правило, производиться после того, как такие исследования подтверждены документально, но часть задачи, выполняемая руководящими инстанциями, редко находит отражение в документах, за исключением случаев направления внутренних (часто секретных) меморандумов. Таким образом, тенденция выбора исходных материалов для выдержек будет основываться в первую очередь на их полезности в плане вышеупомянутого первого условия. Тем, кто интересуется руководящими положениями для выполнения анализа социально-экономических затрат/доходов от проектов промышленного развития в общем,

<sup>1</sup> Том I (ID SFR. E-4; Публикация Организации Объединенных Наций, в продаже под № 67. П. В. 17); Том II (ID SFR. E-5; Публикация Организации Объединенных Наций, в продаже под № 68. П. В. 13); Том III (ID SFR. E-6; Публикация Организации Объединенных Наций, в продаже под № 71. П. В. 12).



рекомендуется смотреть другие источники серии ID/SER. H, в частности среди публикаций ЮНИДО:

Как следует из плана в его стандартной форме, к „хорошо документированному“ предпроектному исследованию, используемому для выдержек, относится такое исследование, которое дает полную картину проекта промышленного инвестирования, касаясь в достаточной степени подробно:

a) рынков сбыта для каждого вида рассматриваемой продукции;

b) технической характеристики планируемых заводов (т.е. рассмотрение возможных альтернативных видов технологии);

c) оценки расходов на инвестирование (желательно с точным указанием факторов, определяющих цены на оборудование для данного района или местности);

d) анализа предстоящего возможного изменения соотношения стоимость-цена, как ожидается в данных местных условиях;

e) мер в области финансового или технического сотрудничества, которые, вероятно, будут предприняты в целях осуществления проекта;

f) оценки рентабельности с должным учетом возможного графика осуществления проекта и использования мощностей.

Подобные предпроектные исследования отличаются от так называемых исследований „возможности“ или исследований „предварительной целесообразности“, которые относятся к ранней стадии подготовки проекта, с одной стороны, и от „планов“ для сооружения проектов, которые составляются, когда проекты вступают в фактическую стадию строительства, с другой стороны.

Поскольку большинство предпроектных исследований связано с коммерческими секретами и часто с авторским правом, то так называемая информация, содержащаяся в каждом исходном материале, является чрезвычайно важным фактором для составления выдержек, предназначенных для общего распространения. Названия стран и учреждений, занимавшихся подготовкой первоначальных исследований, не должны упоминаться. В некоторых случаях нельзя разглашать даже континент, на котором должны быть расположены исследуемые проекты. При выполнении требований, предъявляемых к „нейтрализации“, необходимо проявлять умение и осторожность. При составлении *Выдержек* не указывается, осуществлялись ли когда-либо эти исследуемые проекты или нет, даже если этот факт явился бы существенным критерием для определения того, что называется „хорошими“ предпроектными исследованиями.

Исследования подготовлены несколько лет тому назад; хотя их технологические данные и могут оказаться устаревшими по отдельным аспектам, тем не менее, возможно, они будут иметь большую ценность в других отношениях. *Выдержки* отнюдь не претендуют на роль безошибочной коллекции „моделей проектов“.

<sup>2</sup> *Evaluation of Industrial Projects* (публикация Организации Объединенных Наций, в продаже под № E. 67. II. B. 23). *Guidelines for Project Evaluation* (публикация Организации Объединенных Наций, в продаже под № E. 72. II. B. 11).

Скорее всего они предназначены для содержания сравнительных справочных сведений, которые будут помогать в критической оценке конкретных проектов, намечаемых в данных социально-экономических условиях. Таким образом, некоторые старые материалы, хранящиеся в архивах учреждений по промышленному развитию, исследования, которые не использовались один раз и с тех пор находятся в архивах, могут быть вновь использованы в лучших целях через *Выдержки*.

Было бы весьма желательно выработать окончательный план для этой серии в отношении видов промышленности, которые она будет охватывать. Однако, как и в случае с *Профилями*, такое решение, по всей вероятности, будет довольно непрактичным, учитывая ресурсы, имеющиеся для этой программы. Многие отрасли промышленности и виды проектов представляют интерес для развивающихся стран. По мере роста объема имеющихся исходных материалов они будут находить все большее отражение в *Выдержках*. Было бы вполне полезно изучить два или более непосредственно сравнимых случая, взятых для различных районов, имеющих свои факторы ограничения. Но *Выдержки* предназначены в качестве источника для практического применения, а не для сравнительного анализа методологий планирования проектов. Важно, чтобы они играли определенную роль в международном центре по обмену промышленной информацией, с тем чтобы ЮНИДО занималась ими в качестве непрерывной долгосрочной программы, действующей на основе добровольных вкладов в виде материалов от стран и учреждений, и чтобы она учитывала при этом насущные интересы развивающихся стран как в отношении тематики охвата, так и содержания этих *Выдержек*.

#### *Том I как опытный экземпляр*

Первый том содержит 24 выдержки по различным отраслям промышленности. Некоторые выдержки составлены на основе специальных материалов извне, а некоторые основаны на материале, полученном в результате осуществления операций по оказанию технической помощи со стороны ЮНИДО. Составление этого тома происходило без строгого плана в отношении видов проектов, подлежащих включению, поскольку эту работу пришлось провести до того, как в делах Секретариата ЮНИДО было накоплено достаточное количество „хороших“ исследований. Поэтому отбор случаев в этом томе не осуществлялся по какой-либо конкретной теме. Его главная цель состоит в том, чтобы ознакомить читателей с методикой и получить предложения и материалы из более широкого ряда источников, чем те, которыми пользовались до сих пор в соответствии с данной программой.

Представленный здесь, в частности, формат выдержек может считаться всего лишь временным. В стремлении показать, что точно можно сделать для „нейтрализации“ сущности каждого исходного материала, было предпринято усилие сохранить как можно больше подробностей, которые представляли бы интерес в аналитическом плане для промышленного планирования проектов. Используемая стандартная форма,

видимо, представляет всего лишь наименее сокращенный вариант, который был бы приемлем для составления выдержек. В дальнейшем для этой серии можно рассмотреть вопрос изложения материала в менее подробном виде.

Характер информации, находящейся под различными заголовками и пунктами в стандартной форме, объясняется в технических замечках ниже.

#### *Главное назначение Выдержек*

Как указывалось в других источниках<sup>1</sup>, ожидается, что *Выдержки* практически должны использоваться главным образом в двух направлениях:

a) Когда предварительно анализируются новые идеи по инвестированию до начала использования ресурсов в целях проведения полностью обоснованных предпроектных исследований.

b) Когда другие предпроектные исследования или предложения от возможных поставщиков нуждаются

в тщательной технической оценке с уделением внимания возможным вариантам планов проектов и сметам расходов в различных региональных условиях.

Могут быть также случаи, когда информация, содержащаяся в предынвестиционных исследованиях, окажется полезной даже при оценке работы фактически действующих заводов.

Помимо пользы от публикуемых *Выдержек*, их стандартизированная форма как таковая может послужить проверочным списком для оценки завершенности и последовательности данного предпроектного исследования. Некоторые руководящие работники правительственных учреждений по развитию высказали интерес к вопросу введения практики подобного вида обобщения в их соответствующих учреждениях. Форменное обобщение и передача объемистых документов предпроектного исследования целесообразности требует тщательного чтения и понимания их сущности и на деле может оказаться полезным для выявления ошибок в расчетах и неверных предположений в первоначальных исследованиях, что иначе могло бы пройти незамеченным. Эта работа может также оказаться весьма эффективной мерой в деле самоподготовки инженерно-технического персонала, занимающегося промышленным программированием.

<sup>1</sup> Предварительная записка по этой новой серии была опубликована в *Industrialization and Productivity Bulletin*, No 17 (публикация Организации Объединенных Наций, в продаже под № E. 71. II. B. 8), стр. 17—19.

## INTRODUCCION

Este es el primer número de la serie *Extractos de estudios de viabilidad de proyectos industriales*, destinada a recoger datos de referencia para la planificación de proyectos industriales. En ella se suministra información tecnoeconómica con valor general de referencia, extraída del material que se va originando y acumulando en el proceso de la evaluación en fase de preinversión de proyectos industriales en diversos países en desarrollo. En un intento de aprovechar el material acumulado en las colecciones, dispersas pero cada vez mayores, de estudios de viabilidad industrial, cuya vida útil suele ser sumamente corta pese al elevado costo de su preparación, los *Extractos* no se limitan a catalogar estos documentos, sino que en cada extracto se da un resumen analítico del contenido técnico de un estudio de viabilidad relativamente bien documentado, que se condensa para cierta gama de usos relacionados con la planificación de proyectos industriales.

Los lectores que conozcan ya los *Perfiles de Establecimientos Manufactureros*<sup>1</sup> de la ONUDI se darán cuenta de que los *Extractos* y los *Perfiles* son dos series gemelas de datos de referencia para la programación industrial, con un mismo objetivo amplio en común: ayudar a los expertos y al personal técnico encargados de actividades tales como la evaluación de las deficiencias y de las posibilidades de las industrias existentes y de los proyectos planeados, la evaluación preliminar de nuevas oportunidades de inversión, la preparación de estudios de viabilidad técnica y económica, y la evaluación de ofertas de posibles proveedores en países en desarrollo. A diferencia de los *Perfiles*, que están basados en observaciones directas tomadas de empresas industriales ya en funcionamiento, los *Extractos* recurren a la imaginación —sobre una base de buena información— de los que intentan formular los detalles de los nuevos establecimientos industriales que se desea instalar. En ambas publicaciones, se presta menor atención a las «normas tecnológicas» relativas a los aspectos técnicos de la producción que a la presentación de entidades dedicadas a una actividad económica que funcionan, o que deben

funcionar, en diversas condiciones socioeconómicas y regionales. Dado que los *Perfiles* y los *Extractos* tienen una estructura descriptiva similar y que la información que contienen es complementaria, su utilización conjunta todavía puede reportar mayor provecho.

### *Material de base utilizado para los Extractos*

Los extractos se compilan siguiendo un modelo o formulario uniforme preparado expresamente al efecto. A ser posible, los estudios de viabilidad tecnoeconómica que se seleccionen y cuya información se resuma en este formulario deben ser «adecuados» en el sentido de que:

Presenten un proyecto de inversión bien concebido, debidamente adaptado a las condiciones que imperen en la región o país en desarrollo de que se trate; y

Permitan, gracias a su preparación, una evaluación crítica integral, detallada y ponderada del proyecto de que se trate.

La primera característica será particularmente importante si los extractos van a ser utilizados como fuente de información sobre «normas de programación», a efectos de las actividades de planificación previas a la inversión. Sin embargo, si los extractos han de servir como instrumento de capacitación práctica en materia de evaluación de proyectos industriales, la segunda característica será mucho más importante, puesto que una evaluación crítica y ponderada de una propuesta de inversión mal concebida resultará a esos efectos más valiosa que una evaluación incompleta de un proyecto bien concebido.

De hecho, sin embargo, muchos estudios de preinversión «bien documentados» dedican más espacio a los detalles técnicos de la preparación de proyectos plausibles que a una evaluación crítica de las prioridades socioeconómicas que deban atribuirse a los distintos proyectos. Esto suele ocurrir cuando se trata de estudios encargados a grupos profesionales de consultoría técnica. La evaluación completa de los proyectos en función de su «rentabilidad nacional» y del orden de prioridades para la ejecución se hace, por lo general, una vez que dichos estudios están ya documentados, y esa parte de la tarea de los que deben adoptar decisiones no suele ser objeto de

<sup>1</sup> Volumen I (ID/SER.E/4; publicación de las Naciones Unidas, núm. de venta: 67.II.B.17); volumen II (ID/SER.E/5; publicación de las Naciones Unidas, núm. de venta: 68.II.B.13); volumen III (ID/SER.E/6; publicación de las Naciones Unidas, núm. de venta: 71.II.B.12).

documentación, con la salvedad de algunos memorandos para uso interno (a menudo confidenciales). La selección de material de base para los extractos tenderá, por ello, a fundamentarse principalmente en su utilidad conforme a la primera característica arriba mencionada. Los que se interesan por pautas para efectuar análisis de costos/beneficios socioeconómicos de proyectos de desarrollo en general deben consultar otras fuentes, y concretamente la serie ID/SER.H entre las publicaciones de la ONUDI<sup>2</sup>.

Como se desprende claramente de la estructura del formulario uniforme, un estudio de viabilidad «bien documentado», válido para la serie de extractos, es aquel que ofrece una panorámica completa de un proyecto de inversión industrial, pormenorizando según convenga en lo relativo a:

a) Mercados para cada uno de los proyectos cuya fabricación haya sido considerada;

b) Especificaciones técnicas de las fábricas proyectadas (es decir, examen de las distintas tecnologías posibles);

c) Estimación de los costos de inversión (a ser posible, indicándose explícitamente los factores determinantes de los precios del equipo vigentes en determinada región o localidad);

d) Análisis del posible comportamiento de los precios de costo, tal como pueda preverse dadas las condiciones locales;

e) Sistemas de cooperación financiera y técnica probablemente disponibles para la ejecución del proyecto;

f) Evaluación de la rentabilidad habida cuenta del calendario viable para la ejecución del proyecto y el aprovechamiento de la capacidad.

Tales estudios de viabilidad difieren, por una parte, de los llamados estudios de «oportunidad» o de «previabilidad», propios de una fase menos adelantada de la elaboración del proyecto, y, por otra, de los estudios de «programación detallada» (*blueprints*) de la tecnología del proyecto, que se elaboran cuando los proyectos van a pasar ya a la fase propiamente dicha de construcción.

Puesto que la mayor parte de los estudios de viabilidad llevan aparejado el secreto comercial y a menudo reservas del derecho de reproducción, la «neutralización» de la información contenida en cada fuente de datos es crucial para la compilación de extractos destinados a una difusión

general. No deben mencionarse los países ni las instituciones que intervinieron en la preparación del estudio original. En algunos casos, no puede mencionarse ni siquiera el continente en el que van a ubicarse los proyectos sometidos a estudio. Es preciso actuar con habilidad y cautela para satisfacer esta condición de «neutralidad». A efectos de la preparación de los *Extractos* no se debe tener en cuenta si el proyecto estudiado ha sido ejecutado o no, aunque ello pudiera dar un criterio eficaz para definir cuáles son los estudios de viabilidad «adecuados».

Puede suceder que algunos estudios preparados hace años, aun con datos tecnológicos ya anticuados en algunos aspectos, tengan no obstante un considerable valor de referencia desde otros puntos de vista. Los *Extractos* no aspiran en modo alguno a ser una colección de «proyectos modelo» a la que sea imposible dar un uso incorrecto sino que pretenden suministrar puntos de referencia comparativos que sirvan de ayuda en la evaluación crítica de ideas concretas para proyectos, concebidos teniendo presentes unas condiciones socioeconómicas determinadas. De este modo, parte del antiguo material almacenado en los archivos de las instituciones de desarrollo industrial —estudios utilizados en su día pero archivados hace ya tiempo— puede ser desenterrado para ser aprovechado todavía en los *Extractos*.

Sería muy conveniente establecer un plan definitivo para esta serie en lo que respecta a las ramas industriales que se han de abarcar. Sin embargo, como sucedió con los *Perfiles*, es probable que esto resulte casi imposible, dados los limitados recursos disponibles para este programa. Son muchas las ramas industriales y los tipos de proyecto que revisten interés para los países en desarrollo. A medida que aumenten las disponibilidades de material de base, el ámbito de los *Extractos* irá también ensanchándose. Sería, ciertamente, muy instructivo poder estudiar dos o más casos directamente comparables, planteados con las limitaciones de contextos regionales diferentes. Pero los *Extractos* han sido concebidos como una fuente de información para aplicaciones prácticas y no para el análisis comparativo de metodologías de planificación de proyectos. Es importante que ocupen un lugar reconocido en el centro internacional de intercambio de información industrial, que será mantenido por la ONUDI en calidad de programa permanente y a largo plazo, financiado con contribuciones voluntarias aportadas por países y por instituciones e inspirado en los intereses expresados por los

<sup>2</sup> *Evaluation of Industrial Projects* (publicación de las Naciones Unidas, núm. de venta E.67.II.B.23). *Pautas para la evaluación de proyectos* (publicación de las Naciones Unidas, núm. de venta S.72.II.B.11).

países en desarrollo tanto con respecto a su amplitud como a su contenido.

### *Indole experimental del volumen I*

Este primer volumen contiene 24 extractos relativos a distintas ramas industriales. Algunos están basados en contribuciones especiales procedentes de fuera de la Organización, y algunos se sirven del material originado con ocasión de las operaciones de asistencia técnica de la ONUDI. La compilación de estos casos se hizo sin ningún plan estricto en cuanto a los tipos de proyectos que habían de incluirse, dado que fue preciso emprender este trabajo antes de que se hubiera acumulado en los archivos de la Secretaría de la ONUDI un número suficiente de posibles estudios «adecuados». La selección de casos en este volumen no se ajusta, pues, a ningún tema especial. Su finalidad principal consiste en familiarizar al público con el método, y en solicitar sugerencias y contribuciones de fuentes más diversas que las que hasta el momento han intervenido en este programa.

El formato especial en el que aquí aparecen los extractos puede considerarse como meramente provisional. En un intento de demostrar hasta qué punto podía neutralizarse el contenido de cada fuente de información, se procuró retener la mayor cantidad posible de detalles que pudieran tener interés analítico para la planificación de proyectos industriales. El formulario uniforme utilizado representa, poco más o menos, la versión menos resumida posible que resultaría aceptable como extracto. En la continuación de esta serie tal vez se utilicen extractos algo menos detallados.

En las notas técnicas que figuran más adelante se explica la índole de la información recogida bajo cada uno de los epígrafes y títulos del formulario modelo.

### *Principales usos de los Extractos*

Como se explicó en otra publicación<sup>3</sup>, se espera que los *Extractos* sean utilizados principalmente en los dos siguientes casos:

a) Al hacer el análisis preliminar de nuevas ideas para la inversión, antes de asignar recursos para estudios completos de viabilidad;

b) Cuando se necesite una evaluación técnica cuidadosa de otros estudios de viabilidad o de ofertas de posibles proveedores, prestando atención a las posibles variaciones en el plan y en el presupuesto de los proyectos en función de las diversas circunstancias regionales.

Puede también darse el caso de que la información contenida en estudios de preinversión resulte útil incluso para la evaluación de los resultados obtenidos por fábricas ya existentes.

Aparte de la utilidad de los *Extractos* publicados, su estructura uniforme puede servir por sí misma como lista-guía para evaluar hasta qué punto es completo y coherente un estudio de viabilidad dado. Algunos funcionarios superiores de organismos gubernamentales de desarrollo han mostrado interés por introducir esta forma de condensación de material de referencia en sus departamentos respectivos. La condensación según un formulario y la transcripción de la voluminosa documentación de los estudios de viabilidad requiere una lectura detallada y una buena asimilación del material, que pudieran, de hecho, resultar útiles para detectar errores de cálculo e incongruencias en las hipótesis de los estudios originales que de otro modo tal vez hubieran pasado inadvertidos. Este trabajo también pudiera ser un ejercicio sumamente eficaz para la autocapacitación del personal técnico encargado de la programación industrial.

<sup>3</sup> Ha aparecido ya una reseña preliminar sobre esta nueva serie en el *Boletín de Industrialización y Productividad*, núm. 17 (publicación de las Naciones Unidas, núm. de venta: S.71.II.B.8), páginas 17-19.

## TECHNICAL NOTES

The standard form used in this volume consists of 13 sections of which one (XII) is reserved for any supplementary information that does not readily fit into the rest of the form. The major points to be considered in filling in the form are noted section by section and item by item.

### I. ORIGIN OF THE STUDY

#### 1. *This study was prepared by*

Indicate only the type of the institution that prepared the original feasibility study from which this extract is derived, such as an independent consultant, a private consultant firm, a machine supplier, the staff of a governmental development institution, or of an international technical-assistance agency.

#### *This study was prepared for*

Indicate only the type of the institution that requested the original study, such as an individual private investor, a ministry of industry, or an investment bank.

#### 2. *The study was intended to*

Specify the main investment opportunity that motivated the feasibility study: an investment priorities plan, preliminary sectoral studies, etc. Important factors underlying the opportunity may be mentioned.

#### 3. *Size of the economy considered*

##### — *Other information*

List the main established industries and point out the particular resources with which they are favourably endowed. The geographical region in which the economy is located may or may not be mentioned. If the economy involves more than one country, this should be mentioned.

### II. GENERAL DESCRIPTION

#### 1. *Products*

Describe briefly the technical specifications of the products: e.g., chemical purity, mechanical properties, quality standards, composition. Quantities and product-mix are to be indicated elsewhere.

#### 2. *Major input materials*

Give the qualitative specifications of major raw materials from local origins and any important features of their supply; and indicate important production materials, if any, that are needed but not locally available.

#### 3. *Alternative technologies available and technology adopted for the study*

Indicate the type of process, such as single-product process, multi-product process, single-train or multi-train production;

Describe briefly the technology, mentioning any special name popularly used by experts in the field. Give details in section XII ("Supplement") as deemed appropriate;

State the degree of mechanization and automation. Special advanced features may be described in section XII ("Supplement").

#### 4. *Locational factors*

##### — *Particularly important factors*

Specify the key parameters for transport requirements: quantities of main input materials and output products in terms of gross weights and/or volumes;

Indicate means of transport and transport tariffs applicable;

State the desired degree of proximity to electricity, water and basic infrastructure, including the location of other industries with which the project is to be closely linked;

Indicate crucial regional policy measures recommended for the project feasibility, if any.

##### — *Actually proposed locality*

Describe simply the proposed locality in terms of differential priorities given to important factors.

### III. MARKET

#### 1. *Tabulation of estimated demand on domestic and export markets*

Tabulate separately for the domestic and the relevant export markets;

Indicate any special characteristics, possible margins of error (between optimistic and pessimistic), etc.

#### 2. *Notes on methodology*

Indicate major determinant variables, demand elasticities and other key parameters for projections, and special consumer patterns;

Give an indication of how crude or sophisticated the estimates are;

Describe any special market surveys conducted in the field.

3. *Selection of product-mix*

Justify the selected product-mix from the standpoints of both the market and the production technology. Indicate potential additional products to be included in a future extension of the project.

#### IV. CAPACITY OF PROPOSED PLANT

1. *Nominal maximum capacity according to major process*

Give the time basis of calculation (operating time) and indicate specific groups of machines and equipment that determine the nominal maximum capacity of the major process or processes;

Indicate whether the proposed capacity represents the technologically acceptable minimum plant scale.

2. *Maximum feasible capacity of the plant*

Calculate the feasible capacity of the plant, taking into account normal stoppage, desired shift patterns, indivisibilities of major machines to be combined, etc.;

Indicate potential bottlenecks and selective extension possibilities.

3. *Expected maximum output of the plant*

Indicate expected maximum output, compatible with the expected markets, in percentage of the maximum feasible capacity. Efficiency of labour, demand irregularities, proportion of rejects, seasonal variations of raw material supplies etc. should be taken into account.

#### V. INVESTMENT

1.1. *Land, site development*

Indicate size of plot in parenthesis.

1.2. *Buildings*

Indicate floor space in parenthesis for each sub-item.

— *Others*

Describe water facilities, electricity works, reservoirs, waste-disposal systems, housing for employees, etc., separately if possible.

1.3. *Machinery and equipment*

Give total, including installation.

(Indicate in the foot-note here or in section XII ("Supplement") any extraordinarily high or low estimates of particular items that might be associated with special road and housing development schemes, power supply, leasing of equipment, special properties of inputs and outputs, time-phasing of a potentially larger integrated project, etc.)

2. *Working capital*

State in *ex ante* planning terms, referring to the normal level of operation expected after the completion of the plant and its start-up.

2.1. *Inventories*

Indicate in parenthesis the equivalent number of months.

2.2. *Accounts receivable*

Indicate average period of deferred payment allowed to customers, in parenthesis.

3. *Other investments*

Calculate expenditures prior to the start of production that are to be capitalized.

*Major machinery and equipment (table)*

List (a) production machinery and equipment and (b) auxiliary equipment (transport, laboratory, maintenance, power generation, office equipment, etc.) separately;

Production machinery should be listed preferably by departments or shops rather than item by item, with classification corresponding to the shop alignment as in section VI ("Manning table");

If space permits, indicate the capacity rating of the machinery and equipment by shop, or for predominantly important items. Use section XII ("Supplement") if necessary.

#### VI. MANNING TABLE

List of shops should preferably indicate the main processing stages involved. A process flow chart supporting the given shop alignment may be shown in section XII ("Supplement"); Seasonal workers should be so specified.

#### VII. ANNUAL PRODUCTION

1. *Total annual expected maximum output*

Tabulate by product and by destination. "Unit price ex factory" would include production and/or sales taxes, if any. Special subsidized export prices should be indicated.

2. *Expected sales and inventory build-up*

Give background information on the expected growth of turnover and capacity utilization during the first few years of production, as tabulated in section XIII ("Cash flow table").

3. *Pricing policy*

Compare the prices derived from direct costing with current import prices. The latter should be clarified in terms of the c.i.f. prices, free of import duties at the port of import, and the normal rates of surcharge including duties, sales taxes, trade and transport margins;

State any specifics regarding the proposed export prices;

Indicate the results of any sensitivity tests concerning the desired level of profitability and the pricing of products;

Indicate any necessary governmental protective measures (the justification for such measures should be given in section XI ("Data for evaluation")).

4. *Planned sales organization*

Describe own distribution network via sales representatives and own retail stores or agents, wholesalers and other trading organizations; also the significance of own transport facilities in marketing.

## VIII. ANNUAL OPERATING COSTS AND PROFITS

The data in this section should correspond to the "annual expected maximum output" as shown in section VII.

State separately and in detail: (a) raw materials and semi-processed materials, (b) packaging materials, (c) repair and maintenance supplies, (d) energy, and (e) water and other materials.

*Note:* Office supplies, advertisements, insurance fees, communication, staff travel and other business services to be purchased should be included in item 7 ("Administrative expenses and sales costs"). Item 7 should not include wages and salaries for the enterprise's employees.

3. *Interests*

Give average annual interest charges on borrowed capital as planned. Interest on foreign loans should not be included here.

5. *Indirect taxes*

List value added tax, production tax, turnover tax, employment tax, franchise tax, etc. Profit tax is to be shown in item 9.

6. *Depreciation*

Indicate rate and method of depreciation. Use space in section XII ("Supplement") if necessary.

7. *Administrative expenses*

See note above.

8. *Other costs*

Include work by outside firms on contract basis, if any; otherwise, "contingency allowances" would normally fit under this item.

## IX. FINANCING PROPOSAL

2. *Long-term loans*

List separately loans of different terms.

3. *Other loans*

List separately short- and medium-term loans; indicate interest and repayment conditions for each.

4. *Suppliers' credits*

Indicate over-all repayment conditions.

5. *Remarks on the financing policy*

Indicate whether the financial proposal is only a crude, somewhat arbitrary assumption or whether it reflects the proposal from a potential investment institution. Also state local and foreign sources of capital. Describe briefly any peculiarities of the financing proposal.

## X. IMPLEMENTATION

1. *Technical collaboration service*

Include projections or recommendations concerning further studies required, preparation of project blue-prints, contracting procedures and other major steps to be taken if the project proves acceptable for the purpose for which the original feasibility study was prepared.

2. *Project management*

Indicate, e.g., whether a turn-key contract is envisaged and any specific arrangements proposed for project management during the construction and/or initial operation period.

3. *Recruitment and training of personnel*

Describe any programmes for training abroad and/or locally. Also describe the proposed time schedule for recruitment of technical personnel, skilled workers, etc.

4. *Other items*

Describe any organizational problems, infrastructural requirements to be satisfied, crucial legislative actions required to ensure the viability of the industry considered, etc.

5. *Time schedule*

Give time schedule proposed for major implementation activities, covering contracting and other pre-construction activities, construction schedules start-up and extension phase. The schedule would underlie the calculations presented in section XIII ("Cash flow table").

## XI. DATA FOR EVALUATION

Check the type of analysis included in the original feasibility study and summarize the main findings. Any incorrect or inadequate treatments involved in the original study may be pointed out, and an alternative analysis may be undertaken and presented by those who prepare this extract. The original feasibility study document used for this extract may or may not be complete in terms of



project evaluation. Recommendations made in the original document may or may not be reasonable. A space in this section may well be spared for an expert evaluation pinpointing any notable weak points of the original project study.

## **XII. SUPPLEMENT**

Use this space to provide additional information relating to any sections of the extract. Any further details or commentaries that require extra space or *non-pro forma* presentation should be given here, and reference made in each case to the relevant section and its sub-item.

## **XIII. CASH FLOW TABLE**

Use this standard cash flow table to ensure comparability among different cases. When more than one cash flow table is available and/or a given

cash flow table is in a special form that cannot be reorganized in this standard form, it should be presented in section XII ("Supplement").

Note that, in this tabulation, no. 4 ("Production expenditure") does not include interests on loans and depreciation (which are included in section VIII, sub-sections 3 and 6 respectively). Interests are entered in sub-section B.5.1 ("Interest on loans"). Instead of depreciation allowances, the anticipated replacement expenditures are to be entered in sub-section B.1.3 ("Machinery and equipment (replacement)"). This table is arranged in such a way that internally accumulated profits and depreciation funds are not so isolated, but are absorbed into sub-section C ("Surplus/Deficit"), after being adjusted for yearly expenditures on the capital account (replacement expenditures and repayments of loans and credits).

## NOTES TECHNIQUES

Le plan type utilisé pour les extraits contenus dans ce volume comprend 13 sections dont une, la section XII, est réservée aux renseignements complémentaires qui ne correspondraient exactement à aucune des autres sections. La façon de procéder est donnée ci-après, section par section et rubrique par rubrique.

### I. ORIGINE DE L'ETUDE

#### 1. *La présente étude a été élaborée par*

Préciser seulement si l'étude de faisabilité qui résume l'extrait a été élaborée par un consultant indépendant, une société d'ingénieurs-conseils, un fournisseur de matériel, un organisme national de développement, un organisme international d'assistance technique, ou un autre organisme.

*La présente étude a été rédigée à l'intention de*  
Préciser seulement si l'étude a été demandée par un investisseur privé, un ministère de l'industrie, une banque d'investissement, ou un autre organisme.

#### 2. *L'étude avait pour objet*

Spécifier la principale justification du projet étudié: plan des investissements prioritaires, études sectorielles préliminaires, etc. Certains facteurs ayant joué un rôle important dans le choix du projet peuvent être mentionnés ici.

#### 3. *Importance de l'économie du pays considéré*

##### *Autres renseignements*

Enumérer les principales industries du pays et indiquer les atouts dont elles disposent. La région dans laquelle le pays est situé peut être mentionnée ou non. Si le projet intéresse plusieurs pays, il convient de l'indiquer.

### II. DESCRIPTION GENERALE

#### 1. *Produits*

Donner brièvement les spécifications techniques des produits: pureté chimique, propriétés mécaniques, normes de qualité, composition, etc. Les quantités et la gamme des produits seront indiquées ailleurs.

#### 2. *Principaux matériaux utilisés*

Donner les spécifications qualitatives des principales matières premières d'origine locale et indiquer, le cas échéant, les caractéristiques spéciales de l'approvisionnement; mentionner

aussi les matériaux nécessaires à la production qui ne sont pas disponibles sur place.

#### 3. *Techniques disponibles et technique choisie*

Indiquer le type d'opérations, par exemple, fabrication d'un seul produit ou de plusieurs produits, procédé continu ou discontinu;

Décrire brièvement la technique proposée en indiquant, le cas échéant, les termes couramment utilisés par les experts. Donner au besoin dans la section XII («Renseignements complémentaires») les précisions jugées nécessaires;

Indiquer le degré de mécanisation et d'automation. Les techniques avancées peuvent être décrites dans la section XII («Renseignements complémentaires»).

#### 4. *Facteurs relatifs à l'emplacement*

##### *Facteurs particulièrement importants*

Spécifier les principaux paramètres des besoins en matière de transport: volume ou poids brut des principaux matériaux utilisés et des principaux produits;

Indiquer les moyens de transport nécessaires et le prix de ces transports;

Indiquer à quelle distance l'usine devrait se trouver des installations fournissant l'électricité, l'eau, etc., et des industries qui seraient ses fournisseurs ou ses clients;

Indiquer, le cas échéant, les principales mesures de politique régionale recommandées pour assurer la viabilité du projet.

##### *Emplacement proposé*

Décrire l'emplacement proposé uniquement en énumérant, par ordre de priorité, les facteurs qui doivent déterminer son choix.

### III. MARCHÉ

#### 1. *Tableau estimatif de la demande sur les marchés intérieur et extérieur*

Séparer dans le tableau le marché intérieur et les exportations;

Indiquer, le cas échéant, les caractéristiques spéciales de l'estimation, les marges d'erreur possibles (évaluation optimiste et évaluation pessimiste), etc.

#### 2. *Notes sur la méthodologie*

Indiquer les principales variables qui influent sur la demande, l'élasticité et les

autres paramètres clefs pour les projections ainsi que les particularités de la consommation;

Indiquer si les estimations sont approximatives ou précises;

Décrire, le cas échéant, les études de marché effectuées dans le domaine considéré.

### 3. *Choix de la gamme de produits*

Justifier la gamme de produits choisie du point de vue de débouchés comme de la technique de production. Indiquer les autres produits qui pourraient être fabriqués en cas d'extension ultérieure du projet.

## IV. CAPACITE DE L'USINE PROPOSEE

### 1. *Capacité nominale maximale pour la principale production*

— Indiquer sur quelle durée de fonctionnement est basé le calcul de la capacité de production et préciser quels ensembles de machines et d'éléments de matériel déterminent la capacité nominale maximale pour la principale production ou les principales productions;

Indiquer si la capacité proposée représente l'échelle minimale de production acceptable du point de vue technique.

### 2. *Capacité maximale possible de l'usine*

— Calculer la capacité possible de l'usine, en tenant compte des arrêts normaux, du roulement prévu des équipes, des éléments indécomposables des principales machines à combiner, etc.;

Indiquer les goulots d'étranglement possibles et les possibilités d'extension.

### 3. *Production maximale prévue*

Indiquer, en pourcentage de la capacité maximale possible, la production maximale prévue compte tenu des débouchés escomptés, de l'efficacité de la main-d'œuvre, des irrégularités de la demande, de la quantité de rejets, des variations saisonnières des approvisionnements en matières premières, etc.

## V. INVESTISSEMENTS

### 1.1. *Terrain et aménagement du terrain*

Indiquer entre parenthèses la superficie du terrain.

### 1.2. *Bâtiments*

Indiquer entre parenthèses la superficie de chacun des bâtiments.

#### *Installations auxiliaires*

Si possible, indiquer séparément le coût des différentes installations: alimentation en eau, alimentation en électricité, ré-

servoirs, systèmes d'évacuation des déchets, logements des employés, etc.

### 1.3. *Machines et matériel*

Donner le coût total, y compris celui de l'installation.

(Le cas échéant, donner en note ici ou dans la section XII («Renseignements complémentaires») la raison pour laquelle le coût prévu pour tel ou tel article est particulièrement élevé ou particulièrement faible, par exemple: programmes spéciaux de construction de routes et de logements, fourniture d'énergie, location de matériel, caractéristiques spéciales des facteurs de production et des produits, mise en œuvre graduelle d'un projet intégré plus vaste, etc.)

### 2. *Capital circulant*

Evaluer les besoins en capital circulant en se basant sur le niveau normal de production prévu après l'achèvement de l'usine et son démarrage.

#### 2.1. *Stocks*

Indiquer entre parenthèses à combien de mois de production correspondent les stocks.

#### 2.2. *Sommes à percevoir*

Indiquer entre parenthèses les délais moyens consentis aux clients pour les paiements.

### 3. *Autres investissements*

Evaluer les dépenses imputables sur le compte capital à prévoir avant le démarrage de la production.

#### *Liste des principales machines et des principaux matériels*

Dresser la liste *a)* des machines et matériels de production et *b)* des équipements auxiliaires (transports, laboratoire, entretien, production d'énergie, matériel de bureau, etc.);

— Plutôt que d'énumérer les machines de production une par une, il serait préférable de les grouper par département ou par atelier en suivant le même plan que celui adopté pour la ventilation du personnel dans la section VI («Tableau des effectifs»).

— S'il y a suffisamment de place, indiquer la capacité installée des machines et matériels, par atelier ou bien individuellement pour les machines particulièrement importantes. Utiliser si besoin est la section XII («Renseignements complémentaires»).

## VI. TABLEAU DES EFFECTIFS

— Les ateliers énumérés devraient si possible

correspondre aux principales étapes de la fabrication. A l'appui de la répartition des ateliers un graphique d'acheminement pourra être donné dans la section XII («Renseignements complémentaires»);

Lorsqu'il s'agit de travailleurs saisonniers, il faut le spécifier.

## VII. PRODUCTION ANNUELLE

1. *Total de la production maximale prévue par an*  
Ventiler le total par produit et par destination. «Le prix unitaire départ usine» doit inclure, le cas échéant, les taxes à la production et ou à la vente. S'il existe des subventions à l'exportation, il faut le mentionner.

2. *Ventes et stocks prévus*  
Donner des précisions sur l'augmentation prévue du chiffre d'affaires et du volume de la production au cours des premières années d'exploitation, comme indiqué dans la section XIII («Cash flow»).

3. *Politique de détermination des prix*  
Comparer les prix de vente déterminés en fonction des prix de revient aux prix courants des produits importés. Ces derniers doivent être calculés en tenant compte du prix c.a.f., des droits d'importation, des taxes à la vente, des frais de transport et des marges commerciales;

Donner, le cas échéant, des précisions concernant les prix prévus à l'exportation; Indiquer, le cas échéant, les résultats des analyses de sensibilité concernant le niveau de rentabilité souhaité et les déterminations des prix des produits;

Indiquer, le cas échéant, les mesures de protection que devrait prendre le gouvernement (la justification de ces mesures doit être donnée dans la section XI («Données pour l'évaluation»)).

4. *Organisation des ventes*  
Décrire le réseau de distribution de l'entreprise, par l'intermédiaire de représentants et de magasins de détail lui appartenant en propre, ou bien de concessionnaires, de grossistes et d'autres organisations commerciales; indiquer aussi s'il importe, pour le marketing, que l'entreprise possède ses propres moyens de transport.

## VIII. FRAIS D'EXPLOITATION ET BÉNÉFICES ANNUELS

Les données ici fournies doivent correspondre à la «production annuelle maximale prévue» indiquée dans la section VII.

Chiffrer séparément les différents coûts: a) matières premières et semi-produits, b) matériaux d'emballage, c) fournitures pour les réparations et l'entretien, d) énergie, e) eau et autres matières nécessaires à la production.

*Note:* Les fournitures de bureau, la publicité, les primes d'assurance, les communications, les voyages du personnel et autres frais administratifs doivent être inclus dans la rubrique 7 («Dépenses administratives et coût des ventes»), mais non les traitements et salaires des employés de l'entreprise.

3. *Intérêts*  
Indiquer le montant annuel des intérêts à payer pour les emprunts de capital prévus. Les intérêts des emprunts de capitaux étrangers ne doivent pas figurer ici.

5. *Impôts indirects*  
Faire figurer ici la taxe à la valeur ajoutée, la taxe à la production, l'impôt sur le chiffre d'affaires, la taxe sur l'emploi, l'impôt sur les sociétés, etc. L'impôt sur les bénéfices doit figurer à la rubrique 9.

6. *Amortissement*  
Indiquer le taux et la méthode d'amortissement. Si la place disponible est insuffisante, utiliser la section XII («Renseignements complémentaires»).

7. *Dépenses administratives*  
Voir note ci-dessus.

8. *Autres coûts*  
Le cas échéant, faire figurer ici les travaux donnés en sous-traitance; les provisions pour imprévus doivent normalement figurer dans cette rubrique.

## IX. PLAN DE FINANCEMENT

2. *Emprunts à long terme*  
Enumérer séparément les différents emprunts en indiquant leurs conditions.

3. *Autres emprunts*  
Enumérer séparément les emprunts à court terme et à moyen terme, en indiquant pour chacun d'eux le taux d'intérêt et les conditions de remboursement.

4. *Crédits-fournisseurs*  
Indiquer les conditions générales de remboursement.

5. *Remarques sur la politique de financement*  
Indiquer si le plan de financement représente seulement une hypothèse quelque peu arbitraire ou s'il s'agit d'une proposition de financement émanant d'une institution d'investissement. Indiquer aussi s'il agit de

capitaux nationaux ou étrangers. Décrire brièvement, le cas échéant, les particularités du plan de financement.

## X. MISE EN ŒUVRE DU PROJET

### 1. *Service de collaboration technique*

Faire figurer ici les prévisions ou recommandations concernant les mesures à prendre si le projet sur lequel porte l'étude de faisabilité est jugé acceptable: nouvelles études, préparation du plan d'exécution, préparation des contrats, etc.

### 2. *Gestion du projet*

Indiquer, par exemple, si l'usine doit être fournie clefs en main par le contractant et si des dispositions spéciales sont prévues pour la gestion du projet pendant la construction et pendant la période initiale de fonctionnement.

### 3. *Recrutement et formation du personnel*

Préciser si l'on prévoit des programmes de formation à l'étranger ou sur place. Donner également le calendrier prévu pour le recrutement des techniciens, des ouvriers qualifiés, etc.

### 4. *Autres questions*

Décrire, le cas échéant, les problèmes d'organisation, les besoins d'infrastructure, les mesures législatives nécessaires pour que l'industrie prévue soit viable, etc.

### 5. *Calendrier*

Calendrier prévu pour la réalisation du projet: passation du contrat et autres activités précédant la construction, construction, démarrage et phase d'extension. Ce calendrier doit correspondre aux estimations figurant dans la section XIII («Cash flow»).

## XI. DONNEES POUR L'EVALUATION

Vérifier l'analyse faite dans l'étude de faisabilité et résumer les principales conclusions. Si certaines façons de procéder sont erronées ou insuffisantes, le rédacteur de l'extrait peut le signaler et présenter une nouvelle analyse. L'étude de faisabilité utilisée pour la rédaction de l'extrait peut être

complète ou incomplète du point de vue de l'évaluation du projet. Les recommandations peuvent être raisonnables ou non. Une place pourrait être faite dans cette section à l'évaluation d'un expert signalant éventuellement les principaux points faibles de l'étude de faisabilité.

## XII. RENSEIGNEMENTS COMPLEMENTAIRES

Donner dans cette section les renseignements complémentaires relatifs à l'une quelconque des autres sections de l'extrait. Toutes les précisions et toutes les remarques pour lesquelles il n'y avait pas assez de place dans les autres sections ou qui exigent une présentation spéciale seront consignées ici; la section ou la rubrique auxquelles ces détails ou ces remarques se rapportent devront être indiquées dans chaque cas.

## XIII. CASH FLOW

Employer ce tableau type du cash flow pour pouvoir faire la comparaison entre différents cas. Un seul tableau du cash flow doit figurer dans cette section; les tableaux supplémentaires, s'il en existe, seront insérés dans la section XII («Renseignements complémentaires»), de même que les tableaux établis sous une forme spéciale et qui ne pourraient être remaniés de façon à correspondre à ce tableau type. Il convient de noter que, dans ce tableau, les dépenses de production (rubrique B.4) ne comprennent pas les intérêts des emprunts et l'amortissement (qui dans la section VIII sont inclus respectivement dans les rubriques 3 et 6), et que les intérêts figurent dans la rubrique B.5.1 («Intérêts des emprunts»). Dans la rubrique B.1.3 («Machines et équipement (remplacement)»), on fera figurer, non les provisions pour amortissement, mais les dépenses prévues pour les remplacements. L'agencement de ce tableau fait que les bénéfices accumulés par l'entreprise et les provisions pour amortissement ne sont pas présentés séparément mais inclus dans la sous-section C («Excédent/déficit»), après imputation sur le compte capital des dépenses annuelles (remplacements de machines et remboursement des emprunts et crédits).

## ТЕХНИЧЕСКИЕ ЗАМЕЧАНИЯ

Используемая в настоящем томе стандартная форма состоит из тринадцати разделов, из которых один (XII) отведен для любой дополнительной информации, которая не соответствует назначению остальных разделов этой формы. Основные пункты, принимаемые во внимание при заполнении этой формы, указаны последовательно по разделам и пунктам.

### I. ПРОИСХОЖДЕНИЕ НАСТОЯЩЕГО ИССЛЕДОВАНИЯ

#### 1. *Это исследование подготовлено*

Укажите только виды учреждений, первоначально подготовивших предпроектное исследование, из которого взяты выдержки, к которым можно отнести независимых консультантов, частные консультирующие фирмы, поставщиков оборудования, сотрудников государственного учреждения по вопросам развития или международные агентства по оказанию технической помощи.

*Это исследование подготовлено для*

Укажите только вид учреждения, запросившего первоначальное исследование, такое, как отдельный частный инвестор, министерство промышленности или инвестиционный банк.

#### 2. *Исследование предназначено для*

Укажите основные возможности инвестирования, способствовавшие проведению предпроектного исследования: план очередности инвестирования, предварительные исследования по секторам и т. д. Можно упомянуть важные факторы, лежащие в основе этих возможностей.

#### 3. *Размеры рассматриваемого предприятия*

*Другая информация*

Перечислите главные созданные отрасли промышленности и укажите отдельные ресурсы, которыми они располагают в значительной степени. Можно указывать или не указывать географический район, в котором расположено предприятие. Если в это предприятие вовлечена не одна страна, этот факт следует упомянуть.

### II. ОБЩЕЕ ОПИСАНИЕ

#### 1. *Продукция*

Кратко опишите техническую спецификацию продукции: например, чистота химического состава, механические свойства, уровень качества, структура. Количество и номенклатура разнородной продукции должны указываться в других разделах.

#### 2. *Основные материалы, используемые для производства*

Дайте качественную спецификацию основных сырьевых материалов местного происхождения и любые важные особенности их запасов; и

укажите важные производственные материалы, если таковые имеются, которые необходимы для производства, но которых не имеется на месте.

#### 3. *Имеющаяся альтернативная технология процессов и технология процессов, применяемая для данного исследования*

Укажите тип процесса, такой, как процесс для производства одного вида продукции, процесс для производства многих видов продукции, серийного производства одного вида или многих видов продукции;

Опишите кратко технологию процесса, указав любое специальное патование, которым предпочитают пользоваться эксперты в этой области. Укажите подробности в разделе XII („Дополнение“) в меру надобности;

Укажите степень механизации и автоматизации. Специальные передовые характеристики могут быть отражены в разделе XII („Дополнение“).

#### 4. *Факторы месторасположения*

*Особо важные факторы*

Укажите ключевые параметры транспортных потребностей: количество основных материалов, используемых в производстве, и выход продукции в виде веса брутто и/или объема; Укажите средства транспорта и применяемые транспортные тарифы;

Укажите желаемую степень близости источников электроэнергии, воды и основной инфраструктуры, в том числе расположения других предприятий, с которыми проект должен быть тесно связан;

Укажите решающие мероприятия региональной политики, говорящие в пользу целесообразности проекта, если таковые имеются.

*Фактически намечаемое месторасположение проекта*

Опишите просто намечаемое месторасположение проекта в плане дифференциального порядка очередности, указанного для важных факторов.

### III. РЫНОК СБЫТА

#### 1. *Составление таблиц предполагаемого спроса на внутреннем и внешнем рынках сбыта*

Составьте отдельно таблицы по внутреннему и соответствующему внешнему рынкам сбыта; Укажите любые особые характеристики, пределы возможных ошибок (между оптимистическими и пессимистическими) и т. д.

#### 2. *Замечания по методологии*

Укажите наиболее важные определяющие переменные величины, эластичность спроса

и другие ключевые параметры для прогнозирования и объемы структуры потребления; Укажите, насколько общими или неточными являются оценочные данные; Дайте описание любых специальных обзоров рынка сбыта, осуществленных в этой области.

3. *Выбор номенклатуры разнородной продукции*  
Определите целесообразность выбранной номенклатуры разнородной продукции с учетом как рынка сбыта, так и технологии производства. Укажите потенциальную дополнительную продукцию, которая должна быть учтена при будущем расширении проекта.

#### IV. МОЩНОСТЬ ПРЕДЛАГАЕМОГО ПРЕДПРИЯТИЯ

1. *Номинально-максимальная мощность в соответствии с главным процессом производства*

Возьмите время за основу для расчетов (рабочее время) и укажите конкретные группы машин и оборудования, которые определяют номинально-максимальную мощность главного процесса или процессов производства;

Укажите, представляет ли предложенная мощность технологически приемлемый минимальный масштаб предприятия.

2. *Максимально-целесообразная мощность предприятия*

— Рассчитайте целесообразную мощность предприятия, учитывая обычные задержки, желаемую структуру рабочих смен, совместимость основных машин, работающих вместе, и т. д.;

— Укажите наличие потенциально узких мест или выборочные возможности расширения.

3. *Ожидаемая максимальная производительность предприятия*

Укажите ожидаемую максимальную производительность, соответствующую ожидаемым рынкам сбыта, в процентах от максимально-целесообразной мощности. Необходимо учесть продуктивность труда, нерегулярность спроса, долю отказов, сезонные колебания поставок сырья и т. д.

#### V. ИНВЕСТИРОВАНИЕ

- 1.1. *Земля, подготовка участка*

Укажите размер участка в скобках.

- 1.2. *Здания*

Укажите площадь помещений для каждого подпункта в скобках.

— *Другие вопросы*

Опишите по возможности отдельно систему водоснабжения, электроснабжения, резервуары, системы удаления отходов, жилые помещения для служащих и т. д.

- 1.3. *Техника и оборудование*

Укажите общую сумму вместе с установкой.

(Укажите в сноске здесь или в разделе XII („Приложение“) любые чрезвычайно высокие или низкие сметы по конкретным статьям, которые могут быть связаны со специальными планами

дорожного и жилищного строительства, энерго-снабжения, арендой оборудования, особыми характеристиками затрат и выпуска, разбивкой по временным стадиям потенциально большего интегрированного проекта и т. д.)

2. *Оборотный капитал*

Укажите предварительные сроки планирования с учетом нормального уровня эксплуатации, ожидаемого после завершения строительства предприятия и его пуска.

- 2.1. *Товарные кредиты*

Укажите в скобках эквивалентное число месяцев.

- 2.2. *Принем счетов к оплате*

В скобках укажите средний период отсрочки платежей, предоставляемых клиентам.

3. *Другие инвестиции*

Подсчитайте расходы, предшествующие началу производства, которые должны быть превращены в капитал.

*Основная техника и оборудование (таблица)*

Перечислите *a)* производственную технику и оборудование и *b)* укажите отдельно вспомогательное оборудование (транспорт, лаборатория, обслуживание, выработка электроэнергии, оборудование для учреждений и т. д.); Предпочтительнее указать производственную технику по отделам или цехам, а не по пунктам с классификацией, соответствующей производственно-цеховым линиям, как в разделе VI („Таблица личного состава“);

Если позволяет место, укажите мощность, касающуюся техники и оборудования по цехам или по самым важным пунктам. При необходимости воспользуйтесь разделом XII („Дополнение“).

#### VI. ТАБЛИЦА ЛИЧНОГО СОСТАВА

Перечень цехов должен предпочтительно указывать на основные производственные этапы. Схема технологического процесса, оправдывающая данную производственно-цеховую организацию, может быть приведена в разделе XII („Приложение“);

Необходимо указать сезонных рабочих.

#### VII. ГОДОВОЕ ПРОИЗВОДСТВО

1. *Ожидаемый общий максимальный выпуск в год*

Расположите в виде таблицы продукцию по видам и назначению. „Цена изделия франко завод“ должна включать производство и/или налоги при продаже, если таковые имеются. Необходимо указать особые субсидированные цены на экспорт.

2. *Ожидаемая продажа продукции и учитываемые накопления продукции*

Дайте общую информацию по ожидаемому росту оборота и используемой мощности в течение первых нескольких лет производства, как это указано в таблице в разделе XIII („Таблица потока наличных средств“).

### 3. Политика установления цен

Сравните цены, установленные на основе калькуляции издержек производства, с текущими ценами на импорт. Последние должны объясняться в категориях цен, включающих стоимость, страхование и фрахт, беспошлинный ввоз в импортный порт и обычные тарифы дополнительных расходов, включая пошлины, налоги с оборота, разность торговых и транспортных издержек;

Укажите любые особенности, касающиеся предложенных экспортных цен;

Укажите результаты любых осязаемых проверок в отношении желаемого уровня рентабельности и установления цен на продукцию;

Укажите любые защитные меры, которые необходимо предпринять правительству (целесообразность таких мер должна быть указана в разделе XI („Данные для оценки“)).

### 4. Планируемая организация продажи

Опишите сеть своих представителей по распределению продаваемой продукции и своих магазинов или агентов по сбыту продукции по розничным ценам, оптовиков и других торговых организаций; а также значение наличия своих транспортных средств для торговли.

## VIII. ГОДОВЫЕ ЭКСПЛУАТАЦИОННЫЕ РАСХОДЫ И ПРИБЫЛИ

Данные в этом разделе должны соответствовать „Ожидаемому годовому максимальному выпуску“, как показано в разделе VII.

Укажите отдельно и подробно следующее: а) сырье и полуфабрикаты, б) упаковочные материалы, в) поставки материалов для ремонта и обслуживания, д) энергия и е) вода и другие материалы.

*Примечание:* Канторское оборудование, объявления, страховые взносы, связь, командировки персонала и другие оплачиваемые деловые услуги, которые должны быть включены в пункт 7 („Административные расходы и торговые издержки“). Пункт 7 не должен включать заработную плату рабочим и служащим предприятия.

### 3. Проценты

Укажите подлежащие уплате годовые проценты по взятому займу капитала, как это планировалось. Сюда не следует включать проценты с иностранных займов.

### 5. Косвенные налоги

Перечислите налог на вновь создаваемую стоимость, производственный налог, налог с оборота, налог, уплачиваемый в фонд страхования по безработице, торгово-промышленный налог и т.д. Налоги на прибыль должны быть указаны в пункте 9.

### 6. Амортизация

Укажите нормы и метод установления аморти-

зации. При необходимости используйте место в разделе XII („Дополнение“).

### 7. Административные расходы

См. примечание выше.

### 8. Прочие расходы

Включите работу, сделанную иностранными фирмами на контрактной основе, если такая работа выполнялась; в противном случае под этот пункт могут войти „средства на непредвиденные расходы“.

## IX. ФИНАНСОВОЕ ПРЕДЛОЖЕНИЕ

### 2. Долгосрочные займы

Перечислите займы отдельно в зависимости от различных сроков уплаты.

### 3. Другие займы

Перечислите отдельно краткосрочные и среднесрочные займы; укажите размер процентов и условия их погашения для каждого вида займа.

### 4. Кредиты поставщиков

Укажите общие условия погашения.

### 5. Замечания по политике финансирования

Укажите, представляет ли собой финансовое предложение всего лишь приблизительное и в какой-то степени произвольное предположение или же оно отражает предложение от потенциального инвестиционного учреждения. Укажите также местные и иностранные источники капитала. Опишите вкратце любые другие характерные черты предложения по финансированию.

## X. ОСУЩЕСТВЛЕНИЕ

### 1. Служба технического сотрудничества

Включите прогнозы или рекомендации относительно требуемых дальнейших исследований, подготовку планов проекта, процедур контрактирования и другие основные мероприятия, которые следует предпринять в том случае, если проект окажется приемлемым для выполнения тех задач, для которых было подготовлено первоначальное предпроектное исследование.

### 2. Руководство проектом

Укажите, например, предусматривается ли контракт на строительство объектов под ключ и любые конкретные мероприятия, предложенные для управления проектом в течение строительства и/или начальной стадии эксплуатации проекта.

### 3. Набор и обучение кадров

Опишите любые программы для подготовки кадров за границей и/или на местной основе. Опишите также предложенный график набора инженерно-технического персонала, квалифицированных рабочих и т.д.

### 4. Другие пункты

Дайте описание любых организационных проблем, потребностей в инфраструктуре, которые должны быть удовлетворены, основных законодательных мероприятий для обеспечения жизнеспособности рассматриваемой отрасли промышленности и т.д.



### 5. График

Представьте предложенный график для проведения основных видов деятельности по осуществлению проекта, которые охватывают контрактирование и другие предшествующие строительству виды деятельности, графики начала строительства и период расширения деятельности. Такой график лежал бы в основе расчетов, представленных в разделе XIII („Таблица потока наличных средств“).

### XI. ДАННЫЕ ДЛЯ ОЦЕНКИ

Проверьте вид анализа, включенного в первоначальное предпроектное исследование и резюмируйте основные выводы. Любое неправильное или несоответствующее трактование, связанное с первоначальным обследованием, следует подчеркнуть, осуществив при этом альтернативный анализ, который должен быть выполнен и представлен теми лицами, которые подготовили настоящий материал. Первоначальное предпроектное исследование, которое используется для настоящего материала, может быть полным или неполным с точки зрения оценки проекта. Рекомендации, представленные в первоначальном документе, могут быть обоснованными или не быть обоснованными. В настоящем разделе следует оставить место для оценки эксперта с указанием на любые заслуживающие быть отмеченными слабые стороны первоначального исследования проекта.

### XII. ДОПОЛНЕНИЕ

Используйте эту часть для того, чтобы предоста-

вить дополнительную информацию в отношении любого из разделов настоящего документа. Любые дальнейшие детали или комментарии, для которых необходимо дополнительное место или неформальное представление, должны быть даны здесь, в каждом случае следует упомянуть соответствующий раздел и его подпункт.

### XIII. ТАБЛИЦА ПОТОКА НАЛИЧНЫХ СРЕДСТВ

Используйте настоящую стандартную таблицу потока наличных средств для обеспечения соответствия между различными случаями. В том случае, когда имеется в наличии более чем одна таблица потока наличных средств и/или данная таблица имеет специальную форму, которая не может быть переделана по стандартной форме, ее следует поместить в раздел XII („Дополнение“). Заметьте, что при таком составлении таблиц № 4 („Производственные затраты“) не включает в себя проценты по займам и амортизацию (которые включены в раздел VIII, подразделы 3 и 6 соответственно). Проценты включены в подраздел В. 5.1 („Проценты по займам“). Вместо средств на амортизацию, предполагаемые затраты на замену должны быть помещены в подраздел В. 1.3 („Машины и оборудование [замена]“). Эта таблица построена так, чтобы прибыли внутреннего накопления и амортизационные фонды не разделялись, а объединились в подраздел С („Избытки/Дефицит“), после того как в них внесут уточнения для годовых расходов по капитальному счету (затраты на замену и погашение займов и кредитов).

## NOTAS TECNICAS

El formulario o modelo uniforme empleado en este volumen consta de 13 secciones, una de las cuales (la XII) está reservada para cualquier información complementaria que no encaje bien en el resto del formulario. A continuación se reseñan detalladamente por secciones y por epígrafes, los puntos principales que se han de considerar al llenar el formulario.

### I. ORIGEN DEL ESTUDIO

#### 1. *Este estudio fue preparado por*

Indíquese únicamente el tipo de institución que preparó el estudio de viabilidad original del que se deriva el extracto, como, por ejemplo, un consultor independiente, una firma consultora privada, un proveedor de maquinaria, el personal de una institución oficial de desarrollo o de un organismo internacional de asistencia técnica.

#### *Este estudio fue preparado para*

Indíquese únicamente el tipo de institución que solicitó el estudio original, como, por ejemplo, un inversionista privado, un ministerio de industria o un banco de financiación de inversiones.

#### 2. *El estudio tenía por finalidad*

Especifíquese la oportunidad o perspectiva principal de inversión que motivó el estudio de viabilidad: plan de prioridades de inversión, estudios sectoriales preliminares, etc. Se pueden mencionar los factores importantes a que obedece esa oportunidad.

#### 3. *Tamaño del mercado considerado*

##### — *Otra información*

Enumérense las principales industrias establecidas señalando los recursos de que disponen en condiciones favorables. Se puede indicar la región geográfica en que está situado ese mercado u omitirla. Si el mercado abarca más de un país, es preciso mencionarlo.

### II. DESCRIPCION GENERAL

#### 1. *Productos*

Describábase brevemente las especificaciones técnicas de los productos: por ejemplo, pureza química, propiedades mecánicas, normas de

calidad, composición. Las cantidades y la gama de productos se indicarán en otro lugar.

#### 2. *Principales materiales*

Proporcionéense las especificaciones cualitativas de las principales materias primas de origen local y cualquier característica importante de su abastecimiento; e indíquese, si procede, los materiales de producción importantes que sean necesarios pero no se puedan obtener localmente.

#### 3. *Otras tecnologías posibles y tecnología adoptada para el estudio*

— Indíquese el tipo de proceso, por ejemplo, fabricación de un solo producto o de varios productos, producción en un solo tren o en varios trenes;

— Descríbase brevemente la tecnología, mencionando cualquier nombre especial comúnmente usado por los expertos del ramo. Inclúyanse los detalles que se considere conveniente en la sección XII («Suplemento»);

— Señálese el grado de mecanización y automatización. En la sección XII («Suplemento») puede describirse cualquier característica especial de nivel avanzado.

#### 4. *Factores para el emplazamiento*

##### *Factores de particular importancia*

— Especifíquese los parámetros que determinan las necesidades de transporte: cantidades correspondientes a los principales materiales y productos en peso y/o volumen bruto;

— Indíquese los medios de transporte y las tarifas aplicables;

— Señálese el grado deseado de proximidad a las fuentes de abastecimiento de electricidad y agua y a la infraestructura básica, inclusive la ubicación de las otras industrias con las que el proyecto habrá de estar estrechamente vinculado;

— Indíquese, si las hubiere, las medidas decisivas de política regional recomendadas para que el proyecto sea viable.

##### *Emplazamiento propuesto en la práctica*

Describábase simplemente el emplazamiento propuesto en función de las prioridades diferenciales asignadas a los factores de importancia.

### III. MERCADO

1. *Tabla de la demanda estimada en los mercados interior y de exportación*
  - Tabúlense por separado los datos correspondientes al mercado interior y a los mercados de exportación pertinentes;
  - Indíquense las características especiales, los posibles márgenes de error (entre cálculos optimistas y pesimistas), etcétera.
2. *Notas sobre metodología*
  - Indíquense las principales variables determinantes, las elasticidades de la demanda y otros parámetros clave para proyecciones, y las pautas especiales que se observen en los consumidores;
  - Indíquese si las estimaciones son rudimentarias o complejas y su grado de refinamiento;
  - Descríbase cualquier estudio especial de mercado que haya sido efectuado al respecto.
3. *Selección de los productos*

Justifíquese la composición del producto seleccionada desde los puntos de vista del mercado y de la tecnología de producción. Indíquese qué otros productos podrán incluirse en una futura ampliación del proyecto.

### IV. CAPACIDAD DE LA PLANTA PROYECTADA

1. *Capacidad nominal máxima conforme al proceso principal*
  - Indíquense los tiempos en que se basan los cálculos (tiempo de funcionamiento) y los grupos de máquinas y el equipo concretos que determinan la capacidad nominal máxima del principal proceso o procesos;
  - Indíquese si la capacidad propuesta representa la escala mínima de la planta que resulta aceptable desde el punto de vista tecnológico.
2. *Capacidad máxima viable de la planta*
  - Calcúlese la capacidad viable de la planta, teniendo en cuenta las interrupciones normales, la estructura deseada de los turnos de trabajo, las capacidades indivisibles de las máquinas principales que habrán de combinarse, etcétera;
  - Indíquense los posibles embotellamientos y las posibilidades de ampliación selectiva.
3. *Estimación de la producción máxima de la planta*

Indíquese la producción máxima prevista, que sea compatible con los mercados también

previstos, como porcentaje de la capacidad máxima viable. Deben tenerse en cuenta factores tales como la eficiencia de la mano de obra, las irregularidades de la demanda, la proporción de productos rechazados, las variaciones estacionales del abastecimiento de materias primas, etcétera.

### V. INVERSION

- 1.1. *Terreno, preparación*

Indíquese entre paréntesis el tamaño del solar.
- 1.2. *Edificios*

Indíquese entre paréntesis el tamaño de los locales correspondientes a cada uno de los elementos.

  - *Otros*

Descríbanse, de ser posible, por separado, las instalaciones hidráulicas, eléctricas, los depósitos, los sistemas de evacuación de desechos, las viviendas para empleados, etcétera.
- 1.3. *Maquinaria y equipo*

Indíquese el monto total, incluida la instalación. (En una nota de pie de página o en la sección XII («Suplemento»), indíquese cualquier estimación especialmente alta o baja de determinados componentes que podrían guardar relación con planes especiales de viabilidad y vivienda, el suministro de energía, el arrendamiento de equipo, ciertas propiedades especiales de los insumos y los productos, el calendario de ejecución de un proyecto integrado potencialmente mayor, etcétera.)
2. *Capital de operaciones*

Indíquese en términos de planificación *ex ante*, refiriéndose al nivel normal de operaciones previsto una vez terminada la planta y puesta en marcha.
- 2.1. *Existencias*

Indíquese entre paréntesis el número equivalente de meses.
- 2.2. *Cuentas por cobrar*

Indíquese entre paréntesis el plazo medio de pago concedido a los clientes.
3. *Otras inversiones*

Calcúlese qué desembolsos efectuados antes de iniciada la producción deben considerarse como gastos de capital.

*Maquinaria y equipo principales (cuadro)*
  - Enumérense por separado: *a)* la maquinaria y el equipo de producción y *b)* el equipo auxiliar (transporte, laboratorio,

mantenimiento, producción de energía, equipo de oficina, etcétera);

- Es preferible enumerar la maquinaria de producción por departamentos y talleres a hacerlo por elementos, de manera que la clasificación corresponda a la secuencia de talleres según la sección VI («Plantilla»);
- Si el espacio lo permite, la capacidad de la maquinaria y el equipo se clasificarán por talleres, o por conceptos de importancia predominante. Utilícese la sección XII («Suplemento»), en caso necesario.

## VI. PLANTILLA

- Será preferible que en la lista de talleres se indiquen las principales etapas de elaboración. En la sección XII («Suplemento») se puede incluir un diagrama de operaciones sucesivas que justifique la secuencia prevista para los talleres;
- Se debe especificar qué trabajadores son contratados por temporadas.

## VII. PRODUCCION ANUAL

### 1. *Producción anual máxima prevista*

Prepárese una tabulación por producto y por destino. La partida «precio unitario en fábrica» incluirá los impuestos sobre la producción y/o las ventas, si los hubiere. Se deben indicar los precios especiales de exportación que gozan de subvenciones.

### 2. *Previsión de ventas y de constitución de existencias*

Proporcionéense datos que justifiquen las previsiones relativas al crecimiento de la cifra de ventas y de la utilización de la capacidad durante los primeros años de producción, conforme a la tabulación que figura en la sección XIII («Cuadro de *cash flow*»).

### 3. *Política de precios*

— Compárense los precios que se derivan de la estimación directa del costo con los precios corrientes de importación. Con respecto a estos últimos se aclarará cuáles son los precios c.i.f., libres de derechos de importación en el puerto de entrada, y las tasas normales de recargo incluidos los derechos, impuestos sobre la venta, márgenes comerciales y de transporte;

— Proporcionéense datos concretos con respecto a los precios de exportación propuestos;

— Indíquense los resultados de las pruebas de sensibilidad que se puedan haber efectuado con respecto al nivel deseado de

rentabilidad y a la fijación de precios a los productos;

- Indíquense las medidas de protección gubernamental que puedan resultar necesarias (en la sección XI («Datos para la evaluación») se hará constar la justificación de tales medidas).

### 4. *Organización de ventas planeada*

Describese la red de distribución propia de la empresa mediante representantes vendedores y agentes o almacenes propios para la venta al por menor, mayoristas y otra clase de organizaciones comerciales; indíquese también la importancia de los servicios propios de transporte para la comercialización.

## VIII. COSTOS DE OPERACION Y BENEFICIOS ANUALES

Los datos que aparezcan en esta sección deben corresponder a los de «producción anual máxima prevista» según consten en la sección VII. Indíquese por separado y en detalle: *a)* materias primas y materiales semielaborados, *b)* materiales de envasado, *c)* suministros para reparaciones y mantenimiento, *d)* energía y *e)* agua y otros materiales.

*Nota:* En el punto 7 («Gastos administrativos y costos de venta») deben incluirse el material de oficina, los anuncios publicitarios, las primas de seguros, las comunicaciones, los viajes del personal y otros servicios comerciales que hayan de ser costeados. Este punto no incluirá sueldos y salarios para empleados de la empresa.

### 3. *Intereses*

Indíquense las cargas medias anuales por concepto de interés del capital tomado en préstamo según lo planeado. No se incluirán aquí los intereses correspondientes a préstamos de capital extranjero.

### 5. *Impuestos indirectos*

Enumérense los impuestos sobre el valor añadido, la producción, las ventas, el empleo, las concesiones, etc. El impuesto sobre los beneficios figurará en el punto 9.

### 6. *Depreciación*

Indíquense la tasa y el método de depreciación. Utilícese la sección XII («Suplemento»), en caso necesario.

### 7. *Gastos administrativos*

Véase la nota que figura más arriba.

### 8. *Otros costos*

Inclúyase el trabajo efectuado por otras compañías a base de contratos, si lo hubiere; en caso contrario, la partida para «imprevistos» encajaría bien aquí.

## IX. FINANCIACION PROPUESTA

2. *Préstamos a largo plazo*  
Enumérense por separado los préstamos a diferente plazo.
3. *Otros préstamos*  
Enumérense por separado los préstamos a plazo corto y medio; indiquense en cada caso los intereses y las condiciones de reintegro correspondientes.
4. *Créditos de proveedores*  
Indíquense las condiciones generales de reintegro.
5. *Observaciones sobre la política de financiación*  
Indíquese si la financiación propuesta no es más que una hipótesis aproximada y algo arbitraria o si refleja propuestas formuladas por una posible fuente de financiación de inversiones. Indíquense también las fuentes locales y extranjeras de capital. Describese brevemente toda peculiaridad de la financiación propuesta.

## X. EJECUCION

1. *Servicio de colaboración técnica*  
Inclúyanse las proyecciones o recomendaciones relativas a estudios ulteriores necesarios, la preparación de los planes detallados para el proyecto, los procedimientos de contratación y las demás medidas de importancia que han de adoptarse si el proyecto resulta aceptable para los fines del estudio original de viabilidad.
2. *Dirección del proyecto*  
Indíquese, por ejemplo, si se prevé un contrato llave en mano y los planes concretos propuestos para la dirección del proyecto durante el período de construcción y/o funcionamiento inicial.
3. *Contratación y formación del personal*  
Describáanse los programas de capacitación en el extranjero y/o en el propio país, si los hubiere. Describese también el calendario propuesto para la contratación de personal técnico, de obreros especializados, etcétera.
4. *Otros asuntos*  
Describese todo problema de organización, las necesidades de infraestructura por satisfacerse, las medidas decisivas de carácter legislativo que se requieran para garantizar la viabilidad de la industria considerada, etcétera.
5. *Programa de realización*  
Reséñese el calendario propuesto para las principales actividades de ejecución, incluidas las de contratación y otras previas a la construcción, la iniciación de los programas de

construcción y la fase de ampliación. El programa constituirá la base de las estimaciones presentadas en la sección XIII («Tabla de *cash flow*»).

## XI. DATOS PARA LA EVALUACION

Compruébese el tipo de análisis incluido en el estudio original de viabilidad y resúmanse las conclusiones principales. Puede señalarse cualquier incorrección o deficiencia de enfoque en el estudio original, y los que preparen el presente extracto pueden hacer y exponer un análisis distinto. El estudio de viabilidad original empleado para el presente extracto puede estar completo o no desde el punto de vista de la evaluación del proyecto. Las recomendaciones formuladas en el documento original pueden ser razonables o no. Por ello, en esta sección convendría dejar espacio para una evaluación efectuada por expertos, en la que se señalen los puntos débiles más conspicuos de que pudiera adolecer el estudio original del proyecto.

## XII. SUPLEMENTO

Empléese este espacio para proporcionar información adicional sobre cualquiera de las secciones del extracto. Aquí se deben incluir detalles u observaciones adicionales que requieran más espacio o una presentación que no se ciña al formulario, y, en cada caso, se hará referencia a la sección y el punto pertinentes.

## XIII. CUADRO DE *CASH FLOW*

Empléese esta tabla modelo de *cash flow* a fin de que se puedan comparar casos diferentes. Si se cuenta con más de una tabla de *cash flow* y/o si una de ellas reviste una forma especial que no puede ser reorganizada y volcada en el formato modelo, se la debe incluir en la sección XII («Suplemento»).

Obsérvese que, en la presente tabulación, el punto 4 («Gastos de producción») no incluye intereses de préstamos y depreciación (que figuran en la sección VIII puntos 3 y 6, respectivamente). Los intereses aparecen en la subsección B.5.1 («Intereses por préstamos»). En vez de márgenes de depreciación, los gastos de sustitución previstos figurarán en la subsección B.1.3 («Maquinaria y equipo (sustitución)»). El presente cuadro está dispuesto de tal manera que los beneficios acumulados internamente y los fondos de depreciación no se encuentran tan aislados sino que quedan absorbidos en la subsección C («Superavit/Déficit»), una vez efectuados los ajustes correspondientes a los gastos anuales de la cuenta de capital (gastos de sustitución y reintegro de préstamos y créditos).

## PROJECT CASSAVA STARCH INDUSTRY

(Planning year 1964 )

## I. ORIGIN OF THE STUDY

1. This study was prepared by an independent consulting firm as part of the aid programme sponsored under an international bilateral agreement for a ministry of commerce and industry.

2. The study was intended to assess the supply of cassava which could be made available for local starch manufacturing and to evaluate the economics of starch manufacture. An investment opportunity study has indicated that native raw materials and labour would make up a major portion of the value of production and the starch industry would provide employment in both plantation and manufacturing plants; also high-grade starch could be a source of foreign exchange.
3. Size of the economy considered
- |                          |            |
|--------------------------|------------|
| Population (approx.)     | 11 million |
| Per capita GDP (approx.) | 90 US\$    |
| Other information        |            |

## II. GENERAL DESCRIPTION

1. **Products:** High-grade starch suitable for food products and industrial application is being produced with a 10% moisture content. Further specifications are not given.

2. **Major input materials:** Cassava locally supplied.

3. **Alternative technologies available and technology adopted for the study:** Conventional process consisting of six major sections, namely cleaning and preparation of fresh root, extraction of starch, purification, dewatering or thickening of starch, drying and packing. The production process is continuous. A sulphur burner and absorber for production of sulphurous acid (to prevent enzymatic action in the purification step) is included in the process equipment.

## 4. Locational factors

**Indication of particularly important factors:** The end product is a medium-low-value export item. Therefore, good access to a shipping port is of vital importance. Truck transport cost varies from 4 to 8 cents; reliable transporters probably charge 6 to 8 cents per ton mile. Maximum feasible distance to transport starch from plant to port is approximately 60-75 miles. The starch plant should also be close to the cassava plantation, since cassava roots deteriorate rapidly after harvesting and must be processed within one or two days. Annual rainfall should average 50-70". Care should be exercised to avoid areas where P.H. readings consistently range below 4.5. Land clearing costs should not be higher than \$56 per acre. Water must be pure and free from silt, colloids, salt and iron; freedom from iron is particularly important because iron combined with the prussic acid in cassava forms dark impurities. Large population centres should be avoided generally, where both labour and raw material costs would be high due to high demand of cassava as basic food and land-exhaustion from many years of food crop production.

**Actually proposed locality:** The locality proposed is within 10-15 miles of a seaport. Starch can be lightered to the port for an estimated cost of \$2.10 per ton. Yields of cassava produced by small growers exceed 4 tons per acre without fertilization and cassava is currently in excess supply in this area and available at \$2.60 at the farmer's field. Well water of good quality is available from bore-holes at a depth of about 250 feet and a power line passes through the region less than one mile from the proposed plant site. Labour rates are low and the available supply is sufficient both for starch manufacturing plant and for plantation.

## III. MARKET

## 1. Tabulation of estimated demand on domestic and export markets

Product	Unit	Current annual consumption	Of which imported (%)	Proposed demand in 1964	Increase per year (%)
---------	------	----------------------------	-----------------------	-------------------------	-----------------------

Total consumption data are not given.

## Imports of cassava starch (tons)

Year	USA	Belgium	France	Netherlands	UK	Germany
1954	31,300					
1959	102,600	130	13,210	4,060		
1960	127,000				6,810 <sup>1/</sup>	510 <sup>1/</sup>
1961	139,200					
1962	74,200					
1963	110,750					

Potential starch requirement for internal market is estimated at about 1,500 tons.

<sup>1/</sup> 1954-1962 average

2. **Notes on methodology:** The study is based on information from a separate report on international market potentials for cassava products. It has been found that the United States represents the major market for cassava starch, since particularly all European countries (except Great Britain) have taken a strong protective position with respect to domestic production of corn starch and potato starch by imposing import duties. Therefore only the possibility of exporting to the United States has been taken into account. The market share of industrial-grade and high-grade cassava starch of all imports has been determined (50% high-grade and 50% low-grade starch) and the economic conditions of main international competitors (mainly Thailand) in this market reviewed. The internal market size has been estimated on the starch requirements of all textile mills and the paper industry.

## 3. Selection of product mix:



VII. ANNUAL PRODUCTION

1 Total annual expected maximum output 500,000

Product	Domestic sales				Foreign sales		
	Unit	Quantity	Unit price ex factory (US \$)	Annual turnover (000 US \$)	Quantity	Unit price ex factory (US \$)	Annual turnover (000 US \$)
High-grade cassava starch at 10% moisture	tons	-	-	-	7,100	0.7	5,000

2 Expected sales and inventory build up It is assumed that full capacity utilization is reached after 3 months operation. Production volume in the first operating year will thus amount to about 7,000 tons. Total sales revenue in the first year amounts to US \$500,000.

3 Pricing policy The ex-factory selling price was calculated on the basis of current average price for high-grade starch, c.i.f. New York. To arrive at the ex-factory selling price, lightering cost of \$0.11 per ton, freight of \$0.10 per ton, and an insurance of 1% of c.i.f. price plus 10% were taken into account.

4 Planned sales organization starch purchase commitments by 10 importers were recommended to attain the production levels warranting adequate profitability.

VIII. ANNUAL OPERATING COSTS AND PROFITS

Cost item	Unit	Unit price (US \$)	Quantity	Annual costs (000 US \$)	Foreign currency component (000 US \$)
<b>Total costs</b> (1 - 7)				114	112
<b>I Material costs</b>				102	100
Raw materials					
- cassava root	tons	0.07	12,510	88	-
- sulphur	tons	10.00	5	50	0.15
Diesel oil	litres	0.12	109,110	13	-
Wrapping (multi-wall paper bags)	1,000 149.80		155	23	23
Maintenance supplies 1				15	n.a.
Power costs	1,000 kWh	0.44	2,000	88	-
Fuel oil (for steam generation)	litres	0.011	100,000	10	-

- 1% of the initial investment costs for machinery excluding contingencies and import duties.
- Tax to be paid in the 10th year. During the first 9 years no taxes are to be paid due to 5 years' tax holiday and high depreciation allowances.

Cost item	Annual costs (000 US \$)	Foreign currency component (000 US \$)
<b>2 Personnel costs (1<sup>2</sup>)</b>	92	27
2.1 Wages & salaries	87	27
2.2 Contributions to social securities	-	-
2.3 Fringe benefits	5	-
3 Interests	-	-
4 Rents	-	-
5 Indirect taxes at company level	8	-
6 Depreciation (linear depreciation of total fixed assets and other investment (1 <sup>2</sup> ))	67	67
6.1 Buildings	-	-
6.2 Machinery & equipment	67	67
6.3 Office equipment	-	-
6.4 Other fixed assets	-	-
7 Administrative expenses & sales costs	22	-
8 Other costs	-	-
9 Profit before tax of which profit tax 40% subsidies	78	39 2/

1 <sup>2</sup> ) Categories of persons employed	Domestic		Foreign		Foreign currency component (000 US \$)
	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)	
Top managers			2	31	15.5
Engineers				11	5.5
Technicians	2	2	1	11	6.5
Commercial staff	2	3			
Clerks and typists	4	2			
Foremen	5	6			
Skilled operatives	12	18			
Semi-skilled operatives	-	-			
Unskilled operatives	30	8			
Part-time operatives					
Other special categories					



<b>IX. FINANCING PROPOSAL (in US \$)</b>		<b>4. Suppliers' credits.</b>
1. Equity capital (total) 1,200,000		
2. Long-term loans (total) Rate of interest Repayment		<b>5. Remarks on the financing policy:</b> It is assumed that only equity capital is used.
3. Other loans		

<b>X. IMPLEMENTATION PLAN</b>	
1. Technical collaboration service	It is suggested that major US starch importers should be approached as prime sources of investment capital, technical assistance in setting up the starch plant, assistance in organizing a cassava supply source from plantation or from local farmers, and market commitments required for establishing the starch industry on a viable basis.
2. Project management:	No information is given.
3. Recruitment and training of personnel:	An area of under-employment has been chosen as location where available labour is more than adequate for the starch manufacturing plant and the plantation operation. No further information is given.
4. Other items:	Investment and operating costs for the cassava plantation envisaged are shown in <u>Supplement</u> .
5. Time schedule:	No detailed information is given. Total construction period is approximately one year.

<b>XI. DATA FOR EVALUATION</b>		
1. Profitability evaluation: Check: (x) Break-even point analysis (x) Return to total capital (x) Pay back ( ) Rentability: return to equity capital	2. Further profitability analysis for given project life (Bankability test): Check: ( ) Internal rate of return ( ) Net present value ( ) Any other method used	3. National economic benefit-cost analysis (National priority test): Check: (x) Direct value added and employment effects ( ) Balance of payment effect ( ) Social marginal productivity of capital ( ) Backward and forward effects ( ) Synthetic benefit cost analysis ( ) Any other method used
<i>Give a short outline of the methods used and major findings:</i>		
<p><b>Break-even point analysis:</b> Break-even operating rates were defined in two different ways depending on their purposes: (1) Minimum operating rates, which would cover all costs including depreciation of plant facilities, would be used if low operating rates were expected to persist for a significant time period; (2) For short periods of restricted root supply or sales possibilities, depreciation can be deferred, and a lower break-even operating rate, which would cover all costs except depreciation, can be used.</p> <p>All costs were split into variable costs, which would vary directly with production rate, and fixed costs, but would not change with operating rate. At reduced production rates, it was assumed that the plant would operate at full capacity when root is available and shut down during shortages, and that direct labour would be laid off. It was further assumed that at low operating rates, average root costs would probably be \$8.40 - 9.90 per ton because of the greater percentage purchased from the plantation.</p> <p>Break-even operating rates not including depreciation would be 3,000-3,700 tons per year, i.e. about 43-53% of annual capacity. If depreciation is included as an expense, the break-even operating rate at the same root costs are 4,900-5,900 tons, i.e. 69-84% of the annual capacity.</p> <p><b>Return to total capital:</b> Assuming a root cost of \$8.40, return on capital investment including working capital was estimated to be 7.5% after 9<sup>th</sup> of straight-line depreciation during the period with no tax liability (first 9 years of operation). See <u>Supplement</u> for the data on return to capital.</p> <p><b>Pay back:</b> The pay back period was calculated from the cumulative net profits and depreciation. Net profit in the first operating year is estimated at \$12,000, in the following years at \$76,000. Depreciation amounts to \$67,000 per annum. Thus capital investment is returned after eight years of operation.</p> <p><b>Direct value added and employment effects:</b> The net value added amounts to approximately \$170,000 in factor-cost terms, i.e. wages and salaries including fringe benefits and profit before taxes. The direct contribution to domestic income, however, is less since a part of the salaries has to be accounted for expatriates. The manufacturing plant provides work for 75 domestic employees, 27 of which can be unskilled. If a plantation would be attached to the factory, at least another 120 men would be required.</p>		

XII. SUPPLEMENT

17. Programming data on a larger starch plant

This study also indicates data for a larger cassava starch plant with a capacity of 4<sup>1/2</sup> tons per day, which would require a total capital investment of about \$1.6 million. The output of a plant of this size is about 30% of the estimated imports of high-grade starch into the United States.

The return on investment during the period of operation when no tax liability is incurred is estimated at 22%. To achieve this return, the full annual output of 14,000 tons must be sold as high-grade starch at an average selling price of \$91.5 per ton. Also, cassava must be purchased at an average cost to the plant of \$6.9 per ton, a price which can be attained by an efficient combination of purchases from local farmers and from a plantation.

Adequate return on investment will be realized under much more unfavourable market and cassava supply conditions for the 4<sup>1/2</sup>-ton per day plant than for a 24-ton per day plant. Starch can be sold, for example, to the larger low-grade starch markets at a price of \$70 per ton and still realize an 11% return on investment during the tax holiday period, if root costs are very low (about \$5.60 per ton). If half the output is sold to high-grade markets and half to low-grade markets at an average root procurement cost of \$7 per ton, return on investment is estimated at 1%.

7.1 Investment and operating costs of cassava plantation

In order to ensure a dependable supply of cassava at prices which will permit a starch plant operator to compete for world markets, it is also suggested in the study that a plantation be established to supply at least part of the cassava requirements. It is expected that yields will probably range between 27 and 37 tons per hectare with proper management and economic production techniques. A 3,640-hectare plantation (1,210 hectares planted and harvested each year) producing 32,510 tons of cassava per annum requires an initial total investment of approximately \$500,000, thereof

Preliminary expense, including compensation for crops and buildings	US \$ 42,000
Plantation buildings (shed for plantation equipment and maintenance shop)	16,000
Furnished housing (for executive and administrative personnel)	56,000
Machinery and equipment	190,000
Land clearing (excluding depreciation of machinery)	200,000

and prepaid production expenses (operating costs of planting and cultivating prior to first harvest) of approximately \$200,000.

Annual operating costs average approximately:	US \$
for planting and cultivating	32,000
for harvesting	42,000
for fertilizers	25,000
for supervision and overheads	64,000
for depreciation	24,000

i.e. \$153 per hectare harvested.

The rate of return at a selling price of \$8.40 per ton would thus average approximately 16% during the period of tax holiday. At yields of 37 tons per hectare or above, a 3,640-hectare plantation would yield an attractive return at a selling price as low as \$7 per ton.

An integrated plantation and starch manufacturing operation would result in annual savings of operating costs of approximately \$30,000 in overheads, maintenance, furnished housing, and vehicles.

Profitability evaluation (in US \$ 000)

	Operating year	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
	0	1									
1. Plant investment	840										
2. Working capital <sup>2/</sup>		187									
3. Total capital requirement	840	1,027 <sup>3/</sup>	1,027	1,027	1,027	1,027	1,027	1,027	1,027	1,027	1,027
4. Depreciation reserved <sup>4/</sup>	-	67	134	201	260	327	396	462	529	588	
5. Net assets (3-4)	840	260	893	826	767	700	631	565	498	439	
6. Cumulative net profits	-	14	92	170	249	327	406	484	562	641	683
7. Net capital remaining in plant <sup>5/</sup>	840	246	801	656	518	373	285	149	3	(143)	(244)
8. Sales income		560	652	652	652	652	652	652	652	652	652
9. Operating cost		546	574	574	574	574	574	574	574	574	574
10. Gross profits (8-9)		14	78	78	78	78	78	78	78	78	78
11. Depreciation: (a) allowed <sup>6/</sup>							364	89	72	58	50
(b) included in operating costs							67	67	67	67	67
(c) net for tax purposes (a-b)							297	22	5	(9)	(17)
12. Adjusted gross profits (10-11c)		14	78	78	78	78	(219)	56	73	87	95
13. Cumulative losses carried forward							219	163	90	3	
14. Taxable profit (12-13)		-	-	-	-	-	-	-	-	-	22
15. Income tax at 40% of taxable profit											39
16. Net profit		14	78	78	78	78	78	78	78	78	46
17. Return on plant investment plus working capital (%) <sup>7/</sup>		1.3	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	4.5

- 1/ Production - 6,045 tons in 1st year of operation.
- 2/ Working capital - 3 months' operating cost plus 2 months' transportation expenses.
- 3/ Difference in some figures in comparison to other chapters are due to rounding.
- 4/ Depreciation - 8% initial plant investment. Reserve adjusted for replacement of passenger vehicles every 3 years, lorries every 5 years, 25% salvage value.
- 5/ Bracket ( ) indicates negative number.
- 6/ Includes depreciation of replacement vehicles.
- 7/ After depreciation of 8% of plant investment.

XIII. CASH FLOW TABLE (000 US \$)

	Year	Terminal value of assets
<b>A. Source of cash</b>	-----	
1. Financial resources: total	-----	
1.1. Loan <sup>1</sup>	-----	
1.2. Equity	-----	
1.3. Suppliers' credits	-----	
1.4. Subsidies	-----	
2. Sales revenue <sup>2</sup>	-----	
<b>B. Uses of cash</b>	-----	
1. Fixed capital expenditure: total	-----	
1.1. Land, site improvements, & buildings	-----	( )
1.2. Machinery & equipment (new installation)	-----	( )
1.3. Machinery & equipment (replacement)	-----	( )
2. Net working capital: total	-----	
2.1. Stocks of materials	-----	( )
2.2. Work-in-process <sup>3</sup>	-----	( )
2.3. Stocks of finished products	-----	( )
3. Pre-investment & start-up expenses: <sup>4</sup>	-----	( )
4. Production expenditure: total	-----	
4.1. Personnel expenditure	-----	
4.2. Materials <sup>5</sup>	-----	
4.3. Administrative expenditure	-----	
4.4. Indirect taxes & royalties	-----	
4.5. Other expenditure (rents, contingencies, etc.)	-----	
5. Debt service: total	-----	
5.1. Interest on loans	-----	
5.2. Repayment of loans & credits	-----	
6. Dividends & profit taxes paid: <sup>6</sup>	-----	
<b>C. Surplus/Deficit (A - B)</b>	-----	
<b>SURPLUS/DEFICIT ACCUMULATED:</b>	-----	

<sup>1</sup> Loans of different terms should be shown separately.

<sup>2</sup> Annual value of production of finished goods minus annual accumulation of finished goods inventory.

<sup>3</sup> Total production costs minus production costs of finished goods.

<sup>4</sup> Not including interest during construction.

<sup>5</sup> Annual purchase minus annual accumulation of materials inventory.

<sup>6</sup> This item stands for the part of profit which is to be paid out, namely profit tax, dividends, fees of the members of the executive board, managerial staff's share in profits, etc. Actually this sum will be established after allowances have been made for depreciation which are not included under item 4. (production expenditure). The cash flow balance should be programmed, therefore, in such a way that all necessary replacement (B.1.3.) can be covered in any year by the accumulated surplus.

Comments:

(The cash flow table, prepared in the original study, was in a considerably different form, specifically geared to the calculation of return on investment capital. It is reproduced in Supplement.)

## PROJECT PRODUCTION OF WOOD WOOL SLABS

(Planning year: 1967)

1

<b>I. ORIGIN OF THE STUDY</b>	<p>1. This study was prepared by an independent consulting firm for a national investment bank in a developing country (in Africa)</p> <p>2. The study was intended to substitute imports and to make use of the by-products of local sawmills and joineries as raw material.</p> <p>3. Size of the economy considered:</p> <p>Population (approx.)                      "      million</p> <p>Per capita GDP (approx.)                220    US \$</p> <p>Other information</p>																																		
<b>II. GENERAL DESCRIPTION</b>	<p>1. <b>Products:</b> Wood wool slabs are characterized by the following properties: high thermic insulation and sound absorption, easy processing by sawing, nailing, screwing, gluing and plastering, resistant to vegetal and animal vermin as well as to high atmospheric humidity, low combustibility, low weight. The fields of application are, depending upon the thickness: covering and decoration of walls and ceilings (0.5"), partition walls, sound absorption and thermic insulation (1"), inside walls, sound absorption and thermic insulation (1.5"), other walls and roofs, inside and partition walls (2"). In some fields of application, wood wool slabs can substitute concrete block wall, hollow block wall, brick wall, fixed eoft board, plywood, chip board.</p> <p>2. <b>Major input materials:</b> Three main inputs are used: wood, cement, and the so-called mineralizing agent (a calcium chloride solution of 3% concentration). Residues of industrial wood or branch wood may be used. The cylindric pieces of wood should not be longer than 20" and the diameter should range between 3" and 15". Only soft or moderately hard wood with long fibres, i.e. with a density of up to 40 lbs cu.ft. should be processed. The humidity of wood should range from 4" to 10" depending on the oven-dry weight and types of wood. Rapidly hardening cement with a low lime content should be used. Portland cement is a suitable mineral-binding agent. Magnesite cement is vulnerable to high thermic humidity.</p> <p>3. <b>Alternative technologies available and technology adopted for this study:</b> Technologies available differ only in the degree of mechanization. The process of production adopted is highly mechanized with conveyors, automatic distributing and doeing mechanisms.</p> <p>4. <b>Locational factors:</b>  Indication of particularly important factors: The raw materials and finished goods to be transported are: wood 900 tons, cement 840 tons, calcium chloride 35 tons, wood wool slabs 1,440 tons. Transport costs per ton and mile amount to \$0.03 for wood and cement, \$0.044 for mineralizing agent and wood wool elabe. Specific gravity of the wood slabs is approximately 0.4. Location close to the sales market is of importance for two reasons: relatively high transport costs of the bulky finished product compared with a low sales price; and extension of the sales market by advertising and information service.</p> <p>Actually proposed locality: Since about 70% of total construction volume of the country is concentrated in an area of approximately 800 km<sup>2</sup> and also a cement clinker mill is located in this area, a location has been proposed in this centre of building activities of the country.</p>																																		
<b>III. MARKET</b>	<p>1. Tabulation of estimated demand on domestic and export markets:</p> <table border="1"> <thead> <tr> <th>Product</th> <th>Unit</th> <th>Current annual consumption</th> <th>Of which imported (%)</th> <th>Projected demand in 1968</th> <th>Increase per year (%)</th> </tr> </thead> <tbody> <tr> <td colspan="6"><b>Domestic market</b></td> </tr> <tr> <td>Wood wool elabe (2'x2'x1")</td> <td>000 pce.</td> <td>12</td> <td>100</td> <td>70</td> <td>3</td> </tr> <tr> <td colspan="6"><b>Export market</b></td> </tr> <tr> <td>Wood wool elabe</td> <td></td> <td>not available</td> <td>not available</td> <td>5</td> <td>3</td> </tr> </tbody> </table> <p>2. <b>Notes on methodology:</b> Import statistics proved to be an inadequate basis because of general restrictions of imports and relatively high sales prices resulting from high transport costs and import duties. Thus an analysis was conducted of the structure of the building activity in the country. The major public and private building contractors were contacted and the number of building licences granted taken into account. On the basis of these investigations the annual demand was estimated as follows: New residential buildings: 4,000 dwelling units per annum, 50% of which use an average of 25 elabe per dwelling unit; 100 low-price houses per annum, using 75 slabs per house; public, commercial buildings and churches: about 20% of the demand for housing; extension and remodelling of old buildings, dwelling houses, public and commercial buildings as well as churches: about 5% of the annual demand for new buildings. The share of the different slab thickness in total demand was estimated according to the possible fields of application and in the light of the building structure. The medium slab thickness of 1" and 1.5" will account for 30% each of the total demand, while the elabs of 0.5" and 2" will have a share of 20% each. In the export market it has been suggested to co-operate at first only with a few large importers and dealers in building materials in the neighbouring countries.</p> <p>3. <b>Selection of product-mix:</b> Although a standard size of 8' x 4' for slab-shaped wood materials such as veneer boards, joiner's boards, fibre boards, and chip boards has been established, for reasons connected with production engineering and raw material control, the manufacture of half the size, i.e. 2' in width, is recommended. By joining two slabs, the established standard of 8' x 4' can be reached.</p>					Product	Unit	Current annual consumption	Of which imported (%)	Projected demand in 1968	Increase per year (%)	<b>Domestic market</b>						Wood wool elabe (2'x2'x1")	000 pce.	12	100	70	3	<b>Export market</b>						Wood wool elabe		not available	not available	5	3
Product	Unit	Current annual consumption	Of which imported (%)	Projected demand in 1968	Increase per year (%)																														
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<b>Export market</b>																																			
Wood wool elabe		not available	not available	5	3																														

**IV. CAPACITY OF PROPOSED PLANT**

1. **Nominal maximum capacity according to major process:** The capacity of the proposed wood wool planing machine is about 2.3 tons wood wool in one shift. With a single-shift and 275 working days, an annual capacity amounts to about 630 tons wood wool. Other manufacturing facilities, such as presses, ripping saws and mixing machines for cement and wood wool, are adjusted to this capacity (about 90,000 slabs), which represents the technical minimum capacity of this process. By introducing second and third production shifts, capacity can be doubled or tripled.
2. **Maximum feasible capacity of the plant:** By giving due account to normal stoppage of machinery, maximum feasible capacity is approximately 90% of nominal maximum capacity, i.e. 80,000 pieces of slabs.
3. **Expected maximum output of the plant:** Expected maximum output (70,000 pieces) is some 12% less than the maximum feasible capacity and represents the expected market volume.

**V. INVESTMENT (000 US \$)**

	Total	Foreign currency component		Total	Foreign currency component
<b>TOTAL INVESTMENT</b>	446	181			
1. Fixed assets <sup>1/</sup>	279	135	2. Working capital	94	16
1.1. Land, site development <sup>2/</sup> (0.6 ha)	33	-	2.1. Inventories	44	6
1.2. Buildings	84	17	- Production materials, fuels & auxiliary materials (wood 6 mths, cement 1 mth.)	10	5
- Factory 750 m <sup>2</sup>	70	14	- Parts & supplies for repair & maintenance (3 months)	4	1
- Office 84 m <sup>2</sup> \$43/m <sup>2</sup>	4	1	- Work-in-process (1 week)	3	-
- Storage 117 m <sup>2</sup> \$43/m <sup>2</sup>	5	1	- Finished goods (2 months)	27	-
- Others			2.2. Accounts receivable (2.5 months)	32	-
Auxiliary dept. 125 m <sup>2</sup> \$43/m <sup>2</sup>	5	1	2.3. Other liquid assets (cash for unforeseeable payments)	18	10
1.3. Machinery & equipment (50 kW) (details see below)	162	118	3. Other investments	73	30
			3.1. Pre-investment costs	52	30
			- Preliminary expenditure	-	-
			- Planning costs	19	7
			- Engineering costs	11	11
			- Interest during construction (\$50,000 at 8.5%)	4	4
			- Training costs <sup>3/</sup>	7	5
			- Others	18	3
			3.2. Start-up expenses	14	-
			- Consultant fees	-	-
			- Costs for test run	12	-
			- Others	2	-

- N.B.
- 1/ No import duty on equipment imported.
  - 2/ No costs for land are included in this amount since industrial sites can be rented.
  - 3/ Costs mainly occur during the training of key personnel abroad before and during construction period (18 months) and the test runs of machines (2 months).

Major machinery & equipment	f.o.b. supplier country's price	Transport cost (insurance freight)	Import duty	Landing, local installation cost	Total	Foreign currency component
Wood wool plane and saw	9	0.6	(Exempted)	1.3	10.9	10.0
Wood wool impregnating device	4	0.3		0.7	5.0	5.0
Mixing device and conveyor belt	6	0.4		0.9	7.3	6.0
Continuous press with dosing mechanism	14	1.0		2.2	17.2	15.0
Piling press and saws	17	1.2		2.6	20.8	19.0
Ventilation device, cables, etc.	3	0.2		0.5	3.7	4.0
Contingencies, spare parts	11	0.8		1.8	13.6	13.0
Cement silo	..	..		..	2.0	-
Container for salt solution	..	..		..	1.0	-
Machines and tools of repair shop	4	0.3		0.7	5.0	5.0
Transformer station	20	2.0		3.0	25.0	22.0
Factory equipment	..	..		..	9.0	2.0
Office equipment	..	..		..	13.0	3.0
Vehicles (imported)	9	2.0		3.0	14.0	14.0
Vehicles (from local assembly plant)	-	-		-	14.0	-

**VI. MANNING TABLE**

Total number of persons: 23

Shop	1st shift	2nd shift	3rd shift	Shop	1st shift	2nd shift	3rd shift
1. Primary operative shops (including supervisory staff)	13	-	-	2. Auxiliary operative shops	6	-	-
Production department	13			- Repair & maintenance	3		
				- Utilities control			
				- Product & material storage			
				- Off-site transport			
				- Guards, cleaners, etc.	3		
				3. Administration	4	-	-
				- Production management	1		
				- Research & development	-		
				- Sales & purchase	1		
				- General administration	2		

VII. ANNUAL PRODUCTION

1. Total annual expected maximum output: US \$260,000

Product	Domestic sales				Foreign sales			
	Unit	Quantity	Unit price ex factory (US \$)	Annual turnover (000 US \$)	Quantity	Unit price ex factory (US \$)	Annual turnover (000 US \$)	
Total				251			8.5	
Slabs of 0.5" thickness	8' x 2'	000 pcs.	14	2.85/piece	40	1.0	1.50/piece	1.5
Slabs of 1.0" thickness	"	"	21	3.40/piece	71	1.5	1.70/piece	2.5
Slabs of 1.5" thickness	"	"	21	3.90/piece	82	1.5	1.80/piece	2.7
Slabs of 2.0" thickness	"	"	14	4.15/piece	58	1.0	1.85/piece	1.8

2. Expected sales and inventory build-up: No information is given

3. Pricing policy: Proposed domestic prices are on the average 11.5% below the import-substitution prices, ranging from 7% to 25% depending on the slab thickness. The import-substitution price includes an existing import duty of 50% on c.i.f. price. If import duty would be excluded from the import substitution price and local prices would be fixed accordingly, annual turnover would fall to US \$200,000. For export sales prices ex factory, current c.i.f. prices in neighbouring countries and transport costs of approximately US \$15 per m<sup>3</sup> wool wool slab to these countries have been taken into account. Moreover, current c.i.f. prices of imports from neighbouring countries' ports are to be lowered slightly in order to compete with the present suppliers from overseas. This export price policy results in the fact that, depending upon the slab thickness, the direct costs and 78% - 41% of indirect costs amounting to US \$1.26 per slab are covered by the average price free factory for export consignments.

4. Planned sales organization: All public authorities, architects, and building contractors have to be made familiar with the versatile applicability of wool wool slab by the sales manager. During the 2-month test run, slabs of excellent quality are used for advertising purposes and for the purpose of demonstrating the advantages of wool wool slab.

VIII. ANNUAL OPERATING COSTS AND PROFITS

Cost item	Unit	Unit price (US \$)	Quantity	Annual costs (000 US \$)	Foreign currency component (000 US \$)
<b>Total costs</b>				159	30
<b>1. Material costs</b>				50	30
Wood	tone	16	900	14	-
Cement	tone	34	840	29	-
Calcium chloride	tone	40	35	1	1
Moulding oil	000 l.	220	32	0.7	-
Diesel motor fuel, petrol and lubricants				3	-
Water	000 l.	90	1.5	0.2	-
Electric power	000 kWh	28	70	2	-

1/ Maintenance and repair costs are calculated as 2% of the investment value of buildings and site development, 5% of machines, tools and equipment, and 1% of vehicles.

2/ According to an investment promotion decree newly established industrial enterprises can be exempted from the 50% income tax up to ten years.

Cost item	Annual costs (000 US \$)	Foreign currency component (000 US \$)
<b>2. Personnel costs (*)</b>	26	
2.1. Wages & salaries	19	
2.2. Contributions to social securities	5	
2.3. Fringe benefits	2	
3. Interests (8.5%)	11	
4. Rents (\$1,235/ha)	1	
5. Indirect taxes at company level	-	
6. Depreciation (linear method)	34	
6.1. Buildings (3.3% of \$116,500)	4	
6.2. Machinery & equipment (10% of \$112,000)	11	
6.3. Office equipment (2% of \$22,000)	5	
6.4. Other fixed assets (10% + 2% of \$100,000)	14	
7. Administrative expenses & sales costs	18	
8. Other costs (maintenance, repair <sup>1/</sup> and contingencies)	19	
9. Profit before tax	100	
of which - profit tax (50%) <sup>2/</sup>	(49)	
- subsidies	-	

Category of persons employed	Domestic		Foreign	
	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)
Top managers	1	7.0		
Engineers	1	1.9		
Technicians	1	1.6		
Commercial staff	2	5.0		
Clerks and typists	1	0.9		
Foremen	1	1.0		
Skilled operatives	3	2.1		
Semi-skilled operatives	3	1.8		
Unskilled operatives	10	5.0		
Part-time operatives				
Other special categories				

**IX. FINANCING PROPOSAL (in US \$)**

**4. Suppliers' credits.**

- 1 Equity capital (total) 270,000
- 2 Long term loans (total) 135,000  
 Rate of interest 10% per annum  
 Repayment 5-1 years. No further details given.
- 3 Other loans

5 **Remarks on the financing policy:** Financing with a relatively high proportion of equity capital is recommended, since wood wool slab is a new product on the market, and, at the beginning of production, a significant accumulation of stock has to be expected. In the initial financing phase, therefore, it may be necessary to raise credits to finance the temporary stock.

**X. IMPLEMENTATION PLAN**

- 1 **Technical collaboration service:** It is recommended that a foreign advisor, who is to be at the plant's disposal during the first year of operation, should supervise the assembly work.
- 2 **Project management:** No turn-key contract is envisaged. The following tasks are expected to be performed by engineering consultants: preparation of a detailed time schedule and a financing plan, negotiations with manufacturers of machinery, co-ordination of the requirements laid down by the manufacturer of machinery with the architects' and engineers' calculations, negotiations with relevant government authorities, public utility corporations, etc., supervision of construction and settlement of construction accounts, etc.
- 3 **Recruitment and training of personnel:** A 6-month training programme in a European plant manufacturing wood wool slabs is planned for the following key personnel: works manager (responsible for production flow), work shop manager (responsible for repair shops and auxiliary departments), and sales manager. The sales manager should also familiarize himself with the versatile technical applicability of wood wool slabs.
- 4 **Other items:**
- 5 **Time schedule:** For the realization of the project, a total period of 12 months was considered necessary with the following schedule:
 

Technical detail planning	months 1 to 4	Ordering of machines and delivery	months 3 to 9
Training of technical key personnel	months 4 to 9	Assembly of machines	month 10
Site development	months 5 to 7	Trial run of machines	months 11 and 12
Construction of buildings	months 7 to 10		

Extension phase: No extension phase is planned, since the second and third production shifts can still be introduced when demand grows more than expected.

**XI. DATA FOR EVALUATION**

- 1. **Profitability evaluation.**  
 Check  
 Break-even point analysis  
 Return to total capital  
 Pay back  
 Rentability (return to equity capital)
- 2. **Further profitability analysis for given project life (Bankability test):**  
 Check  
 Internal rate of return  
 Net present value  
 Any other method used
- 3. **National economic benefit cost analysis (National priority test):**  
 Check  
 Direct value added and employment effects  
 Balance of payment effect  
 Social marginal productivity of capital  
 Backward and forward effects  
 Synthetic benefit cost analysis  
 Any other method used

*Give a short outline of the methods used and major findings:*

**Break-even point analysis:** In the calculation the production volume is determined by the total weight of manufactured slabs, since there is a correlation between production costs and total weight of slabs produced. The total costs are broken down into their fixed (5%) and direct cost (45%) components. Direct costs (\$71,500) contain costs of raw materials, general and operating supplies, electric power and parts of wages and maintenance and repair. Fixed costs (\$90,000) consist of costs for administration, depreciation, interest on borrowed capital, and parts of personnel costs and maintenance and repair. The breakeven point lies at an annual production of approximately 37,400 slabs, i.e. approximately 50% of the expected maximum output.

**Return to total capital:** Assuming a tax holiday of five years, gross profit (including depreciation) amounts to approximately \$133,500. Thus the rate of return (gross profit/total investment) amounts to approximately 30%. The rate of return as percentage of profit after depreciation over investment amounts to approximately 20%.

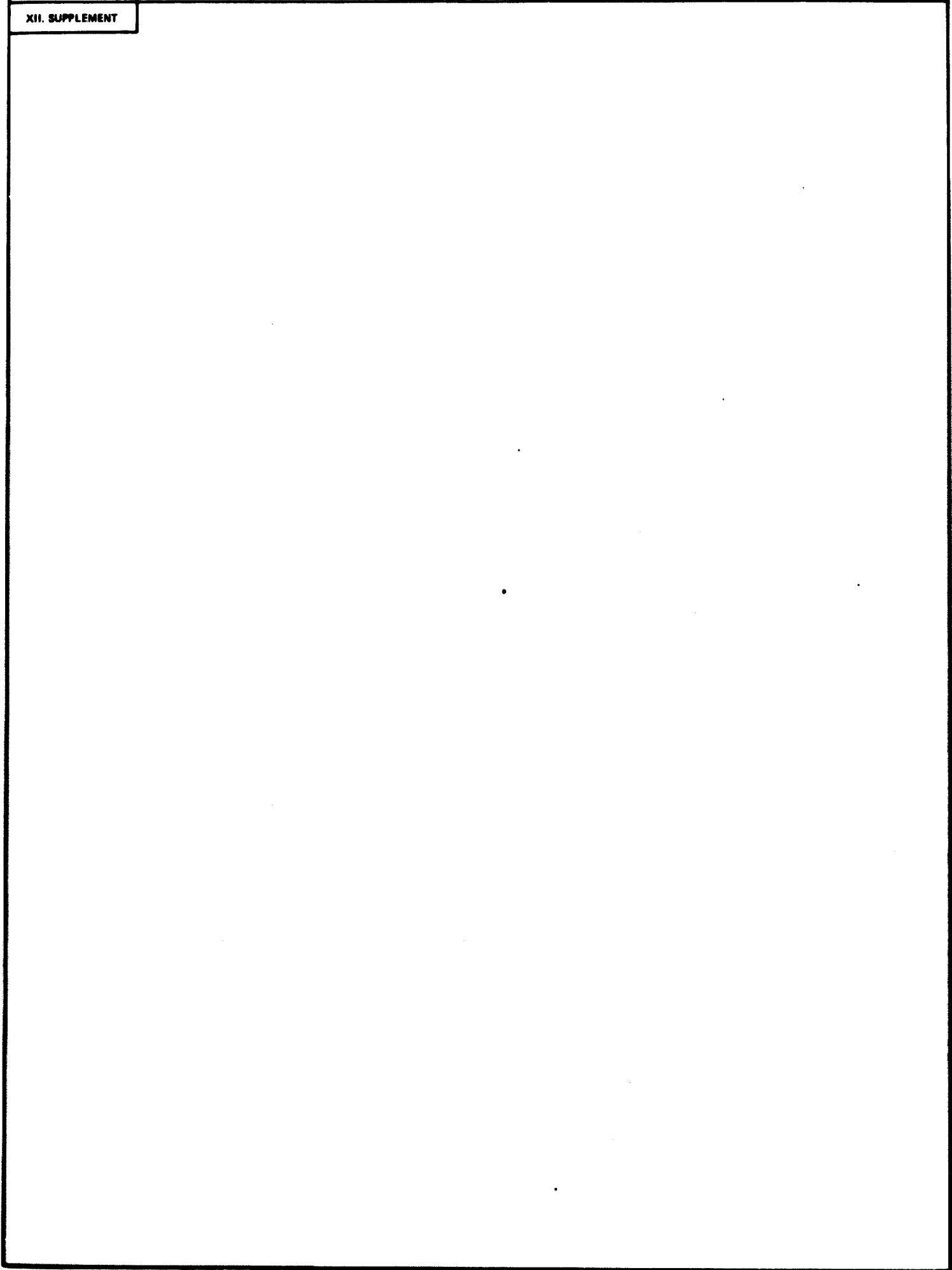
**Direct value added and employment effects:** The direct annual contribution of the project to national income (net of depreciation) totals \$138,000, i.e. wages and salaries 26,500, interest and rent (on average) 1,100, profit (before taxation) 100,000. Due to the relatively simple production process for about 65% of the 23 regularly employed persons no prior training is required. When introducing the second shift the number of employees would increase to approximately 38.

**Balance of payment effect:** The effects on the balance of payments is determined by comparing foreign exchange savings from substitution of imported slabs and foreign exchange earnings from exports of slabs with foreign exchange expenditure for imports of raw materials, operating and general supplies and foreign exchange expenditure for the procurement of spare parts and replacement investments. The annual foreign exchange savings and earnings amount to approximately \$196,000 as against additional expenditure totalling an average of \$51,000. Net foreign exchange savings thus amount to \$145,000 per year. The foreign exchange expenditure for the erection of the plant will be offset by foreign exchange savings in about 1 1/2 years after the start of production.

**Backward and forward effects:** Backward effects might not be felt so strongly, since cement and calcium chloride are to be imported. But the versatile applications and the relative inexpensiveness of wood wool slabs might stimulate programmes for housing development.

3311-(1)AGE 5

XII. SUPPLEMENT





XIII. CASH FLOW TABLE (000 US \$)

	Year										Terminal value of assets
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	
<b>A. Source of cash</b>	1,00,000	1,25,000	1,60,000	1,60,000	1,60,000	1,60,000	1,60,000	1,60,000	1,60,000	1,60,000	
1. Financial resources	1,00,000	85,000	-	-	-	-	-	-	-	-	
1.1 Loan <sup>1</sup> (long-term)	85,000	50,000	-	-	-	-	-	-	-	-	
1.2 Equity	15,000	35,000	-	-	-	-	-	-	-	-	
1.3 Suppliers credits	-	-	-	-	-	-	-	-	-	-	
1.4 Subsidies	-	-	-	-	-	-	-	-	-	-	
2. Sales revenue <sup>2</sup>	-	1,40,000	1,60,000	1,60,000	1,60,000	1,60,000	1,60,000	1,60,000	1,60,000	1,60,000	
<b>B. Uses of cash</b>	1,00,000	1,49,000	1,24,000	1,24,000	1,31,000	1,35,000	1,41,000	1,41,000	1,41,000	1,41,000	
1. Fixed capital expenditure	1,49,000	11,000	-	-	-	11,500	-	-	-	11,500	
1.1 Land, site improvements & buildings	1,17,000	-	-	-	-	-	-	-	-	-	(1,17,000)
1.2 Machinery & equipment (new installation)	32,000	11,000	-	-	-	-	-	-	-	-	(1,11,000)
1.3 Machinery & equipment (replacement)	-	-	-	-	-	11,500	-	-	-	11,500	(1,11,500)
2. Net working capital	14,000	32,000	-	-	-	-	-	-	-	-	
2.1 Stocks of materials	14,000	-	-	-	-	-	-	-	-	-	(1,14,000)
2.2 Work in-process <sup>3</sup>	-	1,000	-	-	-	-	-	-	-	-	(1,10,000)
2.3 Stocks of finished products	-	27,000	-	-	-	-	-	-	-	-	(1,27,000)
3. Pre-investment & start up expenses <sup>4</sup>	15,000	14,000	-	-	-	-	-	-	-	-	(1,69,000)
4. Production expenditure	-	114,000	114,000	114,000	114,000	114,000	114,000	114,000	114,000	114,000	
4.1 Personnel expenditure	-	26,500	26,500	26,500	26,500	26,500	26,500	26,500	26,500	26,500	
4.2 Materials <sup>5</sup>	-	50,500	50,500	50,500	50,500	50,500	50,500	50,500	50,500	50,500	
4.3 Administrative expenditure	-	18,500	18,500	18,500	18,500	18,500	18,500	18,500	18,500	18,500	
4.4 Indirect taxes & royalties	-	-	-	-	-	-	-	-	-	-	
4.5 Other expenditure (rents, contingencies, etc.)	-	18,500	18,500	18,500	18,500	18,500	18,500	18,500	18,500	18,500	
5. Debt service	2,000	3,500	11,500	11,500	11,500	3,200	3,800	1,500	1,500	1,500	
5.1 Interest on loans	2,000	3,500	11,500	11,500	11,500	3,200	3,800	1,500	1,500	1,500	
5.2 Repayment of loans & credits	-	-	-	-	-	-	-	-	-	-	
6. Dividends & profit taxes paid <sup>6</sup>	-	11,500	15,500	15,500	15,500	15,500	15,500	15,500	15,500	15,500	
<b>C. Surplus/Deficit (A - B)</b>	-	76,000	36,000	36,000	29,000	25,000	19,000	19,000	19,000	19,000	
<b>SURPLUS/DEFICIT ACCUMULATED</b>	-	76,000	112,000	148,000	177,000	202,000	221,000	240,000	259,000	278,000	

<sup>1</sup> Loans of different terms should be shown separately  
<sup>2</sup> Annual value of production of finished goods minus annual accumulation of finished goods inventory  
<sup>3</sup> Total production costs minus production costs of finished goods  
<sup>4</sup> Not including interest during construction  
<sup>5</sup> Annual purchases minus annual accumulation of materials inventory  
<sup>6</sup> This item stands for the part of profit which is to be paid out, namely profit tax, dividends, fees of the members of the executive board, managerial staff's share in profits, etc. Actually this sum will be established after allowances have been made for depreciation which are not included under item 4 (production expenditure). The cash flow balance should be programmed therefore in such a way that all necessary replacement (B 1.1) can be covered in any year by the accumulated surplus.

Comments

PROJECT: INTEGRATED WOOD PROCESSING (SAWMILL AND PARTICLE BOARD)  
(Planning year: 1970)

I. ORIGIN OF THE STUDY

1. This study was prepared by an independent consulting firm for a public company in a developing country.

2. The study was intended to evaluate the possibilities for processing local woods.

3. Size of the economy considered

Population (approx) (1968) 6,000,000  
Per capita GDP (approx) (1968) US\$ 680  
Other information -

II. GENERAL DESCRIPTION

1. Products: Particle board and sawn wood

2. Major input materials: logs (from Pinus brutia)

3. Alternative technologies available and technology adopted for the study:

**Timber:** Logs are crosscut, graded and stored throughout the year. Offcuts are transported to the chipping machine to get chips for particle board production.

**Particle board:** Particles are transported through the drying unit to the applicator of glue and further to the mat forming station and to the press. After pressing the boards are cut to size, sanded and graded.

4. Locational factors:

Indication of particularly important factors

Vicinity of a forest

Actually proposed locality

The plant will be located in the Southwest of the country in the middle of a forest of 60,000 ha; the average transport distance will be 60 km.

III. MARKET

1. Tabulation of estimated demand on domestic and export markets.

Product	Unit	Current annual consumption (1969)	Of which imported (%)	Proposed demand in 70	Increase per year (%)
Sawn wood coniferous	000 m <sup>3</sup>	45	70		
Sawn wood non-coniferous	000 m <sup>3</sup>	12	95		
Blockboards and veneered particle board	000 m <sup>3</sup>	8	100		
Reconstituted wood (incl. particle board)	000 m <sup>3</sup>	5	100		

2. Notes on methodology:

Production is supposed to substitute imports; since the output would not exceed the present local consumption and thus the required absorption capacity is given as granted, no market research was carried out.

In addition, it is assumed that particle board will increasingly substitute other wood based panels.

3. Selection of product-mix:

**IV. CAPACITY OF PROPOSED PLANT**

1 Nominal maximum capacity according to major process 10,000 m<sup>3</sup> of sawn wood annually (one shift)  
5,000 m<sup>3</sup> of particle board annually (one shift)

2 Maximum feasible capacity of the plant

30,000 m<sup>3</sup> annually of sawn wood  
15,000 m<sup>3</sup> annually of particle board

3 Expected maximum output of the plant

30,000 m<sup>3</sup> annually of sawn wood  
15,000 m<sup>3</sup> annually of particle board

**V. INVESTMENT (000 US \$)**

	Total	Foreign currency component		Total	Foreign currency component
<b>TOTAL INVESTMENT</b>	1,628	1,628			
1 Fixed assets	1,246	1,158	2 Working capital	196	150
11 Land site development (10-15 ha)	77	49	21 Inventories		
12 Buildings	549		Production materials, fuels & auxiliary materials		
Factory	535		Parts & supplies for repair & maintenance		not specified
Office (incl. social facilities)	7		Work in process		
Storage	11		Finished goods		
Others	200		22 Accounts receivable		
			23 Other liquid assets		
11 Machinery & equipment (excl. or below) (incl. installation)	1,000	1,000	3 Other investments	216	120
New equipment	1,103	1,023	31 Pre investment costs		
Retrofitting equipment	67	67	Preliminary expenditure		
			Planning costs		
			Engineering costs		
			Interest during construction		
			Training costs		
			Others		not specified
			32 Start up expenses		
			Consultant fees		
			Costs for test run		
			Others		

1/ No costs for land cleared

Major machinery & equipment (newly installed)	U.S.P. supplier country's part	Transport cost (insurance freight)	Import duty	Landing, local installation cost	Total	Foreign currency component
Log yard	16,800					
Debarking station	21,600					
Sawmill	70,000					
Preservation plant	4,610					
Kiln	31,200					
Manufacturing of timber	27,600					
Particle boards	550,000					
Finishing of particle boards	60,000					
Steam plant	60,000					
Maintenance and others	61,560					
Power supply	14,400					
Steam supply	1,200					
Water supply	4,800					
Exhaust system	47,000					
Power installation	156,000					
		incl.	incl.	157,100	1,243,200	1,243,200

2/ Installation costs only

**VI. MANNING TABLE**

Total number of persons: 147

Shops	1st shift	2nd shift	3rd shift	Shops	1st shift	2nd shift	3rd shift
1 Primary operative shops (including supervisory staff)	63	11		2 Auxiliary operative shops	17	1	
Sawmill, incl. preservation, kiln and remanufacturing	31	11		Repair & maintenance	6	-	
Particle boards	19	12		Utilities control	2	1	
Finishing of particle boards	17	11		Product & material storage (incl. in 1)	-	-	
				Off site transport and fire protection	4	2	
				Guards cleaners etc.	-	-	
				3 Administration	18	1	
				Production management	5	-	
				Research & development	-	-	
				Sales & purchase	1	-	
				General administration	1	-	
				Others	1	1	

## VII. ANNUAL PRODUCTION

1 Total annual expected maximum output

Product	Domestic sales				Foreign sales		
	Unit	Quantity	Unit price as factory (US \$)	Annual turnover (000 US \$)	Quantity	Unit price as factory (US \$)	Annual turnover (000 US \$)
Sawn timber	t	5,000	40.80	204			
Sawn timber (preserved)	t	5,000	62.40	312			
Sawn timber (dried)	t	5,000	50.80	422			
Sawn timber (remanufactured)	t	2,000	67.20	134			
Particle boards	t	5,000	64.32	322			
Particle boards (veneered)	t	5,000	108.00	540			
Total		10,000		1,934			no exports foreseen

## 2. Expected sales and inventory build up

It is assumed that full capacity will be reached in the third year of production. Total sales revenue in the first year amounts to US\$ 1,358,000 and in the second year to US\$ 1,840,000.

## 3. Pricing policy

Domestic prices were fixed approximately at the CIF level.

## 4. Planned sales organization

The existing market network will be used.

## VIII. ANNUAL OPERATING COSTS AND PROFITS

Cost item	Unit	Unit price (US \$)	Quantity (000)	Annual costs (000 US \$)	Foreign currency component (000 US \$)
<b>Total costs</b>				<b>1,629</b>	<b>712</b>
<b>1. Material costs</b>				<b>922</b>	<b>334</b>
<b>Raw materials</b>					
Logs	m <sup>3</sup>	15.02	30	451	-
Redwood for particle board	m <sup>3</sup>	3.60	11	40	-
Urea resin	t	169.00	0.9	151	n.a.
Wax	t	199.20	0.06	17	n.a.
Preservatives	t	676.90	0.11	74	n.a.
Veneers	m	0.12	660	79	n.a.
<b>Others</b>					
Fuel oil	t	31.20	1.1	37	n.a.
Electricity	kWh	24.00	1.5	84	-
Water	m	0.48	14	7	-
Steam 1/	t	-	15	-	-

Cost item	Annual costs (000 US \$)	Foreign currency component (000 US \$)
2. Personnel costs (*)	284	n.a.
2.1. Wages & salaries	270	
2.2. Contributions to social securities	14	
2.3. Fringe benefits	45	
3. Interests	72	n.a.
4. Rents	-	-
5. Indirect taxes at company level	-	-
6. Depreciation	205	152
6.1. Buildings 4% (incl. civil engineering)	24	?
6.2. Machinery & equipment } 10%	137	111
6.3. Office equipment		
6.4. Other fixed assets 20% (preliminary costs)	44	24
7. Administrative expenses & sales costs	70	n.a.
8. Other costs (maintenance, insurance)	69	n.a.
9. Profit before tax of which profit tax subsidies	305	

Categories of persons employed	Domestic		Foreign	
	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)
Top managers	6	10		
Engineers	-	-		
Technicians	11	21		
Commercial staff	4	9		
Clerks and typists	5	7		
Foremen	6	11		
Skilled operatives	48	71		
Semi-skilled operatives	14	16		
Unskilled operatives	28	11		
Part-time operatives	-	-		
Other special categories	5	7		

1/ Self-supplied

2/ Not including fringe benefits

**IX. FINANCING PROPOSAL (in US \$)**

4 Suppliers' credits -

1 Equity capital (total) US\$ 1.2 million

2 Long term loans (total) US\$ 800,000  
Rate of interest 4.5%  
Repayment eight years

5 Remarks on the financing policy -

3 Other loans

Medium-term loan: US\$ 200,000; rate of interest: 4.5%; repayment: five years  
Short-term loan: overdraft balance**X. IMPLEMENTATION PLAN**

1 Technical collaboration service

2 Project management

Plant will be installed under a turn-key contract.

3 Recruitment and training of personnel

Supplier of equipment will train key personnel on the spot.

4 Other items

New forest roads will have to be constructed by the investing company before the plant starts operations.

5 Time schedule

Construction will take two years.

**XI. DATA FOR EVALUATION**

1 Profitability evaluation

Check

- Break even point analysis  
 Return to total capital  
 Pay back  
 Rentability: return to equity capital

2 Further profitability analysis for given project life (Bankability test)

Check

- Internal rate of return  
 Net present value  
 Any other method used

3 National economic benefit cost analysis (National priority test)

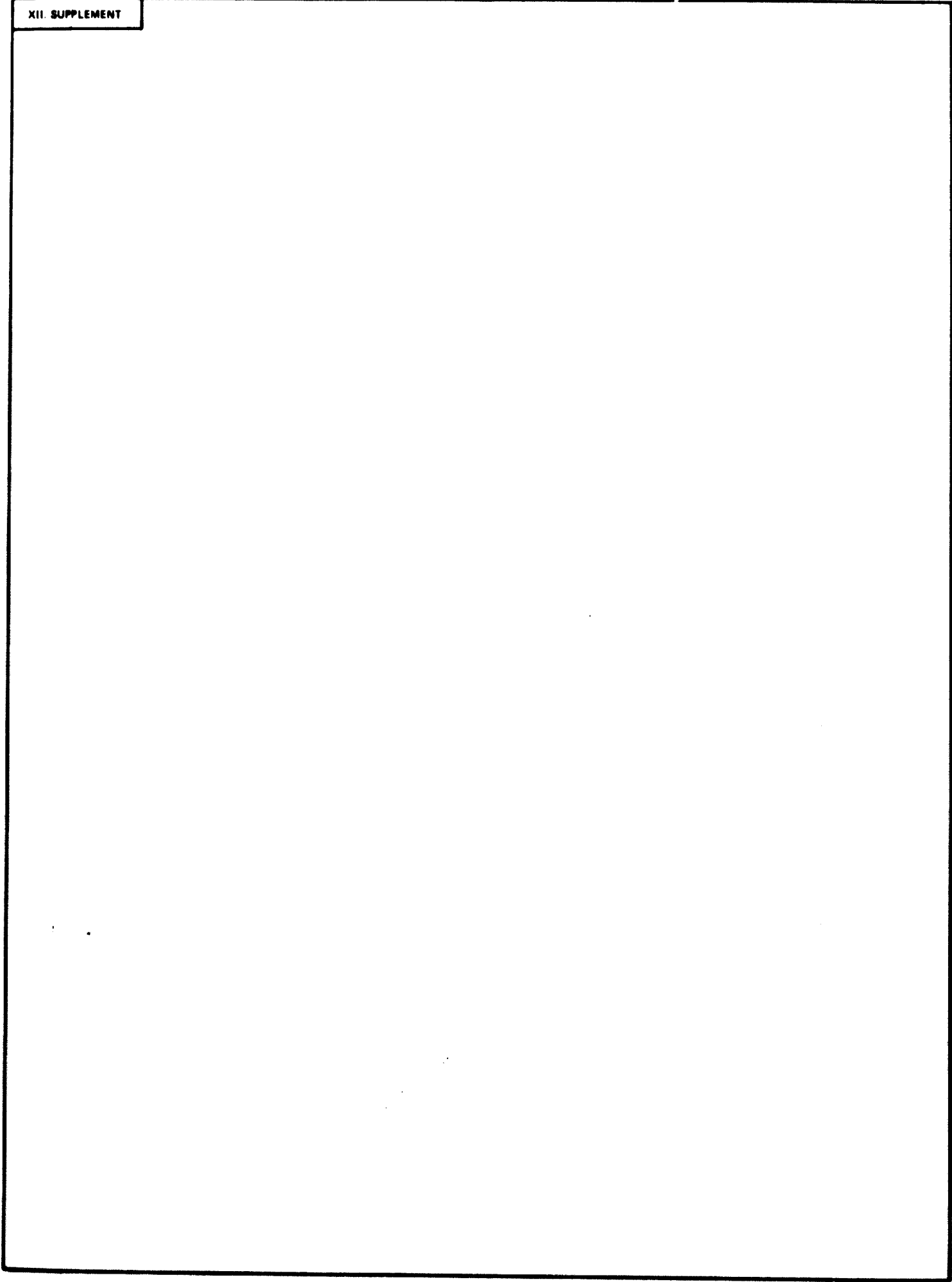
Check

- Direct value added and employment effects  
 Balance of payment effect  
 Social marginal productivity of capital  
 Backward and forward effects  
 Synthetic benefit cost analysis  
 Any other method used

Give a short outline of the methods used and major findings

Return to total capital: 11%Return to equity capital: 15%Internal rate of return: 11.5%Pay-back period: 5.5 years

XII. SUPPLEMENT



XIII. CASH FLOW TABLE (000 US \$)												Terminal value of assets
Year	1	2	3	4	5	6	7	8	9	10	11	
<b>A. Source of cash</b>	840	1,920	1,358	1,840	1,934	1,934	1,934	1,934	1,934	1,934	1,934	
1. Financial resources total	840	1,920	-	-	-	-	-	-	-	-	-	
1.1 Loan <sup>1</sup>	-	1,560	-	-	-	-	-	-	-	-	-	
1.2 Equity	840	360	-	-	-	-	-	-	-	-	-	
1.3 Suppliers' credits	-	-	-	-	-	-	-	-	-	-	-	
1.4 Subsidies	-	-	-	-	-	-	-	-	-	-	-	
2. Sales revenue	-	-	1,358	1,840	1,934	1,934	1,934	1,934	1,934	1,934	1,934	
<b>B. Uses of cash</b>	806	1,638	1,429	1,689	1,869	1,877	1,933	1,913	1,779	1,783	1,853	
1. Fixed capital expenditure: total	650	1,346	-	-	-	-	-	132	-	-	65	
1.1 Land, site improvements, & buildings	376	250	-	-	-	-	-	-	-	-	-	( 376 )
1.2 Machinery & equipment (new installation)	274	1,096	-	-	-	-	-	-	-	-	-	( )
1.3 Machinery & equipment (replacement)	-	-	-	-	-	-	-	132	-	-	65	( 141 )
2. Net working capital: total	-	292	146	49	-	-	-	-	-	-	-	( 486 )
2.1 Stocks of materials	-	-	-	-	-	-	-	-	-	-	-	( )
2.2 Work-in-process <sup>2</sup>	-	-	-	-	-	-	-	-	-	-	-	( )
2.3 Stocks of finished products	-	-	-	-	-	-	-	-	-	-	-	( )
3. Pre-investment & start-up expenses:	156	60	-	-	-	-	-	-	-	-	-	( )
4. Production expenditure: total	-	-	1,029	1,300	1,352	1,352	1,352	1,352	1,352	1,352	1,352	
4.1 Personnel expenditure	-	-	249	278	284	284	284	284	284	284	284	
4.2 Materials <sup>3</sup>	-	-	650	883	929	929	929	929	929	929	929	
4.3 Administrative expenditure	-	-	65	70	70	70	70	70	70	70	70	
4.4 Indirect taxes & royalties	-	-	-	-	-	-	-	-	-	-	-	
4.5 Other expenditure (travels, contingencies, etc.)	-	-	65	69	69	69	69	69	69	69	69	
5. Debt service: total	-	-	254	254	332	332	332	149	149	149	143	
5.1 Interest on loans	-	-	133	122	111	92	72	50	41	32	22	
5.2 Repayment of loans & credits	-	-	121	132	221	240	260	99	108	117	127	
6. Dividends & profit taxes paid:	-	-	-	86	185	193	250	280	278	282	287	
<b>C. Surplus/Deficit (A - B)</b>	34	222	- 71	151	65	57	1	21	155	151	81	
<b>SURPLUS/DEFICIT ACCUMULATED</b>	34	256	185	336	402	459	460	481	636	787	868	

<sup>1</sup> Loans of different terms should be shown separately

<sup>2</sup> Annual value of production of finished goods minus annual accumulation of finished goods inventory

<sup>3</sup> Total production costs minus production costs of finished goods

<sup>4</sup> Not including interest during construction

<sup>5</sup> Annual purchase minus annual accumulation of materials inventory

<sup>6</sup> This item stands for the part of profit which is to be paid out, namely profit tax, dividends, fees of the members of the executive board, managerial staff's share in profits, etc. Actually this sum will be established after allowances have been made for depreciation which are not included under item 4. (production expenditure). The cash flow balance should be programmed, therefore, in such a way that all necessary replacement (B.1.3) can be covered in any year by the accumulated surplus.

Comments

PROJECT:

PULP AND PAPER

(Planning year: 1967/1968 )

**I. ORIGIN OF THE STUDY**

1. This study was prepared by a consulting firm  
for a national development bank.

2. The study was intended to investigate the technical and economic feasibility of establishing and operating a pulp and paper mill designed to produce mainly rayon grade pulp as a raw material for domestic viscose rayon staple fibre plant.

**3. Size of the economy considered**

Population (approx.) million  
Per capita GDP (approx.) US \$  
Other information

**II. GENERAL DESCRIPTION****1. Products**

- rayon grade dissolving pulp in the form of dried sheets, fibre content 94%, highly purified, alpha cellulose content ranging from 30% - 32%, polysaccharides 1 - 1.5% max.
- corrugating medium (paper), main quality 135 g/m<sup>2</sup>

**2. Major input materials:**

Fibrous raw materials:

- beech and hornbeam (for rayon pulp)
- mixed broadleaved wood species (for corrugating medium)

water (0.5 m<sup>3</sup>/sec.), sulfur, limestone (available from domestic resources), salt oaks (by-product of the future staple fibre plant), bleach chemicals

**3. Alternative technologies available and technology adopted for the study:**

There are three ways of manufacturing pulp, differentiated by their method of fibre separation: mechanical, chemical and semiochemical. In this case the conventional association of sulfate pulping (for dissolving grade) along with neutral sulfite semiochemical - NSSC - process (for corrugating medium) were recommended; reasons for selecting this technology were: flexibility with regard to the wood species and the suitability of the sulfate pulp for viscose process.

For further details see Supplements: Process flow chart

**4. Locational factors:**

Indication of particularly important factors

- Proximity and accessibility of wood resources
- Availability of water and possibility of discharging effluents
- Rail or road connexion for the transport of chemicals and of output products

Actually proposed locality

- Centre of an area of approximately 220,000 ha of natural forests; 1200 km of forest roads are needed
- Possible deep-well water supply; reasonable effluent discharge to the sea (10 km pipeline)
- railway and main road link-up
- vicinity of a town

**III. MARKET****1. Tabulation of estimated demand on domestic and export markets:**

Product	Unit	Current annual consumption 1965/66	Of which imported (%)	Projected demand in 1975/76	Increase per year (%)
<b>Domestic market</b>					
Total paper consumption	Tone	73,000		n.a.	10 <sup>2/</sup>
- Printing and writing paper	"	20,000		n.a.	
- Other grades interchangeably used for printing and writing paper	"	15,000		n.a.	5
- Newsprint and white semi-chemical grade paper for magazines and books	"	8,000		n.a.	
- Corrugated board	"	20,000	1/	77,000	10
- Multiwall kraftpaper, most of it used for cement sacks	"	7,000			
- Light wrapping paper, mostly used for small paper bags	"	3,000			
- Dissolving pulp: 40,000 tone per annum is the projected demand for a future viscose rayon staple fibre plant; the demand for any other rayon filament plant is not included in this forecast.					

1/ Total paper supply is imported except for a small percentage of linerboard and corrugating medium (3,000 tons) which is manufactured by a domestic paper producer.

2/ Within the next ten years.

No export is envisaged.

**2. Notes on methodology:**

Consumption and demand data on paper are estimates from import statistics.

**3. Selection of product-mix:**

The exclusive processing of rayon grade pulp could not make full use of the heterogeneous wood resources. Therefore, the corrugating medium is proposed as the second final product. It was selected for the following reasons: the available raw material is appropriate; stock rejects and even particular cooke which are not satisfactory in rayon grade pulp can be utilized as blends to the corrugating medium stock. By-products: yeast and furfural could be of some interest in the future should the plant be extended.



**IV. CAPACITY OF PROPOSED PLANT**

1. Nominal maximum capacity according to major process: 40,000 tons par year (120 tons per day) of dissolving pulp;  
20,000 tons par year ( 60 tons per day) of corrugating medium;  
The capacity represents a minimum economic size.

2. Maximum feasible capacity of the plant: Main process machinery and equipment permit 10% overload.

3. Expected maximum output of the plant: 100% nominal capacity utilization is expected.

**V. INVESTMENT (000 US \$)**

	Total	Foreign currency component		Total	Foreign currency component
<b>TOTAL INVESTMENT</b>	<b>34,000</b>	<b>21,500</b>			
1. Fixed assets	28,771	19,376	2. Working capital	2,000	500
1.1. Land, site development (270,000 m <sup>2</sup> ) 1/	950	-	2.1. Inventories	2,000	500
1.2. Buildings	5,194	853	- Production materials, fuels & auxiliary materials		
- Factory 2/	3,367	602	- Parts & supplies for repair & maintenance	1,000	n.a.
- Office	144	34	- Work-in-process		
- Storage 3/	159	20	- Finished goods	1,000	
- Others 4/	170	-	2.2. Accounts receivable	-	-
Water facilities	170	-	2.3. Other liquid assets	-	-
Power plants	301	46			
Laboratory	87	20	3. Other investments	3,229	1,624
Garages, etc.	38	10	3.1. Pre-investment costs	1,825	1,002
Canteen and kitchen, housing	478	53	- Preliminary expenditure	340	80
Others 4/	450	68	- Planning costs		
1.3. Machinery & equipment (details see below)	22,627	18,523	- Engineering costs	1,025	882
			- Interest during construction	-	-
			- Training costs	100	-
			- Others 5/	160	40
			3.2. Start-up expenses	-	-
			- Consultant fees	-	-
			- Costs for test run	-	-
			- Others	-	-
			3.3. Contingencies	1,404	622

1/ This figure represents the building site only; about 50,000 m<sup>2</sup> for roads and storage area and 188,000 m<sup>2</sup> for landscaping and future mill expansion are not included.

2/ Including pulp and paper storage building.

3/ Storage area for debarked wood and limestone; costs included in land and site development.

4/ Including repair shop, maintenance and supplies building, etc.

5/ Legal costs and administrative expenses.

**Major machinery & equipment**

	f.o.b. supplier country's part	Transport cost (insurance freight)	Import duty 1/	Landing, local installation cost	Total	Foreign currency component
- Wood handling, preparation, barking, chipping, storage equipment					1,400	1,100
- pH cooking and hot water preparation facilities					1,600	1,250
- Washing and screening (I) equipment					1,200	950
- Bleaching section					1,100	900
- Screening (II)					400	310
- Pulp drier and sheet forming section					2,300	1,800
- Neutral sulfite semiochemical equipment (NSSC)					1,100	900
- Evaporators					900	750
- Revolving furnace and boiler 30 t/hour					1,400	1,100
- Lime kiln and causticizing equipment					1,100	850
- Sulfite recovery plant					400	320
- Paper machine					1,700	1,400
- Pulp and paper packing, handling and storage equipment					100	100
- Laboratory equipment					100	100
- Spare parts, approximately 5.5% of total cost					700	700
<b>Total production machinery and equipment</b>					<b>15,500</b>	<b>12,530</b>

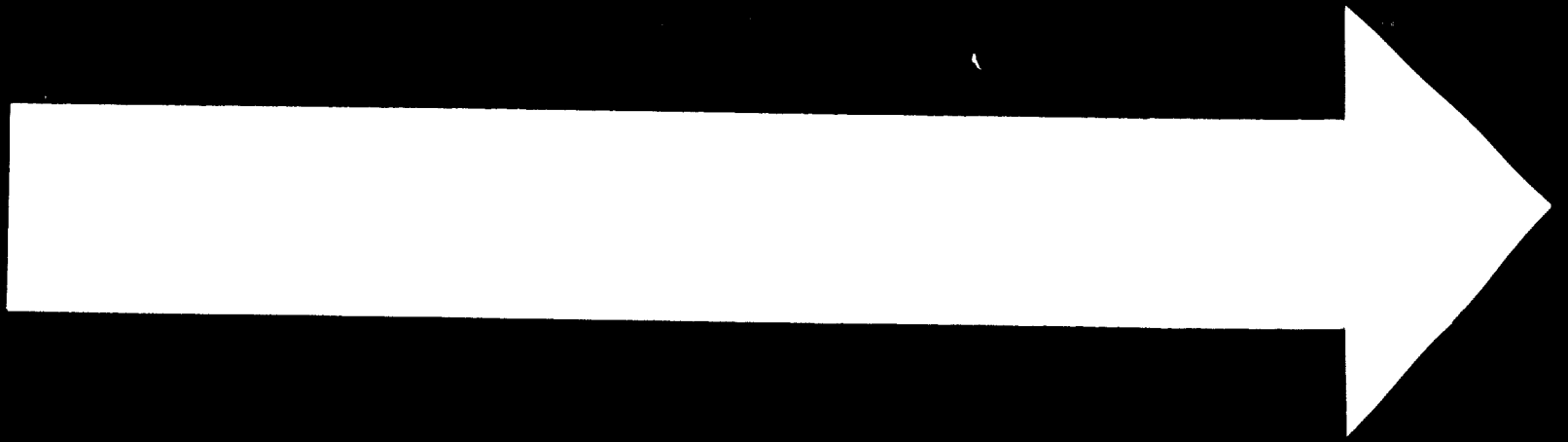
**Auxiliary equipment:** See Supplements, page 5

1/ No import duties

**VI. MANNING TABLE**

Total number of persons: 579

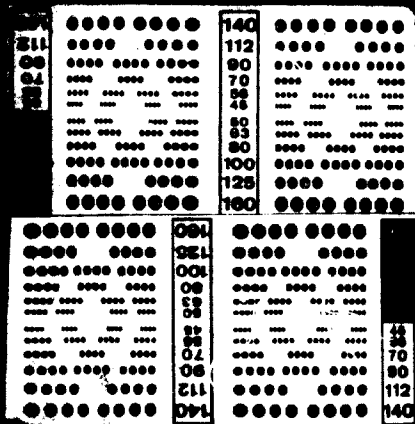
Shops	1st shift	2nd shift	3rd shift	Shops	1st shift	2nd shift	3rd shift
1. Primary operative shops (including supervisory staff)	117	104	70	2. Auxiliary operative shops	155	40	40
- Wood yard	36	34		- Repair & maintenance	89	30	30
- Cooking and stock preparation	15	13	13	- Utilities control			
- Bleaching	5	3	3	- Product & material storage	13	10	10
- Pulp drying, paper machines, finishing	26	25	25	- Off-site transport			
- Chemical and heat recovery	16	14	14	- Guards, cleaners, firemen	35		
- Steam and power	8	7	7	- Social welfare	18		
- Water	4	3	3	3. Administration	53		
- Chemical generation	7	5	5	- Production management	11		
				- Research & development	10		
				- Sales & purchase	13		
				- General administration	7		
				- Accounting	12		



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## VII. ANNUAL PRODUCTION

1. Total annual expected maximum output: \$ 10,620,000

Product	Domestic sales				Foreign sales		
	Unit	Quantity	Unit price ex factory (US \$)	Annual turnover (000 US \$)	Quantity	Unit price ex factory (US \$)	Annual turnover (000 US \$)
- Dissolving pulp	tons	40,000	165.00	6,600			
- Corrugating medium	tons	20,000	201.00	4,020	No exports foreseen		

2. Expected sales and inventory build-up:	1st year	2nd year	3rd year
Dissolving pulp	20,000 t	30,000 t	40,000 t
Corrugating medium	20,000 t	20,000 t	20,000 t

## 3. Pricing policy:

Dissolving pulp: \$165 per ton was determined in regard to the cost structure of the fibre plant which will be the sole buyer of the dissolving pulp.

The price of corrugating medium is based on CIF price + customs duty + excise tax + inland traffic. Customs duty represents US\$ 26.70 per ton.

## 4. Planned sales organization:

The mill will have a sales department. However, it is assumed that no large organization will be necessary as dissolving pulp will be supplied to the staple fibre plant and corrugating medium will probably be sold to a few big customers.

## VIII. ANNUAL OPERATING COSTS AND PROFITS

Cost Item	Unit	Unit price (US \$)	Quantity (000)	Annual costs (000 US \$)	Foreign currency component (000 US \$)	Cost item	Annual costs (000 US \$)	Foreign currency component (000 US \$)
<b>Total costs</b>								
							2,290	1,275
<b>1. Material costs</b>							4,427	210
<b>Raw materials and chemicals:</b>							3,293	66
- Pulp wood (beech and hornbeam) <sup>1/</sup>	m <sup>3</sup>	10.75	213	2,290				
- Pulpwood (mixed hardwoods) <sup>2/</sup>	m <sup>3</sup>	10.75	47	505				
- Sodium sulfate <sup>1/</sup>	t	60.00	3.2	192				
- Sodium sulfate <sup>2/</sup>	t	60.00	0.7	40				
- Sulfur	t	30.00	1.0	29				
- Limestone <sup>1/</sup>	t	4.00	2.0	8				
- Limestone <sup>2/</sup>	t	4.00	2.0	-				
- Salt	t	50.00	3.2	160				
- Sulfuric acid	t	20.00	0.2	3				
- NaClO <sub>3</sub>	t	300.00	0.2	66				
Fuel oil	t	16.00	31	502				
Water and waste water				84				64
- Purification chemicals	t	0.90		54				
- Filters, filter materials				10				
- Laboratory tests and consultants				20				
Other materials, repair and supplies				548	80			
- Packing materials				6				
- Auxiliary materials, lubricants, detergents, etc.				12				
- Felts and screens				60				
- Laboratory materials and replacements				10				
- Repair and maintenance				460				
<sup>1/</sup> for production of 40,000 tons of dissolving pulp <sup>2/</sup> for 20,000 tons of corrugating medium						<b>2. Personnel costs (*)</b> 2.1. Wages & salaries 1,679 695 2.2. Contributions to social securities 1,454 695 2.3. Fringe benefits 185 - 3. Interests (average) <sup>3/</sup> 40 - 4. Rents 447 - 5. Indirect taxes at company level - - 6. Depreciation 2,141 300 6.1. Buildings and land linear depreciation 3-4% 233 - 6.2. Machinery & equipment linear depreciation 4-8% 1,728 - 6.3. Office equipment linear depreciation 5-8% 180 - 6.4. Other fixed assets linear depreciation 5-8% 468 70 7. Administrative expenses & salaries 468 70 8. Other costs (local freight and haulage) 128 - 9. Profit before tax 1,330 - of which - profit tax (average) <sup>4/</sup> 404 - - subsidies - -		
						<b>Domestic</b>		
						<b>Foreign</b>		
						(*) Categories of persons employed		
						No. of persons	Annual wages & salaries & fringe benefits (000 US \$)	Foreign currency component (000 US \$)
						No. of persons	Annual wages & salaries & fringe benefits (000 US \$)	Foreign currency component (000 US \$)
						8	146	
						17	232	168
						18	180	150
						6	18	3
						24	50	-
						49	346	
						213	292	300
								-
						214	163	-
								-
						24	27	-
						<sup>1/</sup> Including chief assistant and plant engineers and chemists; <sup>2/</sup> Chauffeurs and drivers.		
						<sup>3/</sup> 4/ See supplement		

IX. FINANCING PROPOSAL (in US \$)		4. Suppliers' credits: US\$6,500,000 at an interest rate of 6% p.e. repayment within seven years with two year grace period.	
1. Equity capital (total):	US\$ 19,000,000		
2. Long-term loans (total):	US\$ 8,500,000		
- Rate of interest:	8% p.e.		
- Repayment:	within nine years; four year grace period (construction and the first year of production)	5. Remarks on the financing policy:	The financing scheme can be considered only as a crude tentative proposal.
3. Other loans:	US\$ 610,000 in the first year of operation 8% interest		

X. IMPLEMENTATION PLAN												
1. Technical collaboration service:	The contractor (supplier of equipment) has to familiarise himself with the prevailing conditions as to the source of supply, the sufficiency of and the means for obtaining all raw materials and other inputs (water, power, fuel, labour). License fees should be included in the lump-sum machinery and equipment price (negligible in this case). The share of the local companies in the construction is estimated to be 30% (lifting devices, scaffolding, electrical current, X-ray examination equipment, erection equipment, civil works, building and structures, etc.).											
2. Project management:	No turn-key contract. The over-all management and supervision will be in the hands of "Authorized Representatives" of the investor, whose responsibility will be: supervision of the execution schedule, inspection and checking of materials. Responsibility of the supplier firm: delivery of processing and auxiliary equipment and machinery; supervision of installation, testing and start-up.											
3. Recruitment and training of personnel:	The training of foremen and a few skilled workers shall be carried out in a European operating pulp and paper mill; groups of 15 - 30 trainees shall be sent to the petron plant and shall remain there for at least three months. A total of 100 workers shall be trained in this way. The trainees remain at the construction site of the new plant to be constantly informed about the problems related to the installation and erection of machinery and equipment so that they become the nucleus of the plant's production and maintenance force. Additional workers will be trained at the plant during the build-up operation period.											
4. Other items:	- A semi-governmental agency should be established to take care of the co-ordination of interdependent activities (implementation of the mill and of the forest programme). Government participation (70%) should concentrate on logging operations (including road construction and afforestation.)											
5. Time schedule:	<p>Critical path:</p> <table border="0"> <tr> <td>Plans and specifications of machinery and equipment</td> <td>4 months</td> <td rowspan="5">} Construction period 36 months</td> </tr> <tr> <td>Purchase of machinery and equipment</td> <td>3 months</td> </tr> <tr> <td>Construction and fabrication of machinery equipment, shipping and delivery at plant site</td> <td>20 months</td> </tr> <tr> <td>Erection of machinery and equipment, piping and electrical cables</td> <td>9 months</td> </tr> <tr> <td>Tests, inspection and trial run of the new pulp and paper mill</td> <td>3 months</td> </tr> </table>	Plans and specifications of machinery and equipment	4 months	} Construction period 36 months	Purchase of machinery and equipment	3 months	Construction and fabrication of machinery equipment, shipping and delivery at plant site	20 months	Erection of machinery and equipment, piping and electrical cables	9 months	Tests, inspection and trial run of the new pulp and paper mill	3 months
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Erection of machinery and equipment, piping and electrical cables	9 months											
Tests, inspection and trial run of the new pulp and paper mill	3 months											

XI. DATA FOR EVALUATION		
1. Profitability evaluation: Check: <input checked="" type="checkbox"/> Break-even point analysis <input checked="" type="checkbox"/> Return to total capital <input checked="" type="checkbox"/> Pay back <input checked="" type="checkbox"/> Rentability: return to equity capital	2. Further profitability analysis for given project (i.e. Bankability test): Check: <input checked="" type="checkbox"/> Internal rate of return <input type="checkbox"/> Net present value <input type="checkbox"/> Any other method used	3. National economic benefit-cost analysis (National priority test): Check: <input checked="" type="checkbox"/> Direct value added and employment effects <input checked="" type="checkbox"/> Balance of payment effect <input type="checkbox"/> Social marginal productivity of capital <input checked="" type="checkbox"/> Backward and forward effects <input type="checkbox"/> Synthetic benefit cost analysis <input type="checkbox"/> Any other method used
Give a short outline of the methods used and major findings:		
<p><b>Break-even point analysis:</b> The break-even point is close to 50% operating rate as long as the production of corrugating medium is maintained at 20,000 tons per year. The production of dissolving pulp without corrugating medium brings about a different result. The break-even point is between an annual production rate of 40,000 tons - 50,000 tons or an operating rate between 67% - 83%. This indicates the desirability of the combination of dissolving pulp and corrugating medium production.</p> <p><b>Pay back:</b> a) 8.2 years (fixed capital divided by average annual gross profit before taxes and interest payments plus depreciation) b) 12 years (present value of capital - present value of net income after taxes plus depreciation plus interest = 0; rate of discount is 5%).</p> <p><b>Rentability: return to equity capital:</b> Net profits after tax vary between 4% and 8% of equity capital within the first nine years of production averaging approximately 6% at full capacity utilization.</p> <p><b>Internal rate of return:</b> 7% (returns before income taxes; first year of operation = year 1, duration of construction being disregarded; residual value after 12.5 years of operation - US\$ 4 million - is included).</p> <p><b>Direct value added and employment effects:</b> Value added amounts to US\$ 4.7 million; at 100% operating rate the plant will employ 580 persons; after a few years all foreign technicians and managers will be replaced by national employees.</p> <p><b>Balance of payment effect:</b> US\$ 58 million of total foreign exchange savings during the first ten years of operation (both capital and current foreign exchange expenditures considered).</p> <p><b>Backward and forward effects:</b> A detailed analysis of the backward linkages was undertaken (forest plantation, road construction, haulage and transportation); with the exception of the feeder road system (US\$ 10 million) all other expenditures are reflected in the price of the wood delivered.</p> <p><b>Return to total capital:</b> 5.2%</p>		

XII. SUPPLEMENT

Ad V. Investment of Auxiliary Equipment:

	Total (000 US\$)	Foreign Currency Component
- Power facilities	2,505	2,195
- Water facilities and fire protection system and equipment	2,698	2,138
- In-plant transportation equipment	310	285
- Repair shop equipment and storage equipment	500	400
- Office equipment	40	30
- Chemical generation equipment	1,030	910
- Welfare and housing equipment	44	35
<b>Total auxiliary equipment</b>	<b>7,127</b>	<b>5,993</b>

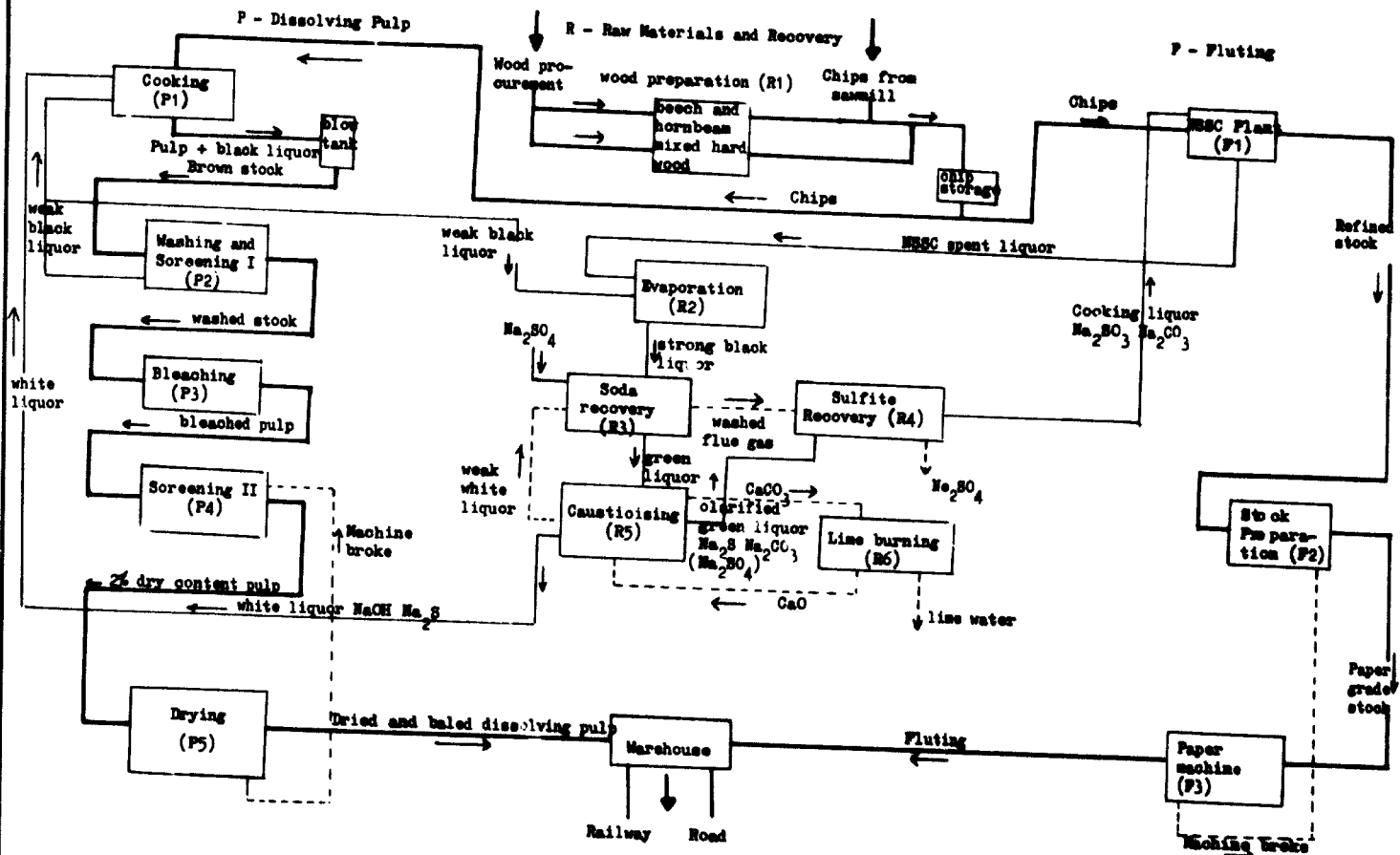
Ad VIII. Annual Operating Costs

- 3/ Amount indicated represents annual average of a nine-year period.
- 4/ Companies producing industrial products are exempted from paying income tax up to five years as from start of production (see page 6, cash flow table). According to income tax law, 15% of profit before tax are exempted (concerns companies whose shares are accepted for transactions at the national stock exchange); the taxable income therefore amounts to 85% of profit before tax.

From the taxable income the following taxes are computed:

	US \$
3% municipality tax and 0.3% contributions to chamber of commerce and guilds	37,000
10% company tax	113,000
25% income tax of 90% taxable income	254,000
	<b>404,000</b>

PROCESS FLOW CHART



XIII. CASH FLOW TABLE (000 US \$)

	Year of Construction			Year of Construction Build-up			Full capacity					110% Capacity 9th-12th	Terminal value of assets
	1st	2nd	3rd	1st	2nd	3rd	4th	5th	6th	7th	8th		
<b>A. Source of cash</b>	100	5,000	12,200	2,230	2,173	10,632	10,620	10,620	10,620	10,620	10,620	11,680	
<b>1. Financial resources:</b>													
<b>total</b>	6,100	6,000	13,200	1,910	400	300	-	-	-	-	-	-	
1.1 Loan <sup>1</sup>	3,700	3,400	1,400	610 <sup>4</sup>	-	-	-	-	-	-	-	-	
1.2 Equity	2,400	2,600	12,000	1,300	400	300	-	-	-	-	-	-	
1.3 Suppliers' credits	-	-	6,500	-	-	-	-	-	-	-	-	-	
1.4 Subsidies	-	-	-	-	-	-	-	-	-	-	-	-	
<b>2. Sales revenue</b>	-	-	-	7,320	8,270	10,620	10,620	10,620	10,620	10,620	10,620	11,680	
<b>B. Uses of cash</b>	10,000	20,000	20,000	2,230	2,173	10,632	10,772	10,562	10,692	9,552	8,142	9,311	
<b>1. Fixed capital expenditure:</b>													
<b>total</b>	10,000	20,000	20,000 <sup>2</sup>	-	-	-	-	-	-	-	-	-	
1.1 Land, site improvements & buildings	-	-	-	-	-	-	-	-	-	-	-	-	( )
1.2 Machinery & equipment (new installation)	1,000	6,000	20,000 <sup>2</sup>	-	-	-	-	-	-	-	-	-	( 4,000 )
1.3 Machinery & equipment (replacement)	-	-	-	-	-	-	-	-	-	-	-	-	( )
<b>2. Net working capital:</b>													
<b>total</b>	-	-	-	2,000	-	-	-	-	-	-	-	-	
2.1 Stocks of materials	-	-	-	1,000	-	-	-	-	-	-	-	-	( )
2.2 Work-in-process <sup>3</sup>	-	-	-	-	-	-	-	-	-	-	-	-	( )
2.3 Stocks of finished products	-	-	-	1,000	-	-	-	-	-	-	-	-	( )
<b>3. Pre-investment &amp; start-up expenses:</b>													
<b>total</b>	-	-	-	-	-	-	-	-	-	-	-	-	( )
<b>4. Production expenditure:</b>													
<b>total</b>	-	-	-	4,800	5,939	6,702	6,702	6,702	6,702	6,702	6,702	7,301	
4.1 Personnel expenditure	-	-	-	1,421	-	1,679	1,679	1,679	1,679	1,679	1,679	1,679	
4.2 Materials <sup>4</sup>	-	-	-	2,371	2/	4,427	4,427	4,427	4,427	4,427	4,427	4,427	2/
4.3 Administrative expenditure	-	-	-	418	-	468	468	468	468	468	468	468	
4.4 Indirect taxes & royalties	-	-	-	-	-	-	-	-	-	-	-	-	
4.5 Other expenditure (rents, contingencies, etc.)	-	-	-	90	-	128	128	128	128	128	128	128	
<b>5. Debt service:</b>													
<b>total</b>	-	-	-	2,430	3,340	3,230	3,720	3,510	3,230	1,380	-	-	
5.1 Interest on loans and credits	-	-	-	2,130	1,120	330	720	510	290	80	-	-	
5.2 Repayment of loans & credits	-	-	-	-	1,700	1,700	1,700	1,700	1,700	1,300	-	-	
					610 <sup>4</sup>	1,300	1,300	1,300	1,300	1,300	-	-	
<b>6. Dividends &amp; profit taxes paid:</b>													
<b>total</b>	-	-	-	-	-	-	350	350	700	1,470	1,440	2,010	
<b>C. Surplus/Deficit (A - B)</b>	+ 100	-	- 100	0	191	- 12	- 152	5 <sup>5</sup>	- 72	1,068	2,473	2,369	
<b>SURPLUS/DEFICIT ACCUMULATED</b>	100	100	0	0	191	179	27	35	13	1,081	3,559		

<sup>1</sup> Loans of different terms should be shown separately.  
<sup>2</sup> Annual value of production of finished goods minus annual accumulation of finished goods inventory.  
<sup>3</sup> Total production costs minus production costs of finished goods.  
<sup>4</sup> Net, including interest during construction.  
<sup>5</sup> Annual purchase minus annual accumulation of materials inventory.  
<sup>6</sup> This item stands for the part of profit which is to be paid out, namely profit tax, dividends, fees of the members of the executive board, managerial staff's share in profits, etc. Actually this sum will be established after allowances have been made for depreciation which are not included under item 4 (production expenditure). The cash flow balance should be programmed, therefore, in such a way that all necessary replacement (B.1.3.) can be covered in any year by the accumulated surplus.

**Comments**

1/ Pre-investment and start-up expenses are included in fixed capital expenditure.  
 2/ Detailed data for production expenditures not available. The cash flow table prepared in the original study was in a different form; therefore, it was not possible to supply more details.  
 3/ Includes the equipment supplied under suppliers' credit (6,500).  
 4/ Short-term loans.

PROJECT:

SULPHURIC ACID

(Planning year: 1969 )

**I. ORIGIN OF THE STUDY**

1. This study was prepared by a governmental advisory body for the Ministry of Planning and Economy in a developing country.

2. The study was intended to investigate the economic feasibility of producing sulphuric acid from imported pyrites.

## 3. Size of the economy considered:

- Population (approx.): 5 million
- Per capita GDP (approx.): 200 US \$
- Other information: -

**II. GENERAL DESCRIPTION**

1. Products: main product: sulphuric acid (98.5 - 99%)  
by-products: residues containing Fe, Pb, As, Zn, Cu, Sb and other non-ferrous metals

2. Major input materials: Pyrites ( $FeS_2$ ) containing approximately 40-50% of sulphur (to be imported).

## 3. Alternative technologies available and technology adopted for the study:

The following processes must be applied:

- 1) roasting of pyrites (five different types of kilns and processes can be used)
- 2) cooling and purifying of gas
- 3) drying, oxidising and absorbing

## 4. Locational factors:

- Indication of particularly important factors:

Vicinity of a phosphate fertiliser plant and electricity and water supply (electricity - 90,000 kWh per day; cooling water - 99,000 m<sup>3</sup> per day).

- Actually proposed locality:

Harbour in the vicinity; an industrial zone as well as a new power station will be developed there; cheap cooling water from the sea is also available.

**III. MARKET**

## 1. Tabulation of estimated demand on domestic and export markets:

Product	Unit	1968 consumption	Of which imported (%)	Projected demand in 1969-72	Increase per year (%)
Domestic market sulphuric acid	000 t	450	0	1,200	31%

## 2. Notes on methodology:

The figure indicated for projected demand was taken from the Four Year Development Plan of the country. It is expected that the existing sulphuric acid plants will expand production up to 850,000 t by 1972. The gap is to be covered by a new plant.

## 3. Selection of product-mix:

Sulphuric acid will be used in the production of phosphate fertilisers.





**VII. ANNUAL PRODUCTION**

**1. Total annual expected maximum output:**

Product	Domestic sales				Foreign sales		
	Unit	Quantity	Unit price ex factory (US \$)	Annual turnover (000 US \$)	Quantity	Unit price ex factory (US \$)	Annual turnover (000 US \$)
Sulphuric acid	000 t	300	20	6,000	no exports foreseen		
Residues				678			
Energy surplus				210			
				<u>6,888</u>			

**2. Expected sales and inventory build-up:**

It is assumed that full capacity will already be reached in the first year of operation.

**3. Pricing policy:**

The cost price varies according to the degree of utilization of the residues and energy surplus between US\$ 16.50 and 19.40.

CIF price of imported sulphuric acid is \$24.85 per ton.

**4. Planned sales organization:**

Sulphuric acid will be delivered directly to the producers of phosphate fertilisers. The residues will be purchased partly by the supplier of the pyrite.

**VIII. ANNUAL OPERATING COSTS AND PROFITS**

Cost Item	Unit	Unit price (US \$)	Quantity (000)	Annual costs (000 US \$)	Foreign currency component (000 US \$)	Cost Item	Annual costs (000 US \$)	Foreign currency component (000 US \$)
<b>Raw costs</b>						<b>2. Personnel costs (*)</b>	260	..
5,964						<b>2.1. Wages &amp; salaries</b>	168	..
3,079						<b>2.2. Contributions to social securities</b>	92	..
<b>1. Material costs</b>						<b>2.3. Fringe benefits</b>	-	-
<b>a) Direct material costs</b>						<b>3. Interests</b>	500	..
Pyrites	13.8		222	3,064	3,064	<b>4. Rents</b>	-	-
<b>b) Auxiliary materials</b>						<b>5. Indirect taxes at company level</b>	15	..
Materials for catalysers	..	..	..	0.7	..	<b>6. Depreciation</b>	1,343	..
Chemicals	..	..	..	14	..	<b>6.1. Buildings</b>		
Cooling water*	m <sup>3</sup>	-	20,000	-	-	<b>6.2. Machinery &amp; equipment</b>	1,343	..
Boiler water*	m <sup>3</sup>	-	30	-	-	<b>6.3. Office equipment</b>		
Electricity*	MWH	-	28	-	-	<b>6.4. Other fixed assets</b>		
						<b>7. Administrative expenses &amp; sales costs</b>	155	..
						<b>8. Other costs (Insurance, maintenance, etc.)</b>	612	..
						<b>9. Profit before tax of which - profit tax - subsidies</b>	924	..

\* self-supplied

**Depreciation:** Production equipment including civil engineering Storage and electric facilities, pumps  
10 years  
15 years

[1] Categories of persons employed	Domestic		Foreign		Foreign currency component (000 US \$)
	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)	
Top managers	16	67	30	29	
Engineers					
Technicians					
Commercial staff	78	72			
Clerks and typists					
Foremen					
Skilled operatives					
Semi-skilled operatives					
Unskilled operatives					
Part-time operatives					
Other special categories					

**IX. FINANCING PROPOSAL (in US \$)**

1. Equity capital (total): US\$ 4,500,000

2. Long-term loans (total): US\$ 3,000,000  
- Rate of interest: 5.5%  
- Repayment: 15 years

3. Other loans: -

4. Suppliers' credits: US\$ 7,400,000  
Rate of interest: 7%  
Repayment: 10 years

5. Remarks on the financing policy:  
Out of US\$ 14.9 million capital requirements for investments US\$ 11 million will be in foreign currency. Short-term loans for financing working capital will be envisaged only if equity capital and credits and loans prove insufficient.

**X. IMPLEMENTATION PLAN**

1. Technical collaboration service:

The necessary know-how is available in the country. In the initial operation period technical experts will be provided by the supplier of equipment.

2. Project management:

No data given

3. Recruitment and training of personnel:

No data given

4. Other items: -

5. Time schedule: The construction of the plant will take 24 months.

**XI. DATA FOR EVALUATION**

1. Profitability evaluation:

- Check:
- Break-even point analysis
  - Return to total capital
  - Pay back
  - Rentability: return to equity capital

2. Further profitability analysis for given project life (Bankability test):

- Check:
- Internal rate of return
  - Net present value
  - Any other method used

3. National economic benefit-cost analysis (National priority test):

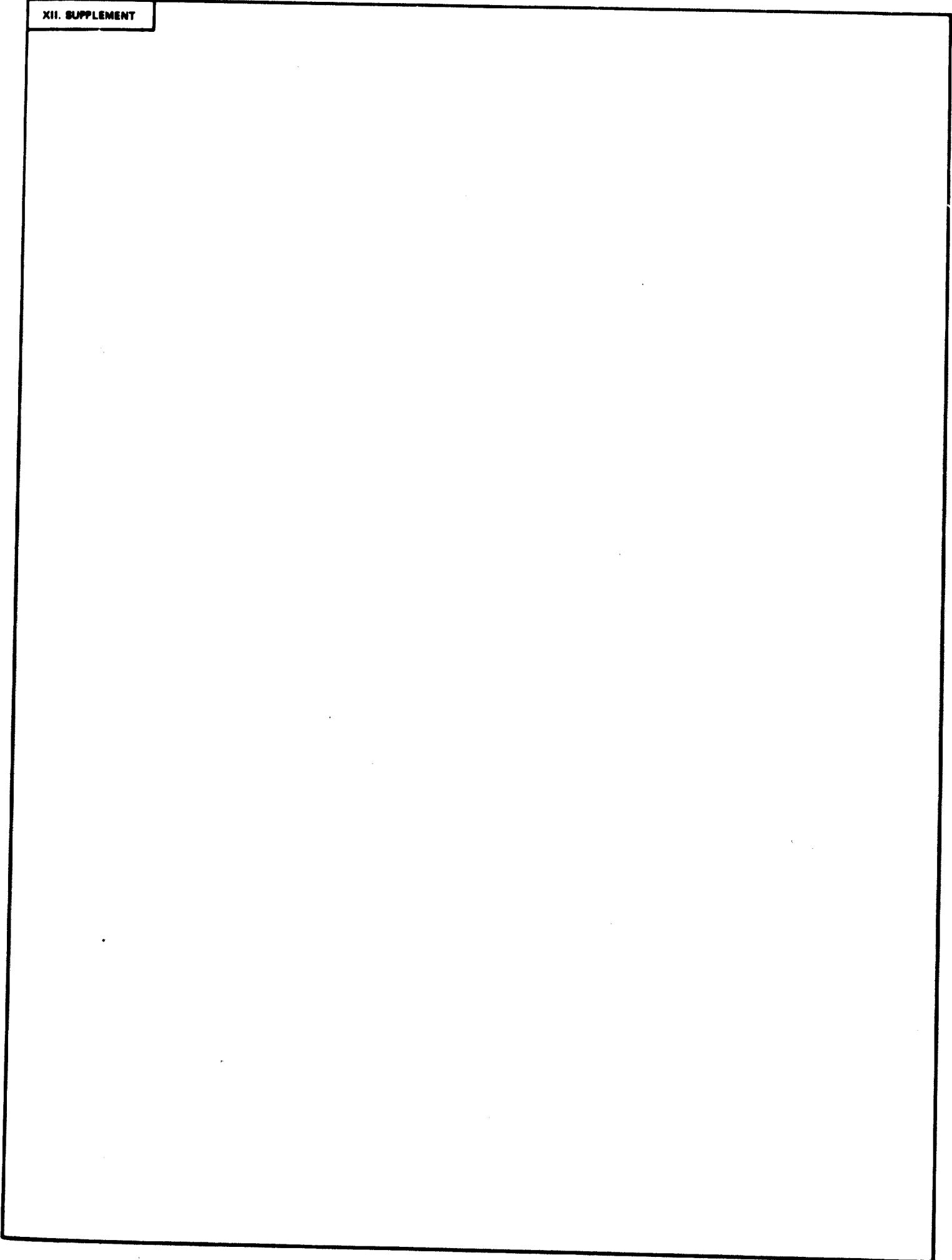
- Check:
- Direct value added and employment effects
  - Balance of payment effect
  - Social marginal productivity of capital
  - Backward and forward effects
  - Synthetic benefit cost analysis
  - Any other method used

Give a short outline of the methods used and major findings:

Return to total capital: 9.5%

Internal rate of return: 12% (to total capital; twelve years)

XII. SUPPLEMENT



**XIII. CASH FLOW TABLE (000 US \$)**

	Year											Terminal value of assets	
	1	2	3	4	5	6	7	8	9	10	11-15		
<b>A. Source of cash</b>	<u>7,900</u>	<u>7,000</u>	<u>6,988</u>	<u>6,888</u>	<u>6,888</u>	<u>6,888</u>	<u>6,888</u>	<u>6,888</u>	<u>6,888</u>	<u>6,888</u>	<u>6,888</u>	<u>6,888</u>	
1. Financial resources: total	7,900	7,000	-	-	-	-	-	-	-	-	-	-	
1.1. Loan <sup>1</sup>	-	3,000	-	-	-	-	-	-	-	-	-	-	
1.2. Equity	4,500	-	-	-	-	-	-	-	-	-	-	-	
1.3. Suppliers' credits	3,400	4,000	-	-	-	-	-	-	-	-	-	-	
1.4. Subsidies	-	-	-	-	-	-	-	-	-	-	-	-	
2. Sales revenue: <sup>2/</sup>	0	0	6,888	6,888	6,888	6,888	6,888	6,888	6,888	6,888	6,888	6,888	
<b>B. Uses of cash</b>	<u>7,450</u>	<u>7,450</u>	<u>6,104</u>	<u>6,040</u>	<u>5,978</u>	<u>5,916</u>	<u>5,853</u>	<u>5,790</u>	<u>5,727</u>	<u>5,664</u>	<u>5,602</u>		
1. Fixed capital expenditure: total	5,555	6,450	-	-	-	-	-	-	-	-	-	-	
1.1. Land, site improvements, & buildings	-	-	-	-	-	-	-	-	-	-	-	-	( )
1.2. Machinery & equipment (new installation)	5,555	6,450	-	-	-	-	-	-	-	-	-	-	( )
1.3. Machinery & equipment (replacement)	-	-	-	-	-	-	-	-	-	-	-	-	( )
2. Net working capital: total	-	695	-	-	-	-	-	-	-	-	-	-	
2.1. Stocks of materials	-	295	-	-	-	-	-	-	-	-	-	-	( )
2.2. Work-in-process <sup>3</sup>	-	-	-	-	-	-	-	-	-	-	-	-	( )
2.3. Stocks of finished products	-	300	-	-	-	-	-	-	-	-	-	-	( )
2.4. Others	-	100	-	-	-	-	-	-	-	-	-	-	( )
3. Pre-investment & start-up expenses: <sup>4/</sup>	1,895	305	-	-	-	-	-	-	-	-	-	-	( )
4. Production expenditure: total	-	-	4,121	4,121	4,121	4,121	4,121	4,121	4,121	4,121	4,121	4,121	
4.1. Personnel expenditure	-	-	260	260	260	260	260	260	260	260	260	260	
4.2. Materials <sup>5</sup>	-	-	3,079	3,079	3,079	3,079	3,079	3,079	3,079	3,079	3,079	3,079	
4.3. Administrative expenditure	-	-	155	155	155	155	155	155	155	155	155	155	
4.4. Indirect taxes & royalties	-	-	15	15	15	15	15	15	15	15	15	15	
4.5. Other expenditure (rents, contingencies, etc.)	-	-	612	612	612	612	612	612	612	612	612	612	
5. Debt service: total	-	-	1,623	1,560	1,497	1,435	1,372	1,309	1,246	1,183	1,121	1,121	
5.1. Interest on loans	-	-	683	620	557	495	432	369	306	243	181	181	
5.2. Repayment of loans & credits	-	-	940	940	940	940	940	940	940	940	940	940 *	
6. Dividends & profit taxes paid: <sup>6/</sup>	-	-	360	360	360	360	360	360	360	360	360	360	
<b>C. Surplus/Deficit (A - B)</b>	<u>450</u>	<u>- 450</u>	<u>784</u>	<u>848</u>	<u>910</u>	<u>972</u>	<u>1,035</u>	<u>1,098</u>	<u>1,161</u>	<u>1,224</u>	<u>1,286</u>		
<b>SURPLUS/DEFICIT ACCUMULATED:</b>	<u>450</u>	<u>-</u>	<u>784</u>	<u>1,632</u>	<u>2,542</u>	<u>3,514</u>	<u>4,549</u>	<u>5,647</u>	<u>6,808</u>	<u>8,032</u>	<u>9,318</u>		

<sup>1</sup> Loans of different terms should be shown separately.  
<sup>2</sup> Annual vs. % of production of finished goods minus annual accumulation of finished goods inventory.  
<sup>3</sup> Total production costs minus production costs of finished goods.  
<sup>4</sup> Not including interest during construction.  
<sup>5</sup> Annual purchase minus annual accumulation of materials inventory.  
<sup>6</sup> This item stands for the part of profit which is to be paid out, namely profit tax, dividends, fees of the members of the executive board, managerial staff's share in profits, etc. Actually this sum will be established after allowances have been made for depreciation which are not included under item 4. (production expenditure). The cash flow balance should be programmed, therefore, in such a way that all necessary replacement (B.1.3.) can be covered in any year by the accumulated surplus.

Comments:  
 \* through the twelfth year; for the years 13-15 only the repayment of the long-term loan is envisaged.

PROJECT:

SULPHURIC ACID

(Planning year: 1970 )

**I. ORIGIN OF THE STUDY**

1. This study was prepared by a governmental advisory body for the Ministry of Planning and Economy in a developing country.

2. The study was intended to investigate the economic feasibility of producing sulphuric acid from imported sulphur.

## 3. Size of the economy considered:

Population (approx.): 5 million  
 Per capita GDP (approx.): 200 US \$  
 Other information: -

**II. GENERAL DESCRIPTION**

## 1. Products:

Sulphuric acid (98.5 - 99%)

## 2. Major input materials:

Natural sulphur (to be imported)

## 3. Alternative technologies available and technology adopted for the study:

The following processes have to be applied;

- 1) Combustion of sulphur
- 2) Purification and drying of  $SO_2$
- 3) Oxidation of  $SO_2$  to  $SO_3$  and absorption ( $H_2SO_4$ )

## 4. Locational factors:

- Indication of particularly important factors:

Vicinity of a phosphate fertilizer plant; energy (36,000 kWh per day); cooling water (37,800 m<sup>3</sup> per day)

- Actually proposed locality:

No data given

**III. MARKET**

Tabulation of estimated demand on domestic and export markets:

Product	Unit	1968 consumption	Of which imported (%)	Projected demand in 1969-72	Increase per year (%)
<u>Domestic market</u>					
Sulphuric acid	000 t	450	0	1,200	

## 2. Notes on methodology:

The figure indicated for projected demand was obtained from the four year development plan of the country. It is expected that the existing sulphuric acid plants will expand production up to 850,000 t by 1972. The gap is to be covered by the new plant.

## 3. Selection of product-mix:

Sulphuric acid will be used in the production of phosphate fertilizers.

**IV. CAPACITY OF PROPOSED PLANT**

1. Nominal maximum capacity according to major process: 300,000 t

2. Maximum feasible capacity of the plant: no data given

3. Expected maximum output of the plant: 300,000 t

**V. INVESTMENT (000 US \$)**

	Total	Foreign currency component		Total	Foreign currency component
<b>TOTAL INVESTMENT</b>	<u>7,570</u>	<u>5,750</u>			
<b>1. Fixed assets</b>	<u>5,500</u>	<u>4,350</u>	<b>2. Working capital</b>	750	750
1.1. Land, site development	100	-	<b>2.1. Inventories</b>	<u>750</u>	<u>750</u>
1.2. Buildings	<u>2,030</u>	<u>1,160</u>	- Production materials, fuels & auxiliary materials	450	450
- Factory			- Parts & supplies for repair & maintenance	-	-
- Office			- Work-in-process	-	-
- Storage	2,030	1,160	- Finished goods	300	-
- Other (utilities, power station)			2.2. Accounts receivable	-	-
			2.3. Other liquid assets	-	-
1.3. Machinery & equipment (incl. storage of sulphur and acid, spare parts, transport, duties and taxes)	<u>3,370</u>	<u>3,190</u>	<b>3. Other investments</b>	1,320	950
	3,370	3,190	3.1. Pre-investment costs	<u>450</u>	<u>750</u>
			- Preliminary expenditure	-	-
			- Planning costs	320	320
			- Engineering costs	400	300
			- Interest during construction	-	-
			- Training costs	-	-
			- Others (licenses)	130	130
			3.2. Start-up expenses	<u>470</u>	<u>200</u>
			- Consultant fees	-	-
			- Costs for test run	50	-
			- Others (incl. contingency)	420	200

Major machinery & equipment	f.o.b. supplier country's port	Transport cost (insurance freight)	Import duty	Landing, local installation cost	Total	Foreign currency component
Sulphur handling equipment						
Combustion furnaces (2)						
Boilers (2)						
Drying towers (2)						
Gas filters (2)						
Fans (3)						
Converters (2)						
Absorbing towers (2)						
Centrifuges (1)						
Refrigerators (2)						
Sulphuric acid containers						

**VI. MANNING TABLE**

Total number of persons: 75

Shift	1st shift	2nd shift	3rd shift	Shift	1st shift	2nd shift	3rd shift
<b>1. Primary operative shops (including supervisory staff)</b>				<b>2. Auxiliary operative shops</b>			
				- Repair & maintenance			
				- Utilities control			
				- Product & material storage			
				- Off-site transport			
				- Guards, cleaners, etc.			
				<b>3. Administration</b>			
				- Production management			
				- Research & development			
				- Sales & purchase			
				- General administration			
No details available							

**VII. ANNUAL PRODUCTION**

## 1. Total annual expected maximum output:

Product	Domestic sales				Foreign sales		
	Unit	Quantity	Unit price on factory (US \$)	Annual turnover (000 US \$)	Quantity	Unit price on factory (US \$)	Annual turnover (000 US \$)
Sulphuric acid	000 t	300	20	6,000	-	-	-
Energy surplus	000 MWH	41	up to 11	405	-	-	-

## 2. Expected sales and inventory build-up:

## 3. Pricing policy:

Assuming a price of \$16 per ton of imported sulphur (CIF), the cost price of sulphuric acid is estimated at \$16 per ton. Sulphuric acid is imported at an average price of US\$ 25 per ton; it is estimated that the price of the domestically produced sulphuric acid will fluctuate between \$19 and \$23. For economic calculations the price was set at \$20 per ton.

## 4. Planned sales organization:

**VIII. ANNUAL OPERATING COSTS AND PROFITS**

Cost Item	Unit	Unit price (US \$)	Quantity (000)	Annual costs (000 US \$)	Foreign currency component (000 US \$)	Cost Item	Annual costs (000 US \$)	Foreign currency component (000 US \$)	
<b>Total costs</b>									
						5,528	..		
<b>1. Material costs</b>						3,814	3,672		
<b>a) Direct material costs:</b>									
Sulphur	t	36	102	3,672	3,672				
<b>b) Auxiliary materials:</b>									
Boiler water	m <sup>3</sup>	0.05	42	2.1	-				
Cooling water	m <sup>3</sup>	0.019	7,200	136.8	-				
Steam	t	1,500	21	3.2	-				
Electricity*	MWH	-	9	-	-				
* Self-supplied									
						<b>2. Personnel costs (*)</b>			
						150	..		
						150	..		
						400	..		
						-	-		
						700	..		
						700	..		
						90	..		
						374	..		
						877	..		
						Profit before tax			
						of which - profit tax			
						- subsidies			
						<b>Domestic</b>		<b>Foreign</b>	
						No. of persons	Annual wages & salaries & fringe benefits (000 US \$)	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)
						Foreign currency component (000 US \$)		Foreign currency component (000 US \$)	
						not specified			
						Foremen			
						Skilled operatives			
						Semi-skilled operatives			
						Unskilled operatives			
						Part-time operatives			
						Other special categories			



**IX. FINANCING PROPOSAL (in US \$)**

- 1. Equity capital (total): US\$ 2,000,000
- 2. Long-term loans (total): US\$ 1,670,000  
Rate of interest: 5.5%  
Repayment: 15 years
- 3. Other loans: -

4. Suppliers' credits: US\$ 3,900,000  
Rate of interest: 7%  
Repayment: 10 years

5. Remarks on the financing policy: -

**X. IMPLEMENTATION PLAN**

- 1. Technical collaboration service:  
The necessary know-how is available in the country. In the initial operation period technical experts will be provided by the supplier of equipment.
- 2. Project management:  
No data given
- 3. Recruitment and training of personnel:  
No data given
- 4. Other items: -
- 5. Time schedule:  
The construction of the plant would be completed within 24 months.

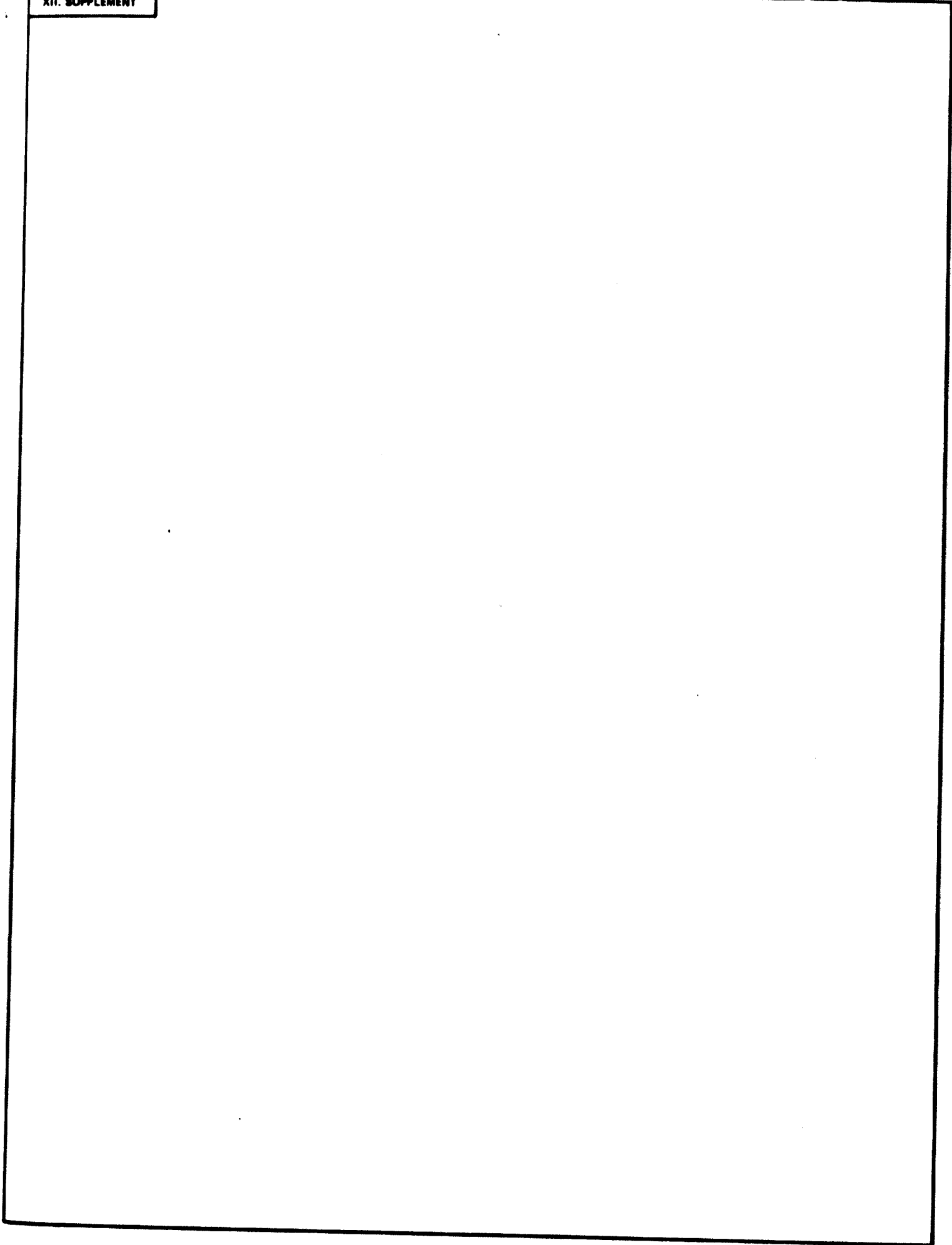
**XI. DATA FOR EVALUATION**

- 1. Profitability evaluation:  
Check:  
 Break-even point analysis  
 Return to total capital  
 Pay back  
 Rentability: return to equity capital
- 2. Further profitability analysis for given project life (Bankability test):  
Check:  
 Internal rate of return  
 Net present value  
 Any other method used
- 3. National economic benefit-cost analysis (National priority test):  
Check:  
 Direct value added and employment effects  
 Balance of payment effect  
 Social marginal productivity of capital  
 Backward and forward effects  
 Synthetic benefit cost analysis  
 Any other method used

Give a short outline of the methods used and major findings:

Return to total capital: 11.5%  
Internal rate of return: 20%

XII. SUPPLEMENT



XIII. CASH FLOW TABLE (000 US \$)												Terminal value of assets
Year	1	2	3	4	5	6	7	8	9	10	11-15	
<b>A. Source of cash</b>	3,900	3,670	6,405	6,405	6,405	6,405	6,405	6,405	6,405	6,405	6,405	
1. Financial resources:	3,900	3,670	6,405	6,405	6,405	6,405	6,405	6,405	6,405	6,405	6,405	
1.1. Loan <sup>1</sup>	-	,670	-	-	-	-	-	-	-	-	-	
1.2. Equity	2,000	-	-	-	-	-	-	-	-	-	-	
1.3. Suppliers' credits	1,900	2,000	-	-	-	-	-	-	-	-	-	
1.4. Subsidies	-	-	-	-	-	-	-	-	-	-	-	
2. Sales revenue:	-	-	6,405	6,405	6,405	6,405	6,405	6,405	6,405	6,405	6,405	
<b>B. Use of cash</b>	3,785	3,785	5,454	5,421	5,387	5,354	5,319	5,287	5,253	5,220	5,187	
1. Fixed capital expenditure:	2,735	2,765	-	-	-	-	-	-	-	-	-	
1.1. Land, site improvements, & buildings	1,330	800	-	-	-	-	-	-	-	-	-	( )
1.2. Machinery & equipment (new installation)	1,405	1,965	-	-	-	-	-	-	-	-	-	( )
1.3. Machinery & equipment (replacement)	-	-	-	-	-	-	-	-	-	-	-	( )
2. Net working capital:	-	750	-	-	-	-	-	-	-	-	-	
2.1. Stocks of materials	-	450	-	-	-	-	-	-	-	-	-	( )
2.2. Work-in-process <sup>2</sup>	-	-	-	-	-	-	-	-	-	-	-	( )
2.3. Stocks of finished products	-	300	-	-	-	-	-	-	-	-	-	( )
3. Pre-investment & start-up expenses:	1,050	270	-	-	-	-	-	-	-	-	-	( )
4. Production expenditure:	-	-	4,429	4,429	4,429	4,429	4,429	4,429	4,429	4,429	4,429	
4.1. Personnel expenditure	-	-	150	150	150	150	150	150	150	150	150	
4.2. Materials <sup>3</sup>	-	-	3,814	3,814	3,814	3,814	3,814	3,814	3,814	3,814	3,814	
4.3. Administrative expenditure	-	-	90	90	90	90	90	90	90	90	90	
4.4. Indirect taxes & royalties	-	-	-	-	-	-	-	-	-	-	-	
4.5. Other expenditure (trans, contingencies, etc.)	-	-	375	375	375	375	375	375	375	375	375	
5. Debt service:	-	-	865	832	798	765	730	698	664	631	598	
5.1. Interest on loans	-	-	365	332	298	265	230	198	164	131	98	
5.2. Repayment of loans & profits	-	-	500	500	500	500	500	500	500	500	500*	
6. Dividends & profit taxes paid:	-	-	160	160	160	160	160	160	160	160	160	
<b>C. Surplus/Deficit (A - B)</b>	115	- 115	951	984	1,018	1,051	1,086	1,118	1,152	1,185	1,218	
<b>SURPLUS/DEFICIT ACCUMULATED:</b>	115	-	951	1,935	2,953	4,004	5,090	6,208	7,360	8,545	9,763	

<sup>1</sup> Loans of different terms should be shown separately.  
<sup>2</sup> Annual value of production of finished goods minus annual accumulation of finished goods inventory.  
<sup>3</sup> Total production costs minus production costs of finished goods.  
<sup>4</sup> Not including interest during construction.  
<sup>5</sup> Annual purchase minus annual accumulation of materials inventory.  
<sup>6</sup> This item stands for the part of profit which is to be paid out, namely profit tax, dividends, fees of the members of the executive board, managerial staff's share in profits, etc. Actually this sum will be established after allowances have been made for depreciation which are not included under item 4. (production expenditure). The cash flow balance should be programmed, therefore, in such a way that all necessary replacement (B.1.3.) can be covered in any year by the accumulated surplus.

Comments:  
 \* through the twelfth year; for the years 13-15 only the repayment of the long-term loan is envisaged.

## PROJECT: PETROCHEMICAL COMPLEX

(Planning year: 1967 )

## I. ORIGIN OF THE STUDY

1. This study was prepared by a designing company for the government of a developing country.

2. The study was intended to assess the feasibility of producing petrochemicals based on derivatives of petroleum and natural gas.

## 3. Size of the economy considered:

- Population (approx.): 14 million
- Per capita GDP (approx.): 240 US \$
- Other information: -

## II. GENERAL DESCRIPTION

## 1. Products:

Ethylene (99.9 mol. % min.), LD polyethylene, HD polyethylene, VC monomer, PVC, detergent alkylate, benzene (99.9% min.), toluene (99.7% min.), xylene (99.5-99.8%)

2. Major input materials: Natural gas condensate; sodium chloride

## 3. Alternative technologies available and technology adopted for the study:

The production process will be based on the following processing units: fractionation of condensate for preparing a naphtha cut-steam pyrolysis of naphtha for ethylene production - production of plastomers - aromatics recovery - sodium chloride electrolysis

## 4. Locational factors:

- Indication of particularly important factors:

Raw material transport, transport of products, power and industrial water, harbours, soil conditions, site conditions, meteorological and oceanographic conditions

- Actually proposed locality:

The actually proposed locality meets the following requirements: raw material conveniently available; convenient for shipment of products by sea; good site conditions, water and electricity available

## III. MARKET

## 1. Tabulation of estimated demand on domestic and export markets:

Product	Unit	Current annual consumption	Of which imported (%)	Projected demand in 1967	Increase per year (%)
---------	------	----------------------------	-----------------------	--------------------------	-----------------------

The estimated domestic consumption in 1972 is:  
LDPE - 7,000 t/y; HDPE - 4,000 t/y; PVC 11,000 t/y;  
detergent alkylate - 4,000 t/y, etc.

The West European ethylene production capacities are estimated to be going up to 9.1 million t/y in 1972, import up to 485,000 t/y and export up to 720,000 t/y. It is expected to export around 76,000 t/y.

The annual world consumption of plastic is estimated to be (in million tons) 27 in 1970 and 105 in 1980. By far the most important plastic on the world market are polyvinylchloride and polyolefines, accounting for over 40% of total plastic production. The exports are estimated for LDPE - 33,000 t/y; HDPE - 6,000 t/y; VC monomer - 24,000 t/y; PVC - 9,000 t/y; detergent alkylate - 26,000 t/y; benzene - 16,000 t/y, toluene - 21,000 t/y, etc.

## 2. Notes on methodology:

The market study was made in close co-ordination with product selection and was backed up not only by statistical analysis but also by on-the-spot industrial surveys which were conducted for various countries in Western and Eastern Europe, North America, Africa and Asia.

It is also assumed that for at least five or ten years to come domestic demand for petrochemicals is unlikely to increase considerably.

3. Selection of product-mix: A variety of products can be produced by a petrochemical complex based on condensate from natural gas. Emphasis has been placed on foreign markets in order to build a large, internationally competitive plant. Among the major categories of products deserving consideration are: plastics, synthetic fibres, synthetic detergents and synthetic rubber. Taking into consideration different factors, the conclusion was made that the principal products to be planned for the proposed complex should be: 1) ethylene, 2) ethylene-derived plastics and 3) detergents.

**IV. CAPACITY OF PROPOSED PLANT**

1. Nominal maximum capacity according to major process:

2. Maximum feasible capacity of the plant:

3. Expected maximum output of the plant:

The expected output of the different production units of the plant at 330 stream days is as follows:

Fractionator - Naptha for ethylene unit - 448,000 t/y; Ethylene Unit - 150,000 t/y;  
VC Monomer Unit - 45,000 t/y; PVC Unit - 20,000 t/y; LDPE Unit - 40,000 t/y; HDPE Unit - 10,000 t/y;  
Detergent Alkylate Unit - 30,000 t/y; Aromatics Recovery Unit - 64,100 t/y; NaCl Electrolysis Unit - 28,000 t/y (Chlorine)

**V. INVESTMENT (000 US \$)**

	Total	Foreign currency component		Total	Foreign currency component
<b>TOTAL INVESTMENT</b>	<u>85,400</u>	n. a. <sup>1/</sup>			
<b>1. Fixed assets</b>	<u>84,700</u>		<b>2. Working capital</b>		
1.1. Land, site development	-----	-----	2.1. Inventories	-----	-----
1.2. Buildings	<u>24,800</u>	-----	- Production materials, fuels & auxiliary materials	-----	-----
- Factory	<u>13,100</u>	-----	- Parts & supplies for repair & maintenance	-----	-----
- Office <sup>2/</sup>	5,100		- Work-in-process	-----	-----
- Storage	6,600		- Finished goods	-----	-----
- Other			2.2. Accounts receivable	-----	-----
			2.3. Other liquid assets	-----	-----
1.3. Machinery & equipment (except see below)	<u>59,900</u>	-----	3. Other investments	<u>700</u>	-----
			3.1. Pre-investment costs	<u>700</u>	-----
			- Preliminary expenditure	-----	-----
			- Planning costs	-----	-----
			- Engineering costs	<u>700</u>	-----
			- Interest during construction	-----	-----
			- Training costs	-----	-----
			- Others	-----	-----
			3.2. Start-up expenses	-----	-----
			- Consultant fees	-----	-----
			- Costs for test run	-----	-----
			- Others	-----	-----
1/ Obviously the study assumes that all the machines and equipment would be imported. Land, building materials, local transport and part of the installation cost may be the only local currency component.					
2/ incl. in Factory					

Major machinery & equipment	f.a.b. for the country's part	Transport cost (insurance & freight)	Import duty	Landing, land installation cost	Total	Foreign currency component
Fractionator					<u>1,600</u>	
Ethylene Unit					<u>15,700</u>	
VC Monomer Unit					<u>3,900</u>	
PVC Unit					<u>1,800</u>	
LD polyethylene unit					<u>18,000</u>	
HD polyethylene unit					<u>6,900</u>	
Detergent alkylate unit					<u>5,100</u>	
Aromatics recovery unit					<u>2,800</u>	
NaCl electrolysis unit					<u>4,100</u>	
					<u>59,900</u>	
*site facilities					<u>25,500</u>	
Total Investment Cost					<u>85,400</u>	

**VI. MANNING TABLE**

Total number of persons: 920

Shop	1st shift			2nd shift			3rd shift		
	1st shift	2nd shift	3rd shift	1st shift	2nd shift	3rd shift	1st shift	2nd shift	3rd shift
<b>1. Primary operative shops (including supervisory staff)</b>							520		
<b>2. Auxiliary operative shops</b>							400		
- Repair & maintenance - Utilities control - Product & material storage - Off-site transport - Guards, cleaners, etc.									
<b>3. Administration</b>									
- Production management - Research & development - Sales & purchase - General administration									

VII. ANNUAL PRODUCTION

1. Total annual expected maximum output:

Product	Domestic sales				Foreign sales		
	Unit	Quantity	Unit price ex factory (US \$)	Annual turnover (000 US \$)	Quantity	Unit price FOB (US \$)	Annual turnover (000 US \$)
Ethylene	t	-	-	-	76,400	47.0	3,591
LDPE	t	7,000	450.0	3,150	33,000	360.0	11,880
HDPE	t	4,000	526.8	2,107	6,000	424.0	2,544
VC monomer	t	-	-	-	24,000	155.0	3,720
PVC	t	11,000	283.2	3,115	9,000	221.0	1,989
Detergent alkylate	t	4,000	175.4	702	26,000	155.0	4,030
Benzene	t	-	-	-	16,600	66.0	1,095
Toluene	t	-	-	-	21,000	52.0	1,092
Xylenes	t	-	-	-	13,500	52.0	702
Caustic soda	t	4,000	70.4	281	28,000	49.0	1,372
P-P	t	21,000	22.0	462	-	-	-
B-B	t	38,000	17.0	646	-	-	-
Kerosene	t	120,000	35.0	4,200	-	-	-
Gas oil	t	142,000	31.4	4,459	-	-	-
Raffinate, etc.	t	29,600	30.0	888	-	-	-
Liquid fuels	t	43,600	17.0	741	-	-	-
<b>Total</b>				<b>20,751</b>			<b>32,015</b>

2. Expected sales and inventory build-up:

3. Pricing policy:

For domestic sales, sales prices 20% up for estimated delivery prices of plastomers, 5% up for those of other chemicals except fuels have been assumed.

4. Planned sales organization:

A special sales promotion service will be established for plastics and detergents.

VIII. ANNUAL OPERATING COSTS AND PROFITS

Cost Item	Unit	Unit price (US \$)	Quantity (000)	Annual costs (000 US \$)	Foreign currency component (000 US \$)	Cost Item	Annual costs (000 US \$)	Foreign currency component (000 US \$)
<b>Total costs</b>				<b>41,297</b>	<b>n.a.</b>			
-----				<b>9,892</b>	-----			
<b>1. Material costs</b>						<b>2. Personnel costs (*)</b>	<b>2,952</b>	<b>n.a.</b>
<b>Raw materials</b>						2.1. Wages & salaries		
Naphtha	t	4.26		14,816		2.2. Contributions to social securities		
Cracked gasoline	t <sub>3</sub>	17.00		1,504		2.3. Fringe benefits		
Hydrogen	m	0.008		67		3. Interests	<b>5,759</b>	
P-P Fraction	t	42.00		1,764		4. Rents		
Benzene	t	45.24		597		5. Indirect taxes at company level, including insurance	<b>964</b>	
Chlorine	t	68.96		2,822		6. Depreciation	<b>9,602</b>	
<b>Others:</b>						6.1. Buildings		
Catalyst and chemicals				3,385		6.2. Machinery & equipment		
<b>Utilities</b>						6.3. Office equipment		
Electricity	kWh	0.008		2,821		6.4. Other fixed assets		
Steam	t	1.50		1,427		7. Administrative expenses & sales costs	<b>1,918</b>	
Fuel	10 <sup>6</sup> kcal	0.595		3,374		8. Other costs	<b>10,210</b>	
Cooling water	kl	0.008		1,382		9. Profit before tax	<b>11,469</b>	
Process water	t	0.10		150		of which - profit tax (corporate tax = 50%)	<b>5,735</b>	
<b>By-products</b>						<b>10. Net profit</b>	<b>5,734</b>	
Kerosene	t	35.00		-6,598				
Gas oil	t	31.40		-6,970				
Off gas	t	7.14		- 963				
P-P fraction as raw material	t	42.00		-2,755				
P-P fraction for sale	t	22.00		- 721				
B-B fraction	t	17.00		-1,007				
Cracked gasoline	t	17.00		-2,333				
Residual oil	t	17.00		- 689				
C5's	t	17.00		- 119				
Raffinate	t	30.00		- 508				
Light polymer and light alkylate	t	30.00		- 382				
Heavy polymer and heavy alkylates	t	30.00		- 172				

	Domestic		Foreign		
(*) Categories of persons employed	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)	Foreign currency component (000 US \$)
Top managers					
Engineers					
Technicians					
Commercial staff					
Clerks and typists					
Foremen					
Skilled operatives					
Semi-skilled operatives					
Unskilled operatives					
Part-time operatives					
Other special categories					

Information not available

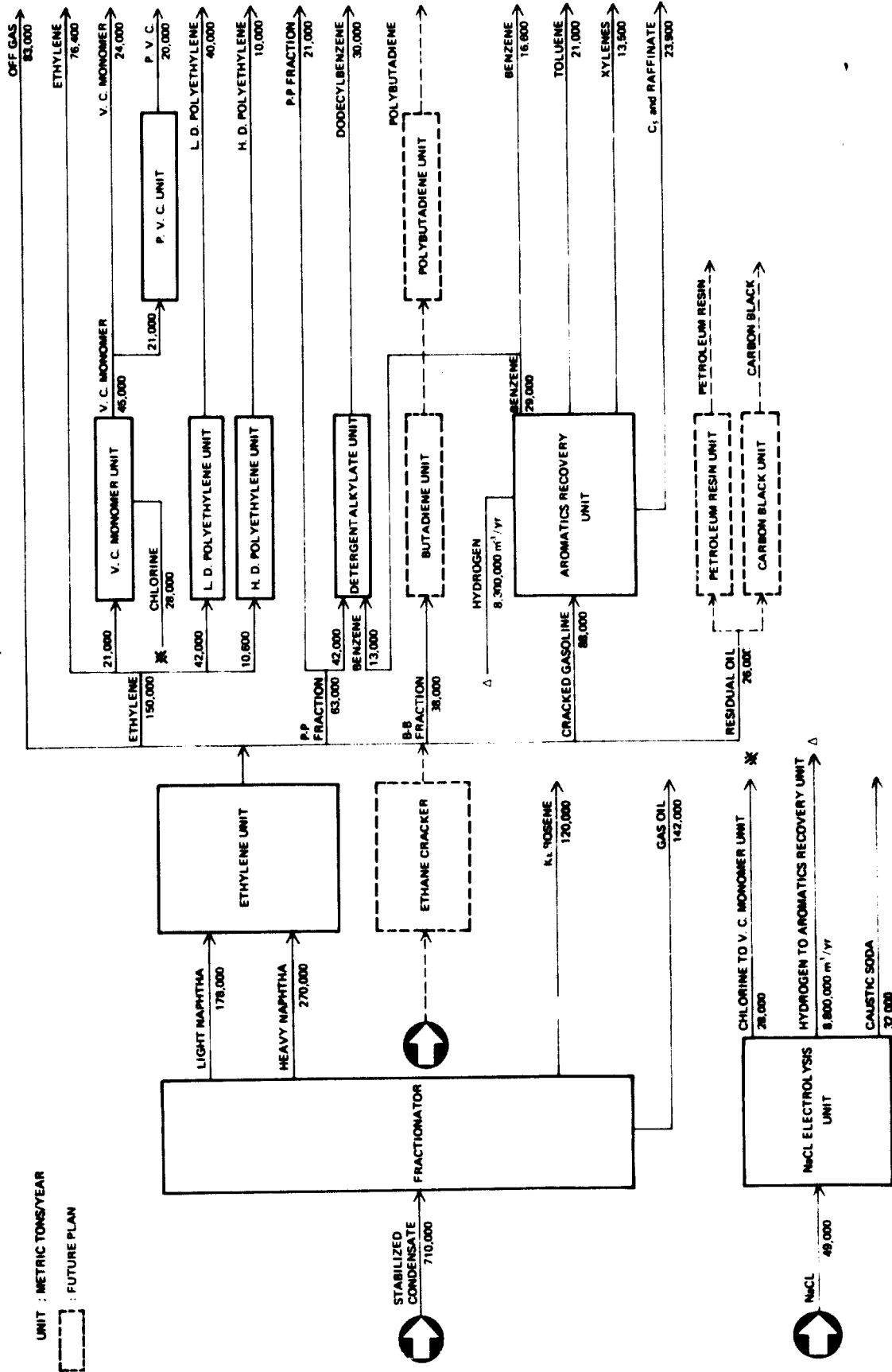
<b>IX. FINANCING PROPOSAL (in US \$)</b>	4. Suppliers' credits:	} Information not available
1. Equity capital (total):	} Information not available	
2. Long-term loans (total): - Rate of interest: - Repayment:		
3. Other loans:		
	5. Remarks on the financing policy:	

<b>X. IMPLEMENTATION PLAN</b>	
1. Technical collaboration services:	} Information not available
2. Project management:	
3. Recruitment and training of personnel:	
4. Other items:	
5. Time schedule: The first production of ethylene, vinylchloride and high-density polystyrene, polyvinylchloride and dodecylbenzene should be started at the latest by the beginning of 1971. Low-density polyethylenes and aromatic recovery units should be started one or two years later.	

<b>XI. DATA FOR EVALUATION</b>		
<b>1. Profitability evaluation:</b> Check: <input type="checkbox"/> Break-even point analysis <input checked="" type="checkbox"/> Return to total capital <input checked="" type="checkbox"/> Pay back <input type="checkbox"/> Rentability return to equity capital	<b>2. Further profitability analysis for given project life (Bankability test):</b> Check: <input type="checkbox"/> Internal rate of return <input type="checkbox"/> Net present value <input type="checkbox"/> Any other method used	<b>3. National economic benefit-cost analysis (National priority test):</b> Check: <input checked="" type="checkbox"/> Direct value added and employment effects <input checked="" type="checkbox"/> Balance of payment effect <input checked="" type="checkbox"/> Social marginal productivity of capital <input type="checkbox"/> Backward and forward effects <input type="checkbox"/> Synthetic benefit cost analysis <input type="checkbox"/> Any other method used
Give a short outline of the methods used and major findings:		
The <u>rate of return to total investment</u> , which was subsequently calculated by using the discounted cash flow technique, assuming ten years for the economic life of the project is as follows: a) rate of return on investment (assuming 50% corporate tax on profit) is 9.5%; b) rate of return on investment (without corporate tax for the first three years) is 13.2%. This calculation is based on information contained in sections V, VII and XIII of this extract.		
The <u>pay back period</u> (7 years and 5 months) was calculated on the basis of the total investments (section V) and the profit before tax (section VIII). Depreciation is not included in the amount of profit. In order to have more complete idea for the total benefits an important part of the interests (item 3) and indirect taxes at company level including insurance (item 5) should be taken into consideration. However, this was not done because of the lack of breakdown of these items.		
<u>Direct value added and employment effects:</u> the direct annual contribution of the project to national income totals \$21,144,000, i.e. wages and salaries \$2,952,000, interests \$5,759,000, indirect taxes at company level \$964,000, profit before tax \$11,469,000. The project provides jobs for more than 900 domestic employees and offers training possibilities both for employees and domestic students of chemistry and chemical engineering. The number of employees per million dollars of investment is only 11. That is rather low, but it is typical of the petrochemical industry.		
<u>Balance of payment effect:</u> The annual foreign exchange earnings will exceed \$30 million. If it is assumed that the whole machinery and equipment is imported (\$59.9 million), the foreign exchange expenditures will be paid back by foreign exchange earnings within two years. Even if foreign exchange expenditures for spare parts, replacement, investment and salaries of foreign specialists are taken into account, it will not change the picture substantially.		
<u>Social marginal productivity of capital:</u> The output-capital ratio of the proposed petrochemical complex is as follows:		
$\frac{\text{value added}}{\text{capital}} = \frac{21,144,000}{85,400,000} = 0.24 \text{ (net value added per \$1 of capital invested)}$		

XII. SUPPLEMENT

Interdependency of the Individual Units of the Petrochemical Complex  
Block Flow Diagram of the Petrochemical Complex





## XII. SUPPLEMENT

## Breakdown of Production Costs by Units of the Petrochemical Complex

## Ethylene Unit

	Unit	Unit Price \$/t	000 \$
Naptha	t	4.26	9,486.0
<u>By-products</u>			
Kerosene	t	35.00	-4,224.0
Gas oil	t	31.40	-4,462.5
Off gas	t	7.14	- 592.5
P-P Fraction as raw material	t	42.00	-1,764.0
P-P Fraction for sale	t	22.00	- 462.0
B-B Fraction	t	17.00	- 645.0
Cracked gasoline	t	17.00	-1,494.0
Residual oil	t	17.00	- 441.0
Electricity	kWh	0.008	1,065.5
Steam	t	1.50	219.2
Fuel	10 <sup>6</sup> kal	0.595	1,276.8
Cooling water	kl	0.008	484.5
Process water	t	0.10	58.5
Catalyst and chemicals		-	334.2
Personnel costs			557.9
Interests			1,478.0
Indirect taxes			249.1
including insurance			
Depreciation			2,466.8
Administrative expenses			492.2
Other costs (maintenance)			617.3
			<u>4,701.0</u>
Cost/t:	\$31.00		

## VC Monomer Unit

	Unit	Unit price \$/t	000 \$
Naptha	t	4.26	1,365.8
Chlorine	t	68.96	1,974.2
<u>By-products</u>			
Kerosene	t	35.00	- 608.4
Gas oil	t	31.40	- 642.6
Off gas	t	7.14	- 85.5
P-P Fraction as raw material	t	42.00	- 253.8
P-P Fraction for sale	t	22.00	- 66.6
B-B Fraction	t	17.00	- 32.7
Cracked gasoline	t	17.00	- 215.1
Residual oil	t	17.00	- 63.4
Electricity	kWh	0.008	234.7
Steam	t	1.50	145.4
Fuel	10 <sup>6</sup> kal	0.595	241.6
Cooling water	kl	0.008	177.6
Process water	t	0.10	13.9
Catalyst and chemicals		-	1,048.3
Personnel costs			248.6
Interests			546.5
Indirect taxes			91.5
including insurance			
Depreciation			911.3
Administrative expense			181.8
Other costs (maintenance, royalty)			228.1
			<u>126.0</u>
Cost/t:	\$121.00		5,457.2

## PVC Unit

	Unit	Unit Price \$/t	000 \$
Naptha	t	4.26	637.2
Chlorine	t	68.96	898.0
<u>By-products</u>			
Kerosene	t	35.00	- 284.0
Gas oil	t	31.40	- 299.8
Off gas	t	7.14	- 39.8
P-P Fraction as raw material	t	42.00	- 118.4
P-P Fraction for sale	t	22.00	- 31.0
B-B Fraction	t	17.00	- 43.2
Cracked gasoline	t	17.00	- 100.4
Residual oil	t	17.00	- 29.6
Electricity	kWh	0.008	149.7
Steam	t	1.50	136.7
Fuel	10 <sup>6</sup> kal	0.595	124.6
Cooling water	kl	0.008	115.0
Process water	t	0.10	9.0
Catalyst and chemicals		-	629.6
Personnel costs			392.0
Interests			409.1
Indirect taxes			68.3
including insurance			
Depreciation			681.9
Administrative expenses			136.1
Other costs (maintenance, royalty)			170.6
			<u>142.8</u>
Cost/t:	\$187.70		3,754.4

## HDPE Unit

	Unit	Unit price \$/t	000 \$
Naptha	t	4.26	670.4
<u>By-products</u>			
Kerosene	t	35.00	- 298.5
Gas oil	t	31.40	- 315.3
Off gas	t	7.14	- 41.9
P-P Fraction as raw material	t	42.00	- 124.6
P-P Fraction for sale	t	22.00	- 32.6
B-B Fraction	t	17.00	- 45.6
Cracked gasoline	t	17.00	- 105.5
Residual oil	t	17.00	- 31.1
Electricity	kWh	0.008	186.6
Steam	t	1.50	199.6
Fuel	10 <sup>6</sup> kal	0.595	135.9
Cooling water	kl	0.008	98.2
Process water	t	0.10	14.3
Catalyst and chemicals		-	108.3
Personnel costs			357.6
Interests			694.6
Indirect taxes			116.0
including insurance			
Depreciation			1,158.0
Administrative expenses			231.5
Other costs (maintenance, royalty)			289.5
			<u>160.0</u>
Cost/t:	\$342.50		3,425.4

## XII. SUPPLEMENT

Breakdown of Production Costs by Units of the Petrochemical Complex (cont.)LDPE Unit

	Unit	Unit Price \$/t	000 \$
Naphtha	t	4.26	2,656.0
<u>By-products</u>			
Kerosene	t	35.00	-1,182.8
Gas oil	t	31.40	-1,249.6
Off gas	t	7.14	- 166.0
P-P Fraction as raw material	t	42.00	- 494.0
P-P Fraction for sale	t	22.00	- 129.2
B-B Fraction	t	17.00	- 180.4
Cracked gasoline	t	17.00	- 418.4
Residual oil	t	17.00	- 123.6
Electricity	kWh	0.008	1,084.1
Steam	t	1.50	450.4
Fuel	10 <sup>6</sup> kal	0.595	476.6
Cooling water	kl	0.008	231.6
Process water	t	0.10	42.9
Catalyst and chemicals		-	986.0
Personnel costs			997.0
Interests			1,953.0
Indirect taxes including insurance			326.4
Depreciation			3,257.1
Administrative expenses			651.2
Other costs (maintenance, royalty)			814.1
			320.0
			<u>10,303.2</u>

Cost/t: \$258.0Detergent Alkylate Unit

	Unit	Unit Price \$/t	000 \$
P-P Fraction	t	42.00	1,764.0
Beneens	t	45.24	597.2
<u>By-products</u>			
Off gas	t	7.14	- 37.6
Light polymer and light alkylate	t	30.00	- 381.6
Heavy polymer and heavy alkylate	t	17.00	- 171.9
Electricity	kWh	0.008	61.7
Steam	t	1.50	83.9
Fuel	10 <sup>6</sup> kal	0.595	85.7
Cooling water	kl	0.008	44.4
Process water	t	0.10	7.6
Catalyst and chemicals		-	169.2
Personnel costs			222.7
Interests			436.9
Indirect taxes including insurance			72.8
Depreciation			728.1
Administrative expenses			145.6
Other costs (maintenance, royalty)			182.0
			<u>87.0</u>
			<u>4,097.7</u>

Cost/t: \$137.00Aromatics Recovery Unit

	Unit	Unit Price \$/t	000 \$
Cracked gasoline	t	17.00	1,503.8
Hydrogen	m	0.008	66.7
<u>By-products</u>			
C <sub>5</sub> 's	t	17.00	- 118.8
Raffinate	t	30.00	- 507.7
Electricity	kWh	0.008	38.3
Steam	t	1.50	191.8
Fuel	10 <sup>6</sup> kal	0.595	37.6
Cooling water	kl	0.008	230.8
Process water	t	0.10	4.1
Catalyst and chemicals		-	109.7
Personnel costs			176.1
Interests			239.5
Indirect taxes including insurance			39.9
Depreciation			399.2
Administrative expenses			79.8
Other costs (maintenance, royalty)			99.8
			25.6
			<u>2,611.2</u>

Cost/t: \$407.00

XIII. CASH FLOW TABLE (000 US \$)		Information not available	Terminal value of assets
	Year		
<b>A. Source of cash</b>			
-----			
-----			
1	Financial resources total	-----	
11	Loans <sup>1</sup>	-----	
12	Equity	-----	
13	Suppliers credits	-----	
14	Subsidies	-----	
2	Sales revenue	-----	
<b>B. Uses of cash</b>			
-----			
-----			
1	Fixed capital expenditure: total	-----	
11	Land, site improvements, & buildings	-----	( )
12	Machinery & equipment (new installation)	-----	( )
13	Machinery & equipment (replacement)	-----	( )
2	Net working capital: total	-----	
21	Stocks of materials	-----	( )
22	Work in-process <sup>2</sup>	-----	( )
23	Stocks of finished products	-----	( )
3	Pre-investment & start-up expenses:	-----	( )
-----			
4	Production expenditure: total	-----	
41	Personnel expenditure	-----	
42	Materials <sup>3</sup>	-----	
43	Administrative expenditure	-----	
44	Indirect taxes & royalties	-----	
45	Other expenditure (rents, contingencies, etc.)	-----	
5	Debt service: total	-----	
51	Interest on loans	-----	
52	Repayment of loans & credits	-----	
6	Dividends & profit taxes paid:	-----	
-----			
<b>C. Surplus/Deficit (A - B)</b>			
-----			
-----			
<b>SURPLUS/DEFICIT ACCUMULATED</b>			
-----			

<sup>1</sup> Loans of different terms should be shown separately  
<sup>2</sup> Annual value of production of finished goods minus annual accumulation of finished goods inventory.  
<sup>3</sup> Total production costs minus production costs of finished goods.  
<sup>4</sup> Not including interest during construction.  
<sup>5</sup> Annual purchase minus annual accumulation of materials inventory.  
<sup>6</sup> This item stands for the part of profit which is to be paid out, namely profit tax, dividends, fees of the members of the executive board, managerial staff's share in profits, etc. Actually this sum will be established after allowances have been made for depreciations which are not included under item 4 (production expenditure). The cash flow balance should be programmed, therefore, in such a way that all necessary replacement (B 1.3.) can be covered in any year by the accumulated surplus.

Comments:

## PROJECT: PETROCHEMICAL COMPLEX

(Planning year: 1971 )

## I. ORIGIN OF THE STUDY

1. This study was prepared by an independent consulting firm for the government of a developing country.

2. The study was intended to assess the feasibility of producing petrochemicals for export.

## 3. Size of the economy considered:

Population (approx.): million  
Per capita GDP (approx.): US \$  
Other information:

The country has large reserves of crude oil and natural gas, but the local market for petrochemicals is minimal; the whole output of the petrochemical complex will, therefore, be exported.

## II. GENERAL DESCRIPTION

## 1. Products:

Ethylene, propylene, butadiene and aromatic derivatives; for detailed information see the Supplement.

## 2. Major input materials:

Naphta combined with petrochemical raw materials (benzene, toluene, xylene, cyclohexane and n-paraffin) to be supplied by another petrochemical plant.

## 3. Alternative technologies available and technology adopted for the study:

Petrochemical raw material could also be combined with natural gas and condensate or with condensate only. For the combination with naphta see the Supplement.

## 4. Locational factors:

Indication of particularly important factors:

Availability of raw materials, water and electricity.

Actually proposed locality:

No information available.

## III. MARKET

## 1. Tabulation of estimated demand on domestic and export markets:

Product	Unit	Current annual consumption	Of which imported (%)	Projected demand in 1975	Increase per year (%)
LDPE	000 t	4,850		9,494	14.4
HDPE	000 t	1,690		3,340	14.6
Polystyrene	000 t	2,000		3,110	9.3
Acrylonitrile	000 t	1,450		2,840	14.3
SBR	000 t	2,190		3,820	5.6
TDI	000 t	260		585	17.9
Maleic anhydride	000 t	300		560	13.2
DNT	000 t	1,790		3,820	16.4
PVC	000 t	4,980		8,860	12.2
PG	000 t	510		805	9.6
PP	000 t	1,441		3,315	18.1
Alkylbenzene	000 t	910		1,315	7.6

(Explanation of abbreviations in the Supplement)

## 2. Notes on methodology:

The total demand for each product in North and South America, in Western Europe and in Southeast Asia was estimated. The possible shares of the markets (which are not indicated here) were estimated with regard to price competitiveness in each market and its custom duty system.

## 3. Selection of product-mix:

The product-mix was determined with regard to achieving the highest internal rate of return and the largest possible variety of petrochemicals.

**IV. CAPACITY OF PROPOSED PLANT**

1. Nominal maximum capacity according to major process:

Ethylene plant:	300,000 t/year
Propylene plant:	200,000 t/year
Butadiene plant:	65,000 t/year
Benzene plant:	125,000 t/year
Toluene plant:	109,000 t/year
Xylene plant:	46,600 t/year

2. Maximum feasible capacity of the plant: -

3. Expected maximum output of the plant: Full capacity utilization is assumed.

**V. INVESTMENT (000 US \$)**

	Total	Foreign currency component		Total	Foreign currency component
<b>TOTAL INVESTMENT</b>	<u>377,000</u>	<u>-----</u>			
1. Fixed assets			2. Working capital		
1.1. Land, site development			2.1. Inventories		
1.2. Buildings			- Production materials, fuels & auxiliary materials		
- Factory			- Parts & supplies for repair & maintenance		
- Office			- Work-in-process		
- Storage	54,540		- Finished goods		
- Others			2.2. Accounts receivable		
			2.3. Other liquid assets		
1.3. Machinery & equipment **	<u>272,560</u>	<u>-----</u>	3. Other investments		Included in 1.
			3.1. Pre-investment costs		
			- Preliminary expenditure		
			- Planning costs		
			- Engineering costs		
			- Interest during construction		
			- Training costs		
			- Others		
			3.2. Start-up expenses		
			- Consultant fees		
			- Costs for test run		
			- Others		

Major machinery & equipment	f.a.b. supplier country's part	Transport cost (insurance freight)	Import duty	Landing, local installation cost	Total	Foreign currency component
Naphta cracking					28,800	
Hydrogen production					1,440	
Aromatics recovery					7,180	
Butadiene extraction					3,540	
Dealkylation					1,570	
PO process section					2,920	
VCM process section					6,660	
Styrene process section					11,530	
PG process section					1,580	
Acrylonitrile process section					9,510	
LDPE process section					25,920	
HDPE process section					22,620	
PVC process section					6,470	
Polystyrene process section					16,400	
PP process section					26,000	
SBR process section					13,550	
Terephthalic acid process section					12,050	
Maleic anhydride process section					8,040	
TDI process section					17,840	
DMT process section					8,730	
P-xylylene process section					3,330	
Caprolactam process section					9,550	
Linear alkyl benzene					6,000	
Nylon 6-F					21,310	

**VI. MANNING TABLE**

Total number of persons: 3,668

Shops	1st shift	2nd shift	3rd shift	Shops	1st shift	2nd shift	3rd shift
1. Primary operative shops (including supervisory staff)		3,668		2. Auxiliary operative shops *			
Supervisors		360		- Repair & maintenance			
Operators		3,308		- Utilities control			
				- Product & material storage			
				- Off-site transport			
				- Guards, cleaners, etc.			
				3. Administration *			
				- Production management			
				- Research & development			
				- Sales & purchase			
				- General administration			

\* Included under 1.

**VII. ANNUAL PRODUCTION**

1. Total annual expected maximum output: US\$ 222,550,000

Product	Unit	Domestic sales			Foreign sales		
		Quantity	Unit price ex factory (US \$)	Annual turnover (000 US \$)	Quantity	Unit price ex factory (US \$)	Annual turnover (000 US \$)
LDPE	tons				130,000	102.1	13,273
HDPE	tons				70,000	261.2	18,084
PVC	tons				91,000	187.4	17,059
Polystyrene	tons				110,000	192.5	21,175
PG	tons				40,000	201.9	8,076
Acrylonitrile	tons				44,000	249.1	11,016
PP	tons				100,000	232.5	23,250
SBR	tons				83,000	264.0	21,912
Maleic anhydride	tons				50,000	197.2	9,860
Linear alkylbenzene	tons				50,000	144.7	7,235
Nylon 6-F	tons				18,000	1,127.7	20,300
TDI	tons				30,000	596.4	17,892
DMT	tons				61,400	304.4	18,690
<b>TOTAL</b>							<b>222,550</b>

\* Average FOB price at country's port

2. Expected sales and inventory build-up: No data available

3. Pricing policy: The prices of the export products were calculated as an average FOB price computed for each major export market in the following way:

$$FOB = \text{Domestic price} + (\text{freight, insurance, customs duties})$$

$$\text{Domestic price}_1 = \text{Wholesale price of the product at market}_1$$

The intended (accounting) price of the intermediate products (ethylene, propylene, benzene, etc.) was computed on the assumption that a 10% rate of return on capital invested in the relevant plant units should be achieved.

4. Planned sales organization:

It is assumed that several international petrochemical companies will take part both in financing the project and in selling its products through their own sales network.

**VIII. ANNUAL OPERATING COSTS AND PROFITS**

Cost item	Unit	Unit price (US \$)	Quantity (000)	Annual costs (000 US \$)	Foreign currency component (000 US \$)
<b>Total costs</b>				191,183	-----
<b>1. Material costs</b>				114,314	-----
Basic materials				86,596	-----
Naphtha	t	20.02	1,200	24,024	
Cracked gasoline	t	19.53	343	6,720	
Hydrogen	Nm <sup>3</sup>	0.013	66,090	874	
Toluene	t	36.7	89	3,260	
Others 1				83,280	
Catalyst and chemicals				16,135	
Power	kWh	0.0065	851,764	5,536	
Steam	t	0.14	2,515	3,440	
Cooling water	t	0.0013	612,863	817	
Fuel	10 <sup>6</sup> kcal	0.446	2,739	1,221	
Process water				31	

1 Including off gas, materials for B-B fraction a and intermediates calculated at selling prices

2 Tax holiday for first five years of operation

Cost item	Annual costs (000 US \$)	Foreign currency component (000 US \$)
<b>2. Personnel costs (*)</b>	2,535	
2.1. Wages & salaries	2,081	
2.2. Contributions to social securities	454	
2.3. Fringe benefits		
3. Interests (7%)	15,000	
4. Rents		
5. Indirect taxes at company level	6,542	
6. Depreciation	32,708	
6.1. Buildings	12,708	
6.2. Machinery & equipment		
6.3. Office equipment		
6.4. Other fixed assets		
7. Administrative expenses & sales costs (overheads)	6,542	
8. Other costs (maintenance: 2% of total investment)	6,542	
9. Profit before tax	31,367	
of which profit tax subsidies	14,115	

(*) Categories of persons employed	Domestic		Foreign		Foreign currency component (000 US \$)
	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)	
Top managers	3,000	9,535			
Engineers					
Technicians					
Commercial staff					
Clerks and typists					
Foremen					
Skilled operatives					
Semi-skilled operatives					
Unskilled operatives					
Part-time operatives					
Other special categories					

**IX. FINANCING PROPOSAL (in US \$)**

1. Equity capital (total): US\$ 120 million

2. Long-term loans (total): US\$ 100 million  
- Rate of interest: 7% p. a.  
- Repayment: 10 years

3. Other loans: -

4. Suppliers' credits: US\$ 107 million  
Rate of interest: 7% p. a.  
Repayment: 10 years

5. Remarks on the financing policy:

It is assumed that several international petrochemical companies will buy shares in this project.

**X. IMPLEMENTATION PLAN**

1. Technical collaboration service: No information available

2. Project management: No information available

3. Recruitment and training of personnel: No information available

4. Other items: -

5. Time schedule: The study did not specify the phasing of construction.

**XI. DATA FOR EVALUATION**

1. Profitability evaluation:

- Check:
- Break-even point analysis
  - Return to total capital
  - Pay back
  - Rentability: return to equity capital

2. Further profitability analysis for given project life (Bankability test):

- Check:
- Internal rate of return
  - Net present value
  - Any other method used

3. National economic benefit-cost analysis (National priority test):

- Check:
- Direct value added and employment effects
  - Balance of payment effect
  - Social marginal productivity of capital
  - Backward and forward effects
  - Synthetic benefit cost analysis
  - Any other method used

Give a short outline of the methods used and major findings:

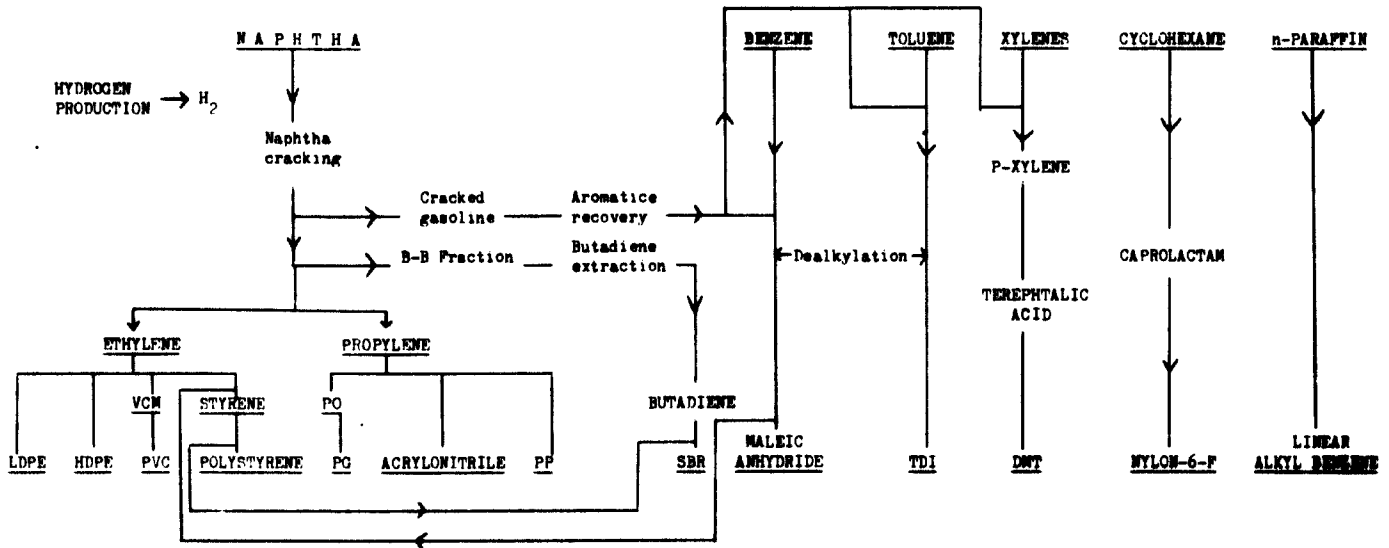
Return to total capital: 14% (working capital not included)

Pay back period: 4 years

Return to equity capital: 26%

Internal rate of return: 27% (working capital disregarded)

## XII. SUPPLEMENT

Ad II.1. and 3. Process Flow Chart of Petrochemicals to be ProducedAd. III.1. Explanation of abbreviations:

- LDPE - low density polyethylene
- HDPE - high density polyethylene
- VCM - vinyl chloride monomer
- PVC - polyvinyl chloride
- PP - polypropylene
- PG - propylene glycol
- SBR - styrene butadiene rubber
- TDI - toluene di-isocyanate
- DMT - dimethyl terphthalate



**XIII. CASH FLOW TABLE (000 US \$)**

	Year											Terminal value of assets
	1	2	3	4	5	6	7	8	9	10	11	
<b>A. Source of cash</b>	327,080	222,550	222,550	222,550	222,550	222,550	222,550	222,550	222,550	222,550	222,550	
1. Financial resources:												
total	327,080	-	-	-	-	-	-	-	-	-	-	
1.1. Loan <sup>1</sup>	100,000	}	-	-	-	-	-	-	-	-	-	-
1.2. Equity	120,000											
1.3. Suppliers' credits	107,080											
1.4. Subsidies	-											
2. Sales revenue:	-	222,550	222,550	222,550	222,550	222,550	222,550	222,550	222,550	222,550	222,550	
<b>B. Uses of cash</b>	327,080	191,183	189,228	187,783	176,333	184,883	193,995	192,545	191,095	189,645	188,195	
1. Fixed capital expenditure:												
total	327,080	-	-	-	-	-	-	-	-	-	-	
1.1. Land, site improvements, & buildings	54,540	}	-	-	-	-	-	-	-	-	-	( )
1.2. Machinery & equipment (new installation)	272,540											
1.3. Machinery & equipment (replacement)	-											
2. Net working capital:												
total	-	-	-	-	-	-	-	-	-	-	-	
2.1. Stocks of materials	}	-	-	-	-	-	-	-	-	-	-	( )
2.2. Work-in-process <sup>2</sup>												
2.3. Stocks of finished products												
3. Pre-investment & start-up expenses:	-	-	-	-	-	-	-	-	-	-	-	( )
4. Production expenditure:												
total	-	143,475	143,475	143,475	143,475	143,475	143,475	143,475	143,475	143,475	143,475	
4.1. Personnel expenditure	-	9,535	9,535	9,535	9,535	9,535	9,535	9,535	9,535	9,535	9,535	
4.2. Materials <sup>3</sup>	-	114,314	114,314	114,314	114,314	114,314	114,314	114,314	114,314	114,314	114,314	
4.3. Administrative expenditure	-	6,542	6,542	6,542	6,542	6,542	6,542	6,542	6,542	6,542	6,542	
4.4. Indirect taxes & royalties	-	6,542	6,542	6,542	6,542	6,542	6,542	6,542	6,542	6,542	6,542	
4.5. Other expenditure (rents, contingencies, etc.)	-	6,542	6,542	6,542	6,542	6,542	6,542	6,542	6,542	6,542	6,542	
5. Debt service:												
total	-	35,708	33,753	32,308	30,858	29,408	27,958	26,508	25,058	23,608	22,158	
5.1. Interest on loans	-	15,000	13,045	11,600	10,150	8,700	7,250	5,800	4,350	2,900	1,450	
5.2. Repayment of loans & credits	-	20,708	20,708	20,708	20,708	20,708	20,708	20,708	20,708	20,708	20,708	
6. Dividends & profit taxes paid:	-	12,000	12,000	12,000	12,000	12,000	22,562	22,562	22,562	22,562	22,562	
<b>C. Surplus/Deficit (A - B)</b>	-	31,367	33,322	34,767	36,217	37,667	28,555	30,005	31,455	32,905	34,355	
<b>SURPLUS/DEFICIT ACCUMULATED:</b>	-	31,367	64,689	99,456	135,673	173,340	201,895	231,900	263,355	296,260	330,615	

<sup>1</sup> Loans of different terms should be shown separately.  
<sup>2</sup> Annual value of production of finished goods minus annual accumulation of finished goods inventory.  
<sup>3</sup> Total production costs minus production costs of finished goods.  
<sup>4</sup> Not including interest during construction.  
<sup>5</sup> Annual purchase minus annual accumulation of materials inventory.  
<sup>6</sup> This item stands for the part of profit which is to be paid out, namely profit tax, dividends, fees of the members of the executive board, managerial staff's share in profits, etc. Actually this sum will be established after allowances have been made for depreciation which are not included under item 4. (production expenditure). The cash flow balance should be programmed, therefore, in such a way that all necessary replacement (B.1.3.) can be covered in any year by the accumulated surplus.

**Comments:**

For simplicity reasons it is assumed that the total complex will be constructed within one year.

PROJECT: BTX - AROMATICS AND CYCLOHEXANE

(Planning year: 1971 )

**I. ORIGIN OF THE STUDY**

1. This study was prepared by an expert  
for the government of a developing country.

2. The study was intended to evaluate the possibilities of producing BTX-aromatics and cyclohexane.

## 3. Size of the economy considered:

- Population (approx.): 115 million
- Per capita GDP (approx.): 100 US \$
- Other information:

**II. GENERAL DESCRIPTION**

1. Products: a) BTX-aromatics: benzene, toluene, paraxylene, ortho-xylene, mixed xylene  
b) Cyclohexane

2. Major input materials: Coal or petroleum → a) pyrolysis gasoline from naphtha cracker  
b) straight-run-naphtha

## 3. Alternative technologies available and technology adopted for the study:

Feedstock for BTX-aromatics processing will be either catalytic reformat or mixed feedstock catalytic reformat/pyrolysis gasoline. BTX-aromatics processing scheme: hydrotreating - catalytic reforming - aromatic extraction - para-xylene separation (PAREX Process) - isomerisation and disproportionation. Cyclohexane processing: benzene is converted into cyclohexane by catalytic hydrogenation.

## 4. Locational factors:

- Indication of particularly important factors:

Since aromatic processing operations are part of refinery processes, the project should be located within a refinery.

- Actually proposed locality:

The plant will be adjacent to an existing refinery.

**III. MARKET**

## 1. Tabulation of estimated demand on domestic and export markets:

Product	Unit	Current annual consumption	Of which imported (%)	Projected demand in 1980	Increase per year (%)
Benzene	t			21,000	
Toluene	t			5,000	
Para-xylene	t			13,000	
Ortho-xylene	t			8,800	
Mixed xylene	t			5,000	
Cyclohexane	t			16,000	

## 2. Notes on methodology:

The expected demand in 1980 was derived from the expected output (1980) of industries consuming BTX-aromatics.

Benzene

15,000 t → 17,000 t nylon  
2,000 t → 13,000 t insecticides  
700 t → 11,000 t washing powder

Para-xylene

18,000 t → 18,000 t polyester fibres

Ortho-xylene

7,800 t → 16,000 t DOP  
1,000 t → 3,000 t alkyd resins

Cyclohexane

16,000 t → 16,000 t caprolactam (for nylon production)

## 3. Selection of product-mix:

The product mix was determined with regard to the requirements of the petrochemical complex within which the project is to be constructed.

**IV. CAPACITY OF PROPOSED PLANT**

1. Nominal maximum capacity according to major process: 53,000 t per year of BTX-aromatics:
  - 21,000 t/y Benzene
  - 5,000 t/y Toluene
  - 9,000 t/y Orthoxylene
  - 13,000 t/y Para-xylene
  - 5,000 t/y Mixed xylene
2. Maximum feasible capacity of the plant: 16,000 t/y of Cyclohexane
3. Expected maximum output of the plant: Full capacity utilization is assumed.

**V. INVESTMENT (000 US \$)**

	Total	Foreign currency component		Total	Foreign currency component
<b>TOTAL INVESTMENT</b>	19,285	10,642			
<b>1. Fixed assets</b>	16,171	9,145	<b>2. Working capital</b>	817	596
1.1. Land, site development	311	-	2.1. Inventories	817	596
1.2. Buildings	1,009	-	- Production materials, fuels & auxiliary materials		
- Factory			- Parts & supplies for repair & maintenance	817	596
- Office			- Work-in-process		
- Storage	1,009	-	- Finished goods		
- Others			2.2. Accounts receivable	-	-
			2.3. Other liquid assets	-	-
1.3. Machinery & equipment <i>(Details see below)</i>	14,851	9,145	<b>3. Other investments</b>	2,297	901
Production equipment	14,536	9,040	3.1. Pre-investment costs	1,121	420
Transport equipment	315	105	- Preliminary expenditure	420	420
			- Planning costs	-	-
			- Engineering costs *	-	-
			- Interest during construction	701	-
			- Training costs **	-	-
			- Others	-	-
			3.2. Start-up expenses	1,176	481
			- Consultant fees		
			- Costs for test run		
			- Others		

\* incl. in "Buildings"  
\*\* incl. in "Start-up expenses"

	C. I. F. Buyer country's part	Transport cost (insurance freight)	Import duty	Landing, local installation cost	Total	Foreign currency component
<b>Major machinery &amp; equipment</b>						
Hydrotreater unit for input-output of 160,000 - 180,000 t/y naphtha						
Reformer, unit capacity of 150,000 t/y of naphtha						
Aromatics extraction unit of 120,000 t/y						
Aromatic fractionation of 100,000 t/y						
Cq-splitter unit of 40,000 t/y						
Parax process unit incl. sieve chamber and fractionation unit of 60,000 t/y charge						
Tortory unit of 50,000 t/y						
Isomerisation unit of 50,000 t/y charge						
Cyclohexane unit of 15,000 t/y						
Extension of existing power plant						
	14,536					

**VI. MANNING TABLE**

Total number of persons: 255

	1st shift	2nd shift	3rd shift		1st shift	2nd shift	3rd shift
<b>1. Primary operative shops (including supervisory staff)</b>		163		<b>2. Auxiliary operative shops</b>		37	
Operators		120		- Repair & maintenance *		37	
Shift engineers (foremen)		8		- Utilities control			
Plant engineers (supervisors)		5		- Product & material storage			
Plant laboratory chemists		10		- Off-site transport			
Unskilled workers		20		- Guards, cleaners, etc.			
				* See XII. Supplement			
				<b>3. Administration</b>		55	
				- Production management			
				- Research & development			
				- Sales & purchase			
				- General administration			
						54	

VII. ANNUAL PRODUCTION

1. Total annual expected maximum output:

Product	Unit	Domestic sales			Foreign sales		
		Quantity	Unit price on factory (US \$)	Annual turnover (000 US \$)	Quantity	Unit price on factory (US \$)	Annual turnover (000 US \$)
Benzene	t	21,000	119.9	2,519			
Toluene	t	5,000	110.0	550			
Para-xylene	t	13,000	239.9	3,119			
Ortho-xylene	t	9,000	129.9	1,169			
Mixed xylene	t	5,000	120.0	600			No exports foreseen
Cyclohexane	t	16,000	127.3	2,037			
<b>Total</b>		<b>69,000</b>	<b>144.8</b>	<b>9,994</b>			

2. Expected sales and inventory build-up:

Capacity utilization for the first two years would be 65% and 95% respectively.

3. Pricing policy:

Selling prices are calculated at the level of CIP prices.

4. Planned sales organization:

VIII. ANNUAL OPERATING COSTS AND PROFITS

Cost item	Unit	Unit price (US \$)	Quantity (000)	Annual cost (000 US \$)	Foreign currency component (000 US \$)
<b>Total costs</b>				<b>6,645</b>	
<b>1. Material costs</b>				<b>3,868</b>	
<u>BTX-aromatics</u>				2,659	
<u>Raw materials</u>					
Feedstock-reformate (net)	t	25.9	54	1,402	
<u>Utilities</u>					
Electricity	kwh	0.008	16,960	142	
Steam	t	1.26	177	223	
Cooling water	m <sup>3</sup>	0.006	13,427	85	
Fuel	10 <sup>6</sup> gal.	1.47	159	234	
Catalyst and chemicals	-	-	-	334	
Maintenance supplies	-	-	-	239	
<u>Cyclohexane</u>				1,209	
<u>Raw materials</u>					
Benzene	t	76.0	15	1,143	
Hydrogen	t	n.a.	n.a.	32	
<u>Utilities</u>					
Electricity	kwh	0.008	480	4	
TW-water	m <sup>3</sup>	n.a.	n.a.	1	
Cooling water	m <sup>3</sup>	0.006	40	0.25	
Catalyst and chemicals	-	-	-	16	
Maintenance supplies	-	-	-	13	

Cost item	BTX-aromatics		Cyclohexane	Foreign currency component
	Annual cost (000 US \$)		(000 US \$)	(000 US \$)
2. Personnel costs (*)				
2.1. Wages & salaries	251	16		
2.2. Contributions to social securities	157	10		
2.3. Fringe benefits	94	6		
3. Interests				
4. Rents	538	27		
5. Indirect taxes at company level	-	-		
6. Depreciation				
6.1. Buildings	1,618	100		
6.2. Machinery & equipment	63	3		
6.3. Office equipment and transport equipment	1,369	87		
6.4. Other fixed assets	59	3		
7. Administrative expenses & sales costs	127	7		
8. Other costs (insurance)	63	4		
9. Profit before tax	307	17		
of which - profit tax	3,349			
of which - subsidies				

(*) Categories of persons employed	Domestic		Foreign		Foreign currency component (000 US \$)
	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)	
Top managers	3	15.5			
Engineers	10	29.6			
Technicians	10	25.9			
Commercial staff	20	25.2			
Clerks and typists	32	26.9			
Foremen	16	23.6			
Skilled operatives	136	110.5			
Semi-skilled operatives	-	-			
Unskilled operatives	28	10.3			
Part-time operatives	-	-			
Other special categories	-	-			

**IX. FINANCING PROPOSAL (in US \$)**

4. Suppliers' credits: -

- 1. Equity capital (total): US\$ 5,398,596
- 2. Long-term loans (total): local long-term loan: US\$ 1,341,270; rate of interest: 8%; repayment: 10 years  
 - Rate of interest: foreign long-term loan: US\$ 40,025,820; rate of interest: 7%; repayment: 10 years  
 - Repayment: B. Remarks on the financing policy: Debt-equity ratio is 72 : 28
- 3. Other loans: Short-term local loan: US\$ 1,470,000; rate of interest: 9%  
 Government debenture: US\$ 1,050,000; rate of interest: 6%

**X. IMPLEMENTATION PLAN**

- 1. Technical collaboration service:
- 2. Project management: A turn-key contract is envisaged.
- 3. Recruitment and training of personnel:  
 Operative staff will be trained in the refinery due to the specific nature of the processes involved. Provision has been made for 20 supervisory employees to be trained overseas for a period of six months prior to the start-up of the project. All other local staff is trained for a period of six months.
- 4. Other items:
- 5. Time schedule:  
 Construction will take three years. It is proposed that the construction start in 1975 and that full capacity utilization be achieved in 1980.

**XI. DATA FOR EVALUATION**

- 1. Profitability evaluation:  
 Check:  
 Break-even point analysis  
 Return to total capital  
 Pay back  
 Rentability: return to equity capital
- 2. Further profitability analysis for given project life (Bankability test):  
 Check:  
 Internal rate of return  
 Net present value  
 Any other method used
- 3. National economic benefit-cost analysis (National priority test):  
 Check:  
 Direct value added and employment effects  
 Balance of payment effect  
 Social marginal productivity of capital  
 Backward and forward effects  
 Synthetic benefit cost analysis  
 Any other method used

Give a short outline of the methods used and major findings:

Break-even point: 40%

Return to total capital: 20%

Return to equity capital: 34%

Pay back: total capital: 9 years

Internal rate of return: 21.7%

Foreign exchange savings: Year 1 (US\$ 000): 4,222.6  
 Year 10 (US\$ 000): 5,753.5

XII. SUPPLEMENT

Ad VI. MANNING TABLE

2. Auxiliary shops

<u>Repair and maintenance</u>	37
Workers (engineers)	16
Foremen	8
Supervisors	5
Helpers	8

**XIII. CASH FLOW TABLE (000 US \$)**

Terminal value of assets

	Year										
	1	2	3	4	5	6	7	8	9	10	11
<b>A. Sources of cash</b>	4,840	6,090	8,165	8,495	9,494	9,994	9,994	9,994	9,994	9,994	9,994
1 Financial resources <i>total</i>	4,840	6,090	8,165	-	-	-	-	-	-	-	-
1.1 Loan <sup>1</sup>	2,520	4,200	7,188	-	-	-	-	-	-	-	-
1.2 Equity	2,320	1,890	1,177	-	-	-	-	-	-	-	-
1.3 Suppliers credits	-	-	-	-	-	-	-	-	-	-	-
1.4 Subsidies	-	-	-	-	-	-	-	-	-	-	-
2 Sales revenue	-	-	-	8,495	9,494	9,994	9,994	9,994	9,994	9,994	9,994
<b>B. Use of cash</b>	1,684	4,557	13,044	7,055	7,430	7,542	6,718	6,702	6,633	7,918	7,854
1 Fixed capital expenditure <i>total</i>	739	4,557	10,875	-	-	-	-	-	-	-	-
1.1 Land, site improvements & buildings	739	357	228	-	-	-	-	-	-	-	-
1.2 Machinery & equipment (new installation)	-	4,200	10,647	-	-	-	-	-	-	-	-
1.3 Machinery & equipment (replacement)	-	-	-	-	-	-	-	-	-	-	-
2 Net working capital <i>total</i>	-	-	817	-	-	-	-	-	-	-	-
2.1 Stocks of materials	-	-	-	-	-	-	-	-	-	-	-
2.2 Work-in-process <sup>2</sup>	-	-	817	-	-	-	-	-	-	-	-
2.3 Stocks of finished products	-	-	-	-	-	-	-	-	-	-	-
3 Pre-investment & start-up expenses	945	-	1,352	-	-	-	-	-	-	-	-
4 Production expenditure <i>total</i>	-	-	-	3,750	4,053	4,205	4,205	4,205	4,205	4,205	4,205
4.1 Personnel expenditure	-	-	-	377	377	377	377	377	377	377	377
4.2 Materials <sup>3</sup>	-	-	-	2,525	2,878	3,030	3,030	3,030	3,030	3,030	3,030
4.3 Administrative expenditure	-	-	-	72	72	72	72	72	72	72	72
4.4 Indirect taxes & royalties (and insurance)	-	-	-	292	292	292	292	292	292	292	292
4.5 Other expenditure (rents, contingencies, etc.)	-	-	-	434	434	434	434	434	434	434	434
5 Debt service <i>total</i>	-	-	-	2,980	2,837	2,688	1,703	1,622	1,541	1,460	1,379
5.1 Interest on loans	-	-	-	1,004	860	712	566	485	404	323	242
5.2 Repayment of loans & credits	-	-	-	1,976	1,976	1,976	1,137	1,137	1,137	1,137	1,137
6 Dividends & profit taxes paid	-	-	-	324	540	649	810	875	892	1,701	1,701
										552	569
<b>C. Surplus/Deficit (A - B)</b>	3,156	1,533	-4,879	1,440	2,064	2,452	3,276	3,292	3,361	2,076	2,140
<b>SURPLUS/DEFICIT ACCUMULATED</b>	3,156	4,673	-	1,440	3,504	5,956	9,232	12,524	15,880	17,956	20,096

<sup>1</sup> Loans of different terms should be shown separately.  
<sup>2</sup> Annual value of production of finished goods minus annual accumulation of finished goods inventory.  
<sup>3</sup> Total production costs minus production costs of finished goods.  
<sup>4</sup> Not including interest during construction.  
<sup>5</sup> Annual purchase minus annual accumulation of materials inventory.  
<sup>6</sup> This item stands for the part of profit which is to be paid out, namely profit tax, dividends, fees of the members of the executive board, managerial staff's share in profits, etc. Actually, this item will be established after allowances have been made for depreciation which are not included under item 4 (production expenditure). The cash flow balance should be programmed therefore in such a way that all necessary replacement (B.1.3.) can be covered in any year by the accumulated surplus.

**Comments**

- After the sixth year of operation 45% profit tax is charged.

## PROJECT PRODUCTION OF CHEMICAL FERTILIZERS AND INTERMEDIATES FOR EXPLOSIVES

(Planning year 1967 )

## I. ORIGIN OF THE STUDY

1. This study was prepared by an independent consulting firm for a national development bank in a developing country (in Africa).

2. The study was intended to find out the possibilities for manufacturing basic chemicals (mainly fertilizers and intermediates for explosives) which could lead to a degree of foreign exchange saving, and at the same time serve as a basis for gradual extension and diversification of the domestic chemical industry.

## 3. Size of the economy considered:

Population (approx) 4 million  
Per capita G.D.P. (approx) 200 US \$  
Other information

## II. GENERAL DESCRIPTION

1. **Products:** The production of the following commodities is proposed: as intermediate products - sulphuric acid (96% conc.), nitric acid, ammonium phosphate,  $P_2O_5$  in phosphoric acid, ammonium nitrate; as end products - ammonium sulphate (21% N), single-superphosphate (18%  $P_2O_5$ ), triple-superphosphate (46%  $P_2O_5$ ), NPK compound fertilizer (15-N : 15- $P_2O_5$  : 15- $K_2O$ ), potassium (60%  $K_2O$ ), ammonium nitrate, mixed acid (36- $HNO_3$  : 58- $H_2SO_4$  : 6- $H_2O$ ), sulphuric acid (92-94%), aluminium sulphate, and plaster.

2. **Major input materials:** The main inputs are sulphur, rock phosphate (39%  $P_2O_5$ ), chloride (60%  $K_2O$ ), ammonia and alumina.

3. **Alternative technologies available and technology adopted for the study:** There will be separate plants and separate production lines for different product groups, but single and triple superphosphate are produced in the same plant with different mixers only. The production processes proposed are conventional. The grinding, packaging and loading plants are used for all kinds of fertilizers produced. There will be, however, different granulating drums for NPK compound fertilizer and single/triple superphosphate. The production of ammonia sulphate is based on phosphoric acid, sulphuric acid and ammonia and not on the Murexberger process. The production process in the main plants is continuous; it is semi-automatic in the packaging plant.

## 4. Locational factors:

**Indication of particularly important factors:** The majority of raw materials has to be imported: 86,830 tons in bulk and 13,430 tons (ammonia) in liquid form. Total annual production will amount to 106,900 tons, of which 85,600 tons are fertilizers (packed), and 21,300 tons intermediate products for the production of explosives (including 3,170 tons of acids in liquid form, which need special transport facilities). The complex has an installed capacity of 2,000 KW and electricity consumption of about 12.3 GWh per annum. Fuel consumption will amount to 2.1 million litres, water consumption to 100,000 cubic metres.

**Actually proposed locality:** The locality proposed is a seaport (with sufficient landing facilities for the imported raw materials), in which vicinity all non-fertilizer products can be sold. In the future this locality will be connected with an inland waterway, which will touch a great area of fertile land. It is also near to rock phosphate deposits, which may substitute the necessary imports. Cheap cooling water in the form of sea water is also available.

## III. MARKET

## 1. Tabulation of estimated demand on domestic and export markets

Product	Unit	Current annual consumption	Of which imported (%)	Projected demand in 1970	Increase per year (%)
in pure nutrient					
Fertilizer					
Nitrogenous fertilizer	000 t	1,010	100	6,600	
Phosphate fertilizer	"	1,137	100	8,800	
Potash fertilizer	"	263	100	6,600	
Unspecified fertilizer	"	415	100	-	
Explosives <sup>1/</sup>					
Gunpowder	"	179	100	3,350	
Blasting explosives <sup>2/</sup>	"	2,188	100		
Other prepared explosives	"	5	100		
Aluminium sulphate (for water purification)	"	2,837	100	8,000 (10,000) <sup>3/</sup>	
Gypsum		-		7,000 (11,000) <sup>3/</sup>	
Sulphuric acid				370	

<sup>1/</sup> The market of explosives is the market for mixed acids (sulphuric acid and nitric acid) and ammonium nitrate.

<sup>2/</sup> There will be possibilities for exporting to neighbouring countries the intermediate products for the production of approximately 2,750 tons of blasting explosives.

<sup>3/</sup> An estimate for 1974.

2. **Notes on methodology:** Fertilizers and basic material for the production of explosives are the most important end-products of the envisaged chemical complex. As the import statistics for fertilizers of the last years do not express the real domestic demand but only reflect the import licences granted, demand projections were based on the area cultivated for crops of first priority (export crops, marketable crops). Assuming that the actual agricultural "extension service" will be improved, it is expected that at least 50 - 75% of the first priority crops will be served with fertilizers. On the basis of this area and the optimal fertilizer composition for the various first-priority crops the future demand was calculated. These estimations were compared with the three other recent studies conducted by international agencies. In the case of other end-products demand projections were relatively less complicated since there was just one prospective buyer for each product.

3. **Selection of product-mix:** The task of the study was to plan a chemical complex with products that can provide a basis for further development of the domestic chemical industry. The possibility of production of ammonia, calcium carbide, caustic soda and chlorine was examined, but rejected because of the lack of relevant raw materials and excessive costs. Fertilizing products are the most important of the envisaged production programme since for these commodities potential selling possibilities are excellent. Other products were selected mainly to guarantee a better utilisation of production capacities.



**IV. CAPACITY OF PROPOSED PLANT**

1. Nominal maximum capacity according to major process: The main plants would technically permit 30% overload as compared with the output ratings listed in VII and in the flowsheet which is given in the Supplement.

2. Maximum feasible capacity of the plant: Maximum feasible capacity is approximately 10% higher than expected maximum output.

3. Expected maximum output of the plant: The expected maximum output as indicated in VII is determined by the estimated domestic demand for fertilizers and explosives.

**V. INVESTMENT (000 US \$)**

	Total 1/	Foreign currency component	Total	Foreign currency component
<b>TOTAL INVESTMENT</b>	13,785	6,893		
1. Fixed assets	9,438	6,128	2,685	607
1.1 Land, site development 2/	262	98	1,210	570
1.2 Buildings	2,043	505		
Factory	1,110		575	570
- Office and canteen	232			
- Storage	1,135			
- Others				
Auxiliary departments	338			
Garages	28			
2. Working capital				
2.1 Inventories				
Production materials, fuels & auxiliary materials (2 months)			118	-
Parts & supplies for repair & maintenance			-	-
Work-in-process (1 week)			118	-
Finished goods (1 mo. fertil.; 2.5 mos. for others)			1,210	-
2.2 Accounts receivable (6 weeks)			208	-
2.3 Other liquid assets			67	-
3. Other investments			1,662	160
3.1 Pre-investment costs				
Preliminary expenditure			5	-
Planning costs			100	74
Engineering costs			100	70
Interest during construction (2.5% p.a.)			1,094	-
Training costs			219	16
Others			144	-
3.2 Start-up expenses				
Consultant fees				
Costs for test run				
Others				

N.B.

1/ No import duties are calculated on assets. It is assumed that the project be granted exemption from import duty under an investment promotion decree.

2/ No costs for land are included in this amount since industrial sites may only be rented.

Major machinery & equipment	Capacity power KW	f.o.b. supplier country's part	Transport cost (insurance & freight)	Import duty	Landing, load installation cost	Total	Foreign currency component
Machinery for sulphuric acid production	300	537	19		205	761	639
Machinery for phosphoric acid production	100	726	42		160	928	805
Machinery for nitric acid production	50	449	27		68	544	483
Machinery equipment for ammonia storage	25	133	8		61	202	163
Machinery for ammonium sulphate production	50	269	2		59	330	299
Machinery for ammonium phosphate production	110	225	6		37	268	243
Machinery for ammonium nitrate production	20	146	5		37	188	164
Machinery for superphosphate production	100	452	19		69	540	486
Machinery for N-P-K fertiliser production	200	442	25		77	544	476
Machinery for the grinding plant	250	289	6		49	344	314
Machinery equipment for bag./load. plant	50	195	29		54	478	421
Machinery equipment for aluminium sulphate prod.	10	52	2		19	93	72
Equipment for concentrated nitric acid prod.	10	29	1		9	39	34
Machinery for crystallized ammonium nitrate prod.	10	54	0.500		10	64	59
Machinery for plaster production	150	152	9		34	195	169
Auxiliary and service departments							
- Power, steam and water supply	300	192					
- Repair workshop	25	45					
- Offices, equip. in social and sanitary buildings		59		19	175	760	654
- Lighting and fire-fighting equipment	40	58					
- Other equipment		212					
Vehicles		46	1		0.300	47	46

**VI. MANNING TABLE**

Total number of persons 301

Shop	1st shift	2nd shift	3rd shift	Shop	1st shift	2nd shift	3rd shift
<b>1. Primary operative shops (including supervisory staff)</b>	61	46	40	<b>2. Auxiliary operative shops</b>	65	32	29
Sulphuric acid plant	6	5	5	- Repair & maintenance	4	3	3
Phosphoric acid plant	7	7	6	- Utilities control	-	-	-
Nitric acid plant	4	4	4	- Product & material storage (Ammonia)	2	2	2
Ammonium sulphate plant	5	3	3	- Off-site transport	20	-	-
Ammonium nitrate plant	4	3	3	- Guards, cleaners, etc.	14	7	7
Ammonium phosphate plant	3	2	2	- Bagging and loading	22	17	14
Superphosphate plant	9	-	-	- Water supply inc. sewage disposal	3	3	3
N-P-K fertiliser plant	6	6	6	<b>3. Administration</b>	28	-	-
Grinding plant	5	5	-	- Production management	12		
Aluminium sulphate plant	4	3	3	- Research & development	4		
Nitric acid conc. plant	2	2	2	- Sales & purchase	2		
Ammonium nitrate cryst. plant	2	2	2	- General administration	10		
Plaster plant	4	4	4				

VII. ANNUAL PRODUCTION

Total annual expected maximum output: \$8,412,000

Product	Domestic sales				Foreign sales		
	Unit	Quantity	Unit price on factory (US \$)	Annual turnover (000 US \$)	Quantity	Unit price on factory (US \$)	Annual turnover (000 US \$)
Total value of production							
Ammonium sulphate	tons	19,800	60	1,188			54
Single superphosphate	tons	4,000	54	216			
Triple superphosphate	tons	11,100	100	1,110			
NPK (15:15:15) compound fertilizer	tons	19,600	100	1,960			
Potassium (60% K <sub>2</sub> O)	tons	6,100	56	342			
Ammonium nitrate	tons	2,040	126	257			
Mixed acid (conc. nitric acid and sulphuric acid)	tons	1,600	60	96	1,400	60	84
Sulphuric acid	tons	370	127	47			
Aluminium sulphate	tons	9,240	60	554			
Plaster	tons	6,600	30	198			

- Expected sales and inventory build-up:** It is assumed that full production (expected maximum output) will be reached already in the first year of production. No explicit references on changes in the production programme and production volume in the following years are given.
- Pricing policy:** Fertilizer prices were calculated on the basis of the current c.i.f. prices for the imports comparable to the items in the production programme. These prices were set at levels about 10 - 25% lower than the c.i.f. prices actually paid. The prices for non-fertilizer products were fixed on the same level as the present c.i.f. import prices (excluding all duties).
- Planned sales organization:** No detailed specifications were given on the planned sales organization. However, it is assumed that no large organisation will be necessary, as the selling of fertilizers will be organized mostly by the governmental agricultural "extension service"; the non-fertilizer products will be sold to only a few big customers.

VIII. ANNUAL OPERATING COSTS AND PROFITS

Cost item	Unit	Unit price (US \$)	Quantity	Annual costs (000 US \$)																																																																		
				Domestic	Foreign currency component (000 US \$)																																																																	
<b>Total costs (*) - (A)</b>																																																																						
				6,552	3,916																																																																	
<b>1. Material costs</b>				4,750	3,416																																																																	
<b>Raw material</b>																																																																						
Sulphur	t	48.5	18,000	873	863																																																																	
Ammonia	t	46.0	11,000	508	508																																																																	
Rock phosphate	t	23.8	44,000	1,043	1,047																																																																	
Potassium chloride	t	41.5	16,000	664	664																																																																	
Alumina	t	77.1	3,000	231	231																																																																	
Filler	t	2.85	6,000	17	-																																																																	
<b>Auxiliary materials</b>																																																																						
Packaging	000 bags	250	2,852	713	13																																																																	
<b>Costs of installed capacity (elec.)</b>																																																																						
Elec. consumption	MWh	80	12,100	98	-																																																																	
Fuel oil	t	870	2,044	178	-																																																																	
Vehicle fuel	000 litres	80	90	7	-																																																																	
Steam 1/	-	-	-	-	-																																																																	
Sweet water	000 m <sup>3</sup>	110	95	10	-																																																																	
Boiler feed water	000 m <sup>3</sup>	110	18	2	-																																																																	
Outside repair costs	-	..	..	244	150																																																																	
<b>2. Personnel costs (**)</b>																																																																						
				631	70																																																																	
<b>2.1. Wages &amp; salaries</b>																																																																						
				434	70																																																																	
<b>2.2. Contributions to social securities</b>																																																																						
				102	-																																																																	
<b>2.3. Fringe benefits</b>																																																																						
				95	-																																																																	
<b>3. Interests (average) 2/</b>																																																																						
				416	-																																																																	
<b>4. Rents (for complex plot)</b>																																																																						
				36	-																																																																	
<b>5. Indirect taxes at company level</b>																																																																						
				-	-																																																																	
<b>6. Depreciation (linear method)</b>																																																																						
				645	300																																																																	
<b>6.1. Buildings and site development 3.33% p.a.</b>																																																																						
				103	-																																																																	
<b>6.2. Machinery &amp; equipment (processing 7%; transp. 25% p.a.)</b>																																																																						
				447	300																																																																	
<b>6.3. Office equipment (25% p.a.)</b>																																																																						
				15	-																																																																	
<b>6.4. Other investments (4.8% p.a.)</b>																																																																						
				80	-																																																																	
<b>7. Administrative expenses &amp; sales costs</b>																																																																						
				74	-																																																																	
<b>8. Other costs</b>																																																																						
				-	-																																																																	
<b>9. Profit before tax</b>																																																																						
				1,860	-																																																																	
				928	-																																																																	
				-	-																																																																	
<table border="0"> <tr> <td></td> <td colspan="2">Domestic</td> <td colspan="2">Foreign</td> </tr> <tr> <td>(*) Categories of persons employed</td> <td>No. of persons</td> <td>Annual wages &amp; salaries &amp; fringe benefits (000 US \$)</td> <td>No. of persons</td> <td>Annual wages &amp; salaries &amp; fringe benefits (000 US \$)</td> </tr> <tr> <td>Top managers</td> <td>-</td> <td>-</td> <td>2</td> <td>45</td> </tr> <tr> <td>Engineers</td> <td>-</td> <td>-</td> <td>6</td> <td>94</td> </tr> <tr> <td>Technicians</td> <td>5</td> <td>20</td> <td>-</td> <td>-</td> </tr> <tr> <td>Commercial staff</td> <td>3</td> <td>15</td> <td>-</td> <td>-</td> </tr> <tr> <td>Clerks and typists</td> <td>10</td> <td>14</td> <td>-</td> <td>-</td> </tr> <tr> <td>Foremen</td> <td>39</td> <td>115</td> <td>-</td> <td>-</td> </tr> <tr> <td>Skilled operatives</td> <td>60</td> <td>115</td> <td>-</td> <td>-</td> </tr> <tr> <td>Semi-skilled operatives</td> <td>109</td> <td>143</td> <td>-</td> <td>-</td> </tr> <tr> <td>Unskilled operatives</td> <td>70</td> <td>70</td> <td>-</td> <td>-</td> </tr> <tr> <td>Part-time operatives</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>Other special categories</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> </tr> </table>							Domestic		Foreign		(*) Categories of persons employed	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)	Top managers	-	-	2	45	Engineers	-	-	6	94	Technicians	5	20	-	-	Commercial staff	3	15	-	-	Clerks and typists	10	14	-	-	Foremen	39	115	-	-	Skilled operatives	60	115	-	-	Semi-skilled operatives	109	143	-	-	Unskilled operatives	70	70	-	-	Part-time operatives	-	-	-	-	Other special categories	-	-	-	-
	Domestic		Foreign																																																																			
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- 1/ Steam as a waste product of the sulphuric acid production process is available without cost.
- 2/ Annual average for the 9-year period from the first year of production to the 9th year of production (assuming repayment of loans in 6 years, with a 4-year grace period).
- 3/ According to an investment promotion decree newly established industrial enterprises can be exempted from income tax up to ten years. The annual profit depends on interests to be paid each year. (See cash flow table.)

**IX. FINANCING PROPOSAL (in US \$)**

1. Equity capital (total): 6,100,000
2. Long-term loans (total): 5,500,000  
 Rate of interest: 8.5% p.a.  
 Repayment: A normal duration of 5 years for long-term loans is envisaged, with a grace period of 1 - 4 years.
3. Other loans:
4. Suppliers' credits: 500,000 - Repayment within three years.
5. Remarks on the financing policy: This is only a crude financing proposal.

**X. IMPLEMENTATION PLAN**

1. **Technical collaboration service:** It is assumed that the detailed planning and the installation and debugging of machinery and equipment will be done by foreign engineering firms. No special technical collaboration service will be needed for the implementation phase. It is supposed that the managerial staff to be included in the know-how contract will guarantee uninterrupted implementation of the project.
2. **Project management:** Engineering consultants are engaged during the construction period, who will control costs and quality just as the technical checking of machinery and equipment.
3. **Recruitment and training of personnel:** As no trained labour for the chemical industry is available on the domestic market, at least 4 foremen, 5 supervisors and 2 laboratory assistants should be trained in Europe during an average time of 1 month. The supervisory personnel, together with the specialized expatriates will have to prepare and to give training courses for foremen, skilled and semi-skilled workers, already during the construction period.
4. **Other items:**
5. **Time schedule:** The total time necessary for the realization of the project will be about 17 months. In terms of project activities, the time requirements are: 9 months for examination of the planning documents, preparation of tenders, duration of tendering, examination of proposals received, and contracting; 24 months for the construction period, i.e. preparing of site and laying foundations (7 months), delivery of machines including sea transport (15), erection of buildings and steel constructions (9), masonry and brick works (10), installing pipes for measuring devices (6), electrical installations (1), and trial runs (1). The entire complex erected, an extension may be considered in the following way: (a) production of aluminium fluoride from alumina and waste gases from the phosphoric acid and superphosphate plants, (b) erection of a sulphate furnace to produce  $K_2SO_4$  which could serve to produce compound fertilizer free of chlorine. If the demand for sulphuric acid will increase, it is planned to switch to the Hesse-Burzer process for the production of ammonia sulphate using gypsum filter cakes.

**XI. DATA FOR EVALUATION**

- |   |  |  |
|---|--|--|
| <p>1. <b>Profitability evaluation:</b><br/>                 Check:<br/> <input type="checkbox"/> Break-even point analysis<br/> <input type="checkbox"/> Return to total capital<br/> <input type="checkbox"/> Pay back<br/> <input checked="" type="checkbox"/> Rentability return to equity capital</p> | <p>2. <b>Further profitability analysis for given project life (Bankability test):</b><br/>                 Check:<br/> <input type="checkbox"/> Internal rate of return<br/> <input type="checkbox"/> Net present value<br/> <input type="checkbox"/> Any other method used</p> | <p>3. <b>National economic benefit cost analysis (National priority test):</b><br/>                 Check:<br/> <input checked="" type="checkbox"/> Direct value added and employment effects<br/> <input checked="" type="checkbox"/> Balance of payment effect<br/> <input checked="" type="checkbox"/> Social marginal productivity of capital<br/> <input type="checkbox"/> Backward and forward effects<br/> <input type="checkbox"/> Synthetic benefit cost analysis<br/> <input type="checkbox"/> Any other method used</p> |
|---|--|--|

*Give a short outline of the methods used and major findings.*

**Rentability: return to equity capital:** The rentability of the project was shown on both a short-term and a long-term basis (full utilization of capacity). Besides, the rentability in the case of under-utilization of 30% was checked. During the first five years (assuming a five-year exemption from income tax), payable dividend is said to climb up to 27% of the equity capital. Long-term profitability would be around 12%, taking into account a profit tax rate of 50%. Assuming an under-utilization of capacity (70% maximum idle capacity just to maintain continuous production processes) profitability may fall to 7%.

**Direct value added and employment effects:** The direct net value added amounts to US \$2,854,000, of which wages and salaries (611,000), rents and interest (452,000) and profit before tax (1,771,000). The project provides jobs for 293 domestic employees and offers training possibilities for domestic students of chemistry and chemical engineering.

**Balance of payment effect:** The annual foreign exchange expenditures will amount to US \$3,936,000 (excluding debt service), of which: Imports of raw materials (3,415,000), spare parts (150,000) and replacement investment (300,000), the salaries of the European management in foreign currency (70,000). As imports of chemical products equivalent to the enterprise's proposed production would amount to some US \$8,300,000, there will be net savings of foreign currency of nearly US \$4,400,000 per annum.

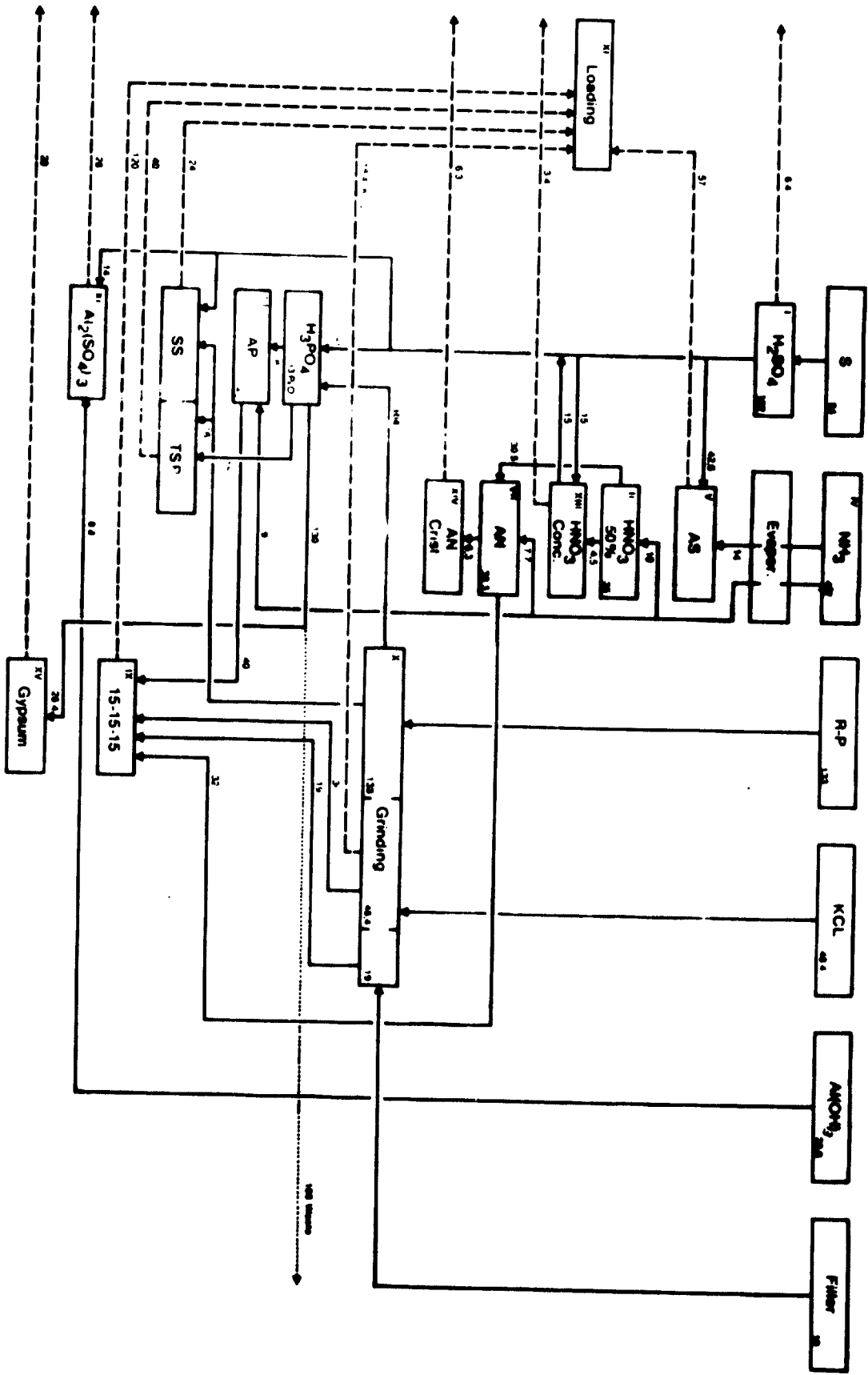
**Social marginal productivity of capital:** Only the output-capital ratio of the envisaged chemical complex is calculated as:

$$\frac{\text{value added}}{\text{capital}} = \frac{3,500,000}{13,785,000} = 0.25 \text{ (value added gross of depreciation allowances)}$$

XII. SUPPLEMENT

1. Interdependencies of the individual departments of the chemical complex.

Flow Sheet of the Entire Complex



XIII. CASH FLOW TABLE (000 US \$)

	Construction years			Production years									Terminal value of assets
	1st	2nd	3rd	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	
<b>A. Source of cash</b>	6,100	-	6,000	7,195	8,412	8,412	8,412	8,412	8,412	8,412	8,412	8,412	
1. Financial resources:													
total	6,100	-	6,000	-	-	-	-	-	-	-	-	-	
1.1. Loan <sup>1</sup>	-	-	5,500										
1.2. Equity	6,100	-	-										
1.3. Suppliers' credits	-	-	500										
1.4. Subsidies	-	-	-										
2. Sales revenue: <sup>2</sup>	-	-	-	7,195	8,412	8,412	8,412	8,412	8,412	8,412	8,412	8,412	
<b>B. Use of cash</b>	1,888	3,788	5,414	8,112	6,502	7,959	8,404	8,213	8,641	8,564	8,593		
1. Fixed capital expenditure:													
total	1,645	3,714	4,078										
1.1. Land, site improvements, & buildings	-	2,172	938										( 2,281 )
1.2. Machinery & equipment (new installation)	1,645	1,542	3,140										( 2,737 )
1.3. Machinery & equipment (replacement)	-	-	-	-	-	-	107	-	-	-	107		( 81 )
2. Net working capital:													
total	-	-	575	2,110									
2.1. Stocks of materials	-	-	575										( 575 )
2.2. Work-in-process <sup>3</sup>	-	-	-	118									( 118 )
2.3. Stocks of finished products	-	-	-	1,217									( 1,217 )
3. Pre-investment & start-up expenses: <sup>4</sup>	243	74	251										( )
4. Production expenditure:													
total	-	-	-	5,492	492	492	492	492	492	492	492	492	
4.1. Personnel expenditure				632	632	632	632	632	632	632	632	632	
4.2. Materials <sup>5</sup>				4,750	4,750	4,750	4,750	4,750	4,750	4,750	4,750	4,750	
4.3. Administrative expenditure				74	74	74	74	74	74	74	74	74	
4.4. Indirect taxes & royalties				-	-	-	-	-	-	-	-	-	
4.5. Other expenditure (rents, contingencies, etc.)				36	36	36	36	36	36	36	36	36	
5. Debt service:													
total	-	-	510	510	510	967	1,305	1,227	1,149	1,072	994		
5.1. Interest on loans			510	510	510	467	189	311	233	156	78		( 9th year )
5.2. Repayment of loans & credits			-	-	-	500	916	916	916	916	916		( 9th year )
6. Dividends & profit <sup>6</sup> taxes paid:					500	1,500	1,500	1,500	2,000	2,000	2,000		
<b>C. Surplus/Deficit (A - B)</b>	4,212	-3,788	586	-917	1,910	453	8	193	-229	-152	-181		
<b>SURPLUS/DEFICIT ACCUMULATED:</b>	4,212	424	1,010	93	2,003	2,456	2,464	2,657	2,428	2,276	2,095		

<sup>1</sup> Loans of different terms should be shown separately.  
<sup>2</sup> Annual value of production of finished goods minus annual accumulation of finished goods inventory.  
<sup>3</sup> Total production costs minus production costs of finished goods.  
<sup>4</sup> Not including interest during construction.  
<sup>5</sup> Annual purchase minus annual accumulation of materials inventory.  
<sup>6</sup> This item stands for the part of profit which is to be paid out, namely profit tax, dividends, fees of the members of the executive board, managerial staff's share in profits, etc. Actually this sum will be established after allowances have been made for depreciation which are not included under item 4 (production expenditures). The cash flow balance should be programmed, therefore, in such a way that all necessary replacement (B.1.3.) can be covered in any year by the accumulated surplus.

Comments: The long-term loans are assumed to be repaid by the 9th year of production. From the 10th year on, there will be no cash withdrawal for debt services. The annual cash surplus of some 1,000,000, to be internally accumulated, will then make possible substantial renovation/expansion of the complex.

PROJECT: \_\_\_\_\_ FERTILIZER COMPLEX  
(Planning year: 1967 )

**I. ORIGIN OF THE STUDY**

1. This study was prepared by a designing company for the government of a developing country.

2. The study was intended to assess the feasibility of producing fertilizers from calcined phosphate rock.

## 3. Size of the economy considered:

- Population (approx.): 14 million
- Per capita GDP (approx.): 240 US \$
- Other information:

**II. GENERAL DESCRIPTION**

1. Products: Diammonium phosphate (grades 18-46-0), triple superphosphate (grades 0-46-0)

## 2. Major input materials:

Phosphate rock (BPL 75), elemental sulphur, ammonia. Sulphur is not locally available and therefore should be imported.

## 3. Alternative technologies available and technology adopted for the study:

See XII. Supplement. For the production of phosphoric acid the wet process will be applied; phosphate rock is decomposed with sulphuric acid. Methods of producing phosphoric acid without using sulphur (as thermal process, hydrochloric acid process and nitric acid process) have been considered and found unsuitable.

## 4. Locational factors:

- Indication of particularly important factors:

Raw material transport, transport of products, power and industrial water, harbours, soil conditions, site conditions, meteorological and oceanographic conditions.

- Actually proposed locality:

A location is proposed which shows the following advantages: phosphate rock conveniently available, extremely convenient road and railroad transport; abundant supply of industrial water, good electricity supply; located near grain production centre.

**III. MARKET**

## 1. Tabulation of estimated demand on domestic and export markets:

Product	Unit	Current annual consumption (1970)	Of which imported (%)	Projected consumption in 1975	Increase per year (%)
<b>Domestic market:</b>					
<b>Nitrogenous fertilisers:</b>					
Ammonium nitrate					
- 33-35%	000 t	18		30	10.8
- 20-22%	000 t	8		8	-
Urea	000 t	-		5	-
Ammonium phosphate or nitrophosphate	000 t	-		2	-
<b>Mixed fertilisers</b>	<b>000 t</b>	<b>5</b>		<b>5</b>	<b>-</b>
Total	000 t	31		50	10.0
<b>Phosphatic fertilisers:</b>					
Superphosphate 16%	000 t	10		5	-
Triple superphosphate 45-50%	000 t	5		10	14.9
Ammonium phosphate or nitrophosphate	000 t	-		5	-
<b>Mixed fertilisers</b>	<b>000 t</b>	<b>17</b>		<b>25</b>	<b>8.0</b>
Total	000 t	32		45	7.1

## 2. Notes on methodology:

The market study has been made in close co-ordination with product selection and has been backed up by not only on-the-spot industrial surveys conducted by survey teams of the designing company but also by extensive statistical analysis. Among others, the statistics of the International Superphosphate Manufacturers' Association (ISMA), publications of the International Ore and Fertiliser Corporation of the Sulphur Institute, the Parker's forecast method, etc., have been used. The world consumption for phosphatic fertiliser (as  $P_2O_5$ ) in 1970 is estimated to be 23 million t/y, and in 1980 39 million t/y. The demand for the three types of fertilisers (nitrogenous, phosphatic and potash) total 71 million tons for 1969/1970, 100 million tons for 1974/1975 and 130 million tons for 1979/1980. The proportional demands for nitrogenous, phosphatic and potash fertilisers will change from 1.2 : 1 : 0.8 for 1965 to 1.3 : 2 : 0.8 for 1970 and 1.6 : 1 : 0.7 for 1980 showing greater demand for nitrogenous and phosphatic fertilisers.

## 3. Selection of product-mix:

The overall trend is to high-concentrate complete fertilisers. This means the use of very concentrated constituents of which especially ammonium phosphate is in high demand, on the export market. The consumption of triplesuperphosphate is increasing considerably and there is a possibility of exporting it in the future. Small quantity of triplesuperphosphate has hitherto been imported by this country, whose domestic demand is increasing. Under these circumstances a study has been conducted on combination complex of diammonium phosphate and triplesuperphosphate.

**IV. CAPACITY OF PROPOSED PLANT**

1. Nominal maximum capacity according to major process:

2. Maximum feasible capacity of the plant:

3. Expected maximum output of the plant:

The expected output of the Fertilizer Complex at 330 stream days is as follows: Sulphuric Acid Unit - 370,000 t/y (as 100% H<sub>2</sub>SO<sub>4</sub>); Phosphoric Acid Unit - 150,000 t/y (as 100% P<sub>2</sub>O<sub>5</sub>); Diammonium Phosphate (18-46-0) Unit - 255,000 t/y; Triple Superphosphate Unit<sup>4</sup> - 90,000 t/y (as 46% P<sub>2</sub>O<sub>5</sub>).

**V. INVESTMENT (000 US \$)**

	Total	Foreign currency component		Total	Foreign currency component
<b>TOTAL INVESTMENT</b>	21,000	n.a. <sup>1/</sup>			
1. Fixed assets	20,400	n.a.	2. Working capital		
1.1. Land, site development (700,000 m <sup>2</sup> ) <sup>2/</sup>			2.1. Inventories		
1.2. Buildings	8,500	n.a.	- Production materials, fuels & auxiliary materials		
- Factory	3,900		- Parts & supplies for repair & maintenance		
- Office <sup>3/</sup>			- Work-in-process		
- Storage	900		- Finished goods		
- Others	2,100		2.2. Accounts receivable		
			2.3. Other liquid assets		
1.3. Machinery & equipment (details see below)	11,900	n.a.	3. Other investments	600	n.a.
			3.1. Pre-investment costs		
			- Preliminary expenditure		
			- Planning costs		
			- Engineering costs		
			- Interest during construction		
			- Training costs		
			- Others		
			3.2. Start-up expenses		
			- Consultant fees		
			- Costs for test run		
			- Others		

1/ Obviously the study assumes that all the machines and equipment would be imported. The land, building materials local transport and part of the installation cost may be the only local currency component.

2/ excl. company housing

3/ incl. in "Factory"

Major machinery & equipment	f.o.b. supplier country's port	Transport cost (insurance freight)	Import duty	Landing, local installation cost	Total	Foreign currency component
Sulphuric acid unit					3,300	
Phosphoric acid unit					4,700	
Diammonium phosphate unit					2,200	
Triple superphosphate unit					1,700	
					11,900	
Offsite facilities					9,100	
Total Investment Cost					21,000	

**VI. MANNING TABLE**

Total number of persons: 190

Shops	Total number of persons			Shops	Total number of persons		
	1st shift	2nd shift	3rd shift		1st shift	2nd shift	3rd shift
1. Primary operative shops (including supervisory staff)				2. Auxiliary operative shops			
Chief engineers				- Repair & maintenance			
Shift foremen				- Utilities control			
Skilled workers				- Product & material storage			
Unskilled workers			80	- Off-site transport			
				- Guards, cleaners, etc.			110
				3. Administration			
				- Production management			
				- Research & development			
				- Sales & purchase			
				- General administration			

**VII. ANNUAL PRODUCTION**

1. Total annual expected maximum output:

Product	Domestic sales				Foreign sales		
	Unit	Quantity	Unit price ex factory (US \$)	Annual turnover (000 US \$)	Quantity	Unit price FOB (US \$)	Annual turnover (000 US \$)
Diammonium phosphate	t	52,000	90	4,680	203,000	70	14,210
Triple super-phosphate	t	18,000	70	1,260	72,000	50	3,600
				5,940			17,810

2. Expected sales and inventory build-up:

3. Pricing policy:

For domestic sales price, the ex-factory price (excl. tax) has been adopted. The export prices (FOB) have been estimated for the period 1970/1975 as follows: diammonium phosphate \$70/t and for triple super-phosphate \$50/t.

4. Planned sales organization:

A special sales promotion service will be established.

**VIII. ANNUAL OPERATING COSTS AND PROFITS**

Cost Item	Unit	Unit price (US \$)	Quantity (000)	Annual costs (000 US \$)	Foreign currency component (000 US \$)	Cost Item	Diammonium phosphate	Triple super-phosphate
<b>Total costs</b>				19,225	n.a.	<b>2. Personnel costs (*)</b>		
<b>1. Material costs</b>				15,269	n.a.	2.1. Wages & salaries	287	161
<b>Diammonium phosphate:</b>				12,491		2.2. Contributions to social securities	287	161
<b>Raw materials:</b>						2.3. Fringe benefits		
Sulphuric acid	t	16.85		4,988		3. Interests	632	350
Phosphate rock	t	12.20		4,284		4. Rents		
Ammonia	t	39.00		2,298		5. Indirect taxes at company level (see 8. Other costs)		
<b>Utilities:</b>						6. Depreciation	1,049	583
Electricity	kWh	0.008		254		6.1. Buildings		
Steam	t	1.50		398		6.2. Machinery & equipment		
Cooling water	kl	0.008		112		6.3. Office equipment	1,049	583
Process water	t	0.10		139		6.4. Other fixed assets		
Fuel	10 <sup>6</sup> kal	0.595		18		7. Administrative expenses & sales costs	208	117
<b>Triple superphosphate</b>				2,778		8. Other costs (tax, insurance and maintenance)	365	204
<b>Raw materials:</b>						9. Profit before tax	3,858	667
Sulphur	t	38.00		994		of which - profit tax (corporate tax = 50%)		2262
Phosphate rock	t	12.20		1,563		10. Net profit		2263
<b>Utilities:</b>								
Electricity	kWh	0.008		90				
Steam	t	1.50		14				
Cooling water	kl	0.008		34				
Process water	t	0.10		81				
Fuel	10 <sup>6</sup> kal	0.595		16				
Catalyst	SD*)	220.00		14				

Categories of persons employed	Domestic		Foreign	
	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)
Top managers				
Engineers				
Technicians				
Commercial staff				
Clerks and typists				
Foremen				
Skilled operatives				
Semi-skilled operatives				
Unskilled operatives				
Part-time operatives				
Other special categories				

No information.

\*) Stream/day



**IX. FINANCING PROPOSAL (in US \$)**

1. Equity capital (total):

2. Long-term loans (total):

- Rate of interest:
- Repayment:

3. Other loans:

4. Suppliers' credits:

5. Remarks on the financing policy:

Information not available

Information not available

**X. IMPLEMENTATION PLAN**

1. Technical collaboration service:

2. Project management:

3. Recruitment and training of personnel:

4. Other items:

5. Time schedule:

Information not available

**XI. DATA FOR EVALUATION**

1. Profitability evaluation:

Check:

- ( ) Break-even point analysis
- (X) Return to total capital
- (X) Pay back
- ( ) Rentability: return to equity capital

2. Further profitability analysis for given project life (Bankability test):

Check:

- ( ) Internal rate of return
- ( ) Net present value
- ( ) Any other method used

3. National economic benefit-cost analysis (National priority test):

Check:

- (X) Direct value added and employment effects
- (X) Balance of payment effect
- (X) Social marginal productivity of capital
- ( ) Backward and forward effects
- ( ) Synthetic benefit cost analysis
- ( ) Any other method used

Give a short outline of the methods used and major findings:

The rate of return on total investment which was subsequently calculated by using the discounted cash-flow technique assuming ten years for the economic life of the project and 50% corporate tax on profit is 13.4%. The rate of return, calculated on the basis of the pre-tax profit (\$4,525 million) is 21.5%. The calculation is based on information contained in sections V, VII and VIII of this extract.

The payback period (four years and eight months) was calculated on the basis of the total investments (Section V) and the profit before tax (Section VIII). Depreciation is not included in the amount of profit. In order to have more comprehensive idea for the total benefits, an important part of the interests (Item 3) and indirect taxes at company level including insurance (item 5) should be taken into consideration. However, this was not done because of the lack of breakdown of these items.

Direct value added and employment effects: The direct annual contribution of the project to national income totals a minimum of \$6,239,000, i.e. wages and salaries: \$448,000; interests: \$982,000; indirect taxes and insurance: \$284,000 (50% of item 8. Other costs, which include tax, insurance and maintenance); profit before tax: \$4,525,000. The project provides jobs for more than 170 domestic employees and offers training possibilities both for employees and students of chemistry and chemical engineering. The number of employees per million dollar investment is only 9. It is low, but that is typical for the chemical industry.

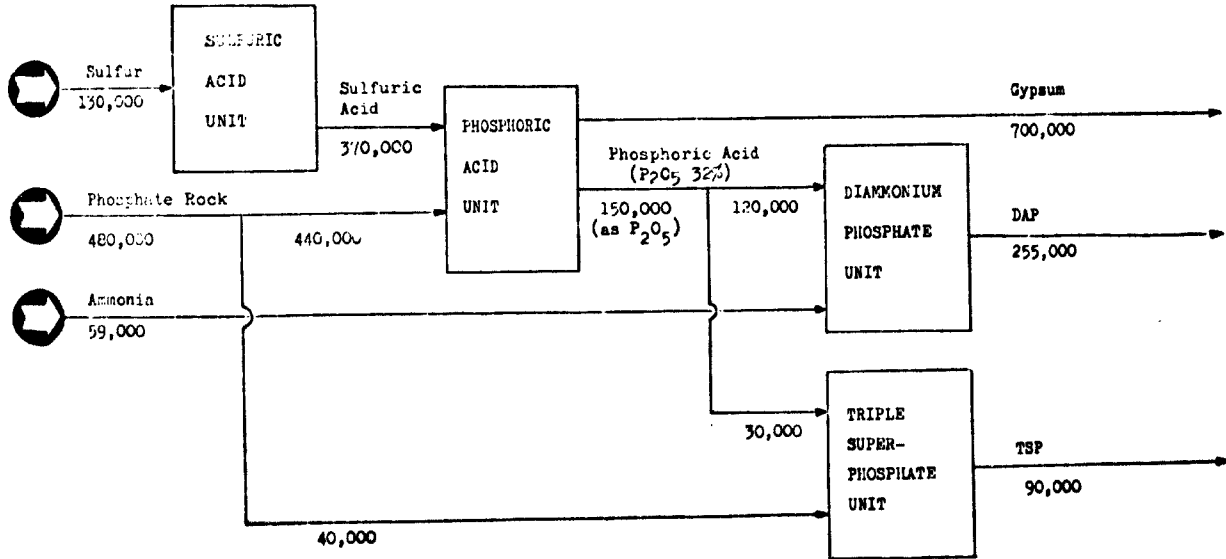
Balance of payment effect: The annual foreign exchange earnings from foreign sales are estimated at \$17,810,000. Assuming that the whole machinery and equipment is imported (\$19,000,000), the foreign exchange expenditures will be paid back by foreign exchange earnings within less than one year. Even if foreign exchange expenditures for spare parts, replacement investment, salaries of foreign specialists and import of sulphur (about \$4,500,000 for sulphur only), the total foreign exchange expenditures will be covered by foreign exchange earnings for approximately one year.

Social marginal productivity of capital: The output-capital ratio of the proposed fertiliser complex is as follows:

$$\frac{\text{value added}}{\text{capital}} = \frac{6,239,000}{21,000,000} = 0.30 \text{ (net value added per \$1 of invested capital)}$$

XII. SUPPLEMENT

Block Flow Diagram for the Interdependencies of the Individual Units of the Fertilizer Complex



XIII. CASH FLOW TABLE (000 US \$)		INFORMATION NOT AVAILABLE					Terminal value of assets
	Year						
<b>A. Source of cash</b>							
-----							
-----							
<b>1. Financial resources:</b>							
total							
-----							
1.1. Loan <sup>1</sup>							
-----							
1.2. Equity							
-----							
1.3. Suppliers' credits							
-----							
1.4. Subsidies							
-----							
<b>2. Sales revenue:</b>							
-----							
<b>B. Use of cash</b>							
-----							
<b>1. Fixed capital expenditure:</b>							
total							
-----							
1.1. Land, site improvements, & buildings							( )
-----							
1.2. Machinery & equipment (new installation)							( )
-----							
1.3. Machinery & equipment (replacement)							( )
-----							
<b>2. Net working capital:</b>							
total							
-----							
2.1. Stocks of materials							( )
-----							
2.2. Work-in-process <sup>2</sup>							( )
-----							
2.3. Stocks of finished products							( )
-----							
<b>3. Pre-investment &amp; start-up expenses:</b>							
-----							
-----							
<b>4. Production expenditure:</b>							
total							
-----							
4.1. Personnel expenditure							
-----							
4.2. Materials <sup>3</sup>							
-----							
4.3. Administrative expenditure							
-----							
4.4. Indirect taxes & royalties							
-----							
4.5. Other expenditure (rents, contingencies, etc.)							
-----							
<b>5. Debt service:</b>							
total							
-----							
5.1. Interest on loans							
-----							
5.2. Repayment of loans & credits							
-----							
<b>6. Dividends &amp; profit taxes paid:</b>							
-----							
-----							
<b>C. Surplus/Deficit (A - B)</b>							
-----							
-----							
<b>SURPLUS/DEFICIT ACCUMULATED</b>							
-----							

<sup>1</sup> Loans of different terms should be shown separately

<sup>2</sup> Annual value of production of finished goods minus annual accumulation of finished goods inventory.

<sup>3</sup> Total production costs minus production costs of finished goods.

<sup>4</sup> Not including interest during construction.

<sup>5</sup> Annual purchase minus annual accumulation of materials inventory.

<sup>6</sup> This item stands for the part of profit which is to be paid out, namely profit tax, dividends, fees of the members of the executive board, managerial staff's share in profits, etc. Actually this item will be established after allowances have been made for depreciation which are not included under item 4. (production expenditure). The cash flow balance should be programmed, therefore, in such a way that all necessary replacement (B.1.3.) can be covered in any year by the accumulated surplus.

Comments

PROJECT:

POLYESTER FIBRES

(Planning year: 1971 )

**I. ORIGIN OF THE STUDY**

1. This study was prepared by an expert  
for the Government of a developing country.

2. The study was intended to assess the feasibility of producing polyester fibres based on own raw materials.

## 3. Size of the economy considered:

Population (approx.) 115 million  
Per capita GDP (approx.) 100 US \$  
Other information:

**II. GENERAL DESCRIPTION**

## 1. Products:

Polyester fibres (staple fibres and filament yarn)

## 2. Major input materials:

Diethyl terephthalate (DWT), to be produced locally  
Ethylene glycole, to be imported

## 3. Alternative technologies available and technology adopted for the study:

Polyethylene terephthalate for fibres is obtained by a) transesterification using diethyl terephthalate (DWT) or b) direct esterification using terephthalic acid (TPA). Advantage of direct esterification: faster reaction, less catalyst residue in the polymer, higher molecular weight polymers result, no special recovery system needed for by-product (water), etc. The direct esterification will become more and more important in the future but it is recommended that the plant described in the study start with the transesterification process and later adopt the direct esterification.

## 4. Locational factors:

Indication of particularly important factors:

The plant should be located very close to the BTX-aromatics and monomer producing plants which will be the supplier of the main raw material (DWT) so that no high transport costs arise.

## - Actually proposed locality

The plant will be located in an area near a large town that has been designated for industrial development and is already partly equipped with infrastructural facilities.

**III. MARKET**

## 1. Tabulation of estimated demand on domestic and export markets:

Product	Unit	Current annual consumption 1970	Of which imported (%)	Projected demand in 1974/75	Increase per year (%)
<b>Polyester fibres:</b>					
Staple fibres	t	80	100	10,000	
Filament	t	90	100		
Blends	t	35	100		
Effect yarn	t	200	100		

It is expected that by 1974/75 polyester/cotton blends will use about 8,000 t of polyester staple fibre; 800 t of polyester staple fibre would be used for polyester/wool blends and 1,200 t filament yarn in the silk industry.

For 1980 the demand for polyester fibre is estimated at 20,000 t.

## 2. Notes on methodology:

The import of polyester fibres was very limited because of the extremely high landing costs. It is therefore believed that the consumption of polyester fibres will increase rapidly once they are produced locally.

It is assumed that 3% of total cotton yarn production will be produced in the form of polyester/cotton blends.

## 3. Selection of product-mix:

In the first phase of the project 5,000 t of staple fibres will be produced, mainly for the blends with cotton, and 1,000 t of filament yarn.

After 1980 the plant will be extended to 12,000 t and the share of filament yarn will increase.

**IV. CAPACITY OF PROPOSED PLANT**

1. Nominal maximum capacity according to major process:

2. Maximum feasible capacity of the plant  
 5,000 t of staple fibre  
 1,000 t of filament yarn.

3. Expected maximum output of the plant

**V. INVESTMENT (000 US \$)**

	Total	Foreign currency component		Total	Foreign currency component
<b>TOTAL INVESTMENT</b>	<u>19,437</u>	<u>7,085</u>			
<b>1. Fixed assets</b>	<u>15,206</u>	<u>7,625</u>	<b>2. Working capital <sup>2</sup></b>	<u>2,231</u>	<u>194</u>
1.1 Land, site development	619	-	2.1 Inventories	745	-
1.2 Buildings	<u>11,557</u>	-	Production materials, fuels & auxiliary materials; spare parts	1,234	149
Factory	1,830		Parts & supplies for repair & maintenance	252	-
Office			Work-in-process	-	-
Storage			Finished goods	-	-
Others			2.2 Accounts receivable	-	-
1.3 Machinery & equipment <i>(already see below)</i>	<u>13,057</u>	<u>7,625</u>	2.3 Other liquid assets	-	-
Production equipment	12,700 <sup>1</sup>	7,457	<b>3. Other investments</b>	<u>2,060</u>	<u>672</u>
Transport equipment	252	168	3.1 Pre-investment costs	<u>1,346</u>	<u>273</u>
Office equipment	105	-	Preliminary expenditure	210	147
			Planning costs	842	-
			Engineering costs	294	126
			Interest during construction	-	-
			Training costs	-	-
			Others	-	-
			3.2 Start-up expenses	<u>714</u>	<u>399</u>
			Consultant fees	-	-
			Costs for test run	-	-
			Others	-	-

Major machinery & equipment	f.o.b. supplier country's port	Transport cost <sup>3</sup> (months freight)	Import duty <sup>4</sup>	Landing, local installation cost	Total	Foreign currency component
-----------------------------	---	---	-----------------------------	--	-------	----------------------------------

Polyethylene terephthalate chips production unit,  
 including esterification and polycondensation into chips  
 Methanol glycol distillation unit  
 Yarn fibre production unit  
 Spinning production unit  
 Water supply and treatment equipment  
 Laboratory equipment

12,700

<sup>1</sup> incl. engineering and know-how  
<sup>2</sup> before start-up  
<sup>3</sup> on CIF basis the break-up is as follows:  
 customs duty: 35%; insurance clearance, internal  
 transport: 4%

**VI. MANNING TABLE**

Total number of persons: 362

Shops	Total number of persons			Shops	Total number of persons		
	1st shift	2nd shift	3rd shift		1st shift	2nd shift	3rd shift
<b>1. Primary operative shops (including supervisory staff)</b>		147		<b>2. Auxiliary operative shops</b>		128	
Operators		60		Repair & maintenance *		118	
Helpers		15		Utilities control			
Shift engineers (foremen)		20		Product & material storage			
Plant engineers (supervisors)		12		Off-site transport		30	
Chemists		20		Guards, cleaners, etc.			
				<b>3. Administration</b>		67	
				Production management		4	
				Research & development		-	
				Sales & purchase		3	
				General administration		60	

\* See III. Supplement

## VII. ANNUAL PRODUCTION

## 1. Total annual expected maximum output:

Product	Unit	Domestic sales			Foreign sales		
		Quantity	Unit price at factory (US \$)	Annual turnover (000 US \$)	Quantity	Unit price at factory (US \$)	Annual turnover (000 US \$)
<b>Polyester fibres</b>							
Staple	t	5,000	1,995	9,975	No exports foreseen		
Filament yarn	t	1,000	2,625	2,625			
Total	t	6,000		12,600			

## 2. Expected sales and inventory build-up: The inventory of finished goods will consist of 30 days supply (at full capacity).

## Capacity utilisation schedule

First year: 85%  
 Second year: 95%  
 Third year: 100%

## 3. Pricing policy:

The ex-factory selling prices were fixed on the basis of the existing CIF price.

## 4. Planned sales organization:

No information given

## VIII. ANNUAL OPERATING COSTS AND PROFITS

Cost item	Unit	Unit price (US \$)	Quantity (000t)	Annual costs (000 US \$)	Foreign currency component (000 US \$)	Cost item	Annual costs (000 US \$)	Foreign currency component (000 US \$)
<b>Total costs</b>						2. Personnel costs (*)		
9,179						635		
6,749						2.1. Wages & salaries		
1. Material costs						397		
Raw materials:						2.2. Contributions to social securities		
DMT t 567.0 5.4 3,062						238		
Ethylene glycol t 252.0 1.8 454						2.3. Fringe benefits		
Catalyst and chemicals 479						3. Interests		
Other materials:						4. Rents		
Electricity kwh 0.015 12,000 176						5. Indirect taxes at company level		
Steam t 1.9 60 113						8. Depreciation		
Cooling water m <sup>3</sup> 0.011 1,781 20						6.1. Buildings and site preparation 99		
Clarified water m <sup>3</sup> 0.011 178 2						6.2. Machinery & equipment 1,400		
Compressed air Nm <sup>3</sup> 0.02 3,000 63						6.3. Office equipment 12		
Fuel t 21.0 0.7 15						6.4. Other fixed assets 68		
Nitrogen Nm <sup>3</sup> 0.06 1,200 76						7. Administrative expenses & sales costs 99		
Maintenance material 210						9. Other costs 117		
Packing material 2,079						9. Profit before tax 3,421		
						of which - profits tax - subsidies		
						Domestic Foreign		
						(*)		
						Categories of persons employed		
						No. of persons		
						Annual wages & salaries & fringe benefits (000 US \$)		
						No. of persons		
						Annual wages & salaries & fringe benefits (000 US \$)		
						Foreign currency component (000 US \$)		
						Top managers 7 47.0		
						Engineers 25 116.8		
						Technicians 20 82.6		
						Commercial staff 26 46.7		
						Clerks and typists 30 35.3		
						Others 31 25.5		
						Foremen 38 89.9		
						Skilled operatives 115 149.6		
						Semi-skilled operatives - -		
						Unskilled operatives 70 41.4		
						Part-time operatives - -		
						Other special categories - -		

**IX. FINANCING PROPOSAL (in US \$)**

4. Suppliers' credits: -

1. Equity capital (total): US\$ 6,897,450

2. Long-term loans (total): Foreign loan: US\$ 9,084,810; local loan: US\$ 3,515,190  
Rate of interest: 7%  
Repayment: 10 years

5. Remarks on the financing policy: Debt/equity ratio is 65 : 35

3. Other loans: -

**X. IMPLEMENTATION PLAN**

1. Technical collaboration service: -

2. Project management:

The plant will be independently managed within the petrochemical industry complex of the country.

3. Recruitment and training of personnel:

The training programme will cover a period of two years starting one year before start-up. The plan provides for six months of overseas training for 15-30 key people of the production, maintenance and management team.

4. Other items:

5. Time schedule:

Construction: three years

**XI. DATA FOR EVALUATION**

1. Profitability evaluation:

- Check:
- Break-even point analysis
- Return to total capital
- Pay back
- Rentability: return to equity capital

2. Further profitability analysis for given project life (Bankability test):

- Check:
- Internal rate of return
- Net present value
- Any other method used

3. National economic benefit cost analysis (National priority test):

- Check:
- Direct value added and employment effects
- Balance of payment effect
- Social marginal productivity of capital
- Backward and forward effects
- Synthetic benefit cost analysis
- Any other method used

Give a short outline of the methods used and major findings:

Break-even point: 40%

Return to total capital: 17.3%

Return to equity capital: 39.2%

Pay back: Total capital - 5.8 years

Internal rate of return: 24.1%

Foreign exchange savings: Year 1 (000 US\$): 5,248.7  
Year 6 (000 US\$): 7,066.7

## XII. SUPPLEMENT

Ad VI. MANNING TABLE2. Auxiliary shops

<u>Repair and maintenance</u>	118
- Workers	55
- Helpers	35
- Engineers (foreman)	18
- Engineers (supervisors)	10

DATA FOR A POLYESTER FIBRE PLANT WITH A CAPACITY OF 12,000 t

	<u>US\$ 000</u>
<u>TOTAL INVESTMENT</u>	<u>28,321</u>
1. <u>Fixed assets</u>	<u>22,171</u>
1.1. Land, site development	672
1.2. Buildings	1,722
1.3. Machinery and equipment	19,777
2. <u>Working capital</u>	<u>3,736</u>
3. <u>Other investments</u>	<u>2,414</u>
<u>Total number of employees:</u>	592
<u>Annual sales:</u>	23,545
<u>Annual operating costs and profits:</u>	<u>17,575</u>
1. <u>Material costs</u>	<u>13,841</u>
<u>Raw materials</u>	
DMT	6,464
Ethylene glycol	907
Catalyst and chemicals	958
<u>Other materials</u>	
Electricity	353
Steam	227
Cooling water	41
Clarified water	4
Potable water	1
Compressed air	126
Fuel	31
Nitrogen	151
Maintenance material	420
Packing material	4,158
2. <u>Personnel costs</u>	<u>976</u>
6. <u>Depreciation</u>	<u>2,439</u>
7. <u>Administrative expenses and sales costs</u> )	319
8. <u>Other costs</u> )	
9. <u>Profit before tax</u>	<u>5,970</u>

Break-even point: 40%Return to total capital: 18.5%Pay back: Total investment - 3.5 years

Foreign exchange savings: Year 1: (US\$ 000) 10,333.3  
Year 6: (US\$ 000) 12,895.3



**XIII. CASH FLOW TABLE (000 US \$)**

Terminal  
value of  
assets

	Year											
	1	2	3	4	5	6	7	8	9	10	11	
<b>A. Source of cash</b>	2,340	7,380	3,577	10,710	11,970	12,600	12,600	12,600	12,600	12,600	12,600	
1 Financial resources: total	2,340	7,380	3,577	-	-	-	-	-	-	-	-	
1.1 Loan <sup>1</sup>	-	4,200	3,400	-	-	-	-	-	-	-	-	
1.2 Equity	2,340	3,180	177	-	-	-	-	-	-	-	-	
1.3 Suppliers credits	-	-	-	-	-	-	-	-	-	-	-	
1.4 Subsidies	-	-	-	-	-	-	-	-	-	-	-	
2 Sales revenue	-	-	-	10,710	11,970	12,600	12,600	12,600	12,600	12,600	12,600	
<b>B. Uses of cash</b>	1,519	5,068	3,752	10,496	11,104	10,590	10,558	10,529	10,499	11,593	11,636	
1 Fixed capital expenditure: total	989	4,830	5,329	1,771	448	196	196	196	196	196	196	
1.1 Land, site improvements, & buildings	989	630	630	-	-	-	-	-	-	-	-	( )
1.2 Machinery & equipment (new installation)	-	4,200	4,699	-	-	-	-	-	-	-	-	( )
1.3 Machinery & equipment (replacement)	-	-	-	1,771	448	196	196	196	196	196	196	( )
2 Net working capital: total	-	-	2,231	-	840	-	-	-	-	-	-	
2.1 Stocks of materials	-	-	2,231	-	-	-	-	-	-	-	-	( )
2.2 Work in-process <sup>2</sup>	-	-	-	-	-	-	-	-	-	-	-	( )
2.3 Stocks of finished products	-	-	-	-	840	-	-	-	-	-	-	( )
3 Pre-investment & start-up expenses:	630	238	1,192	-	-	-	-	-	-	-	-	( )
4 Production expenditure: total	-	-	-	6,583	7,261	7,599	7,599	7,599	7,599	7,599	7,599	
4.1 Personnel expenditure	-	-	-	6,317	6,995	7,333	7,333	7,333	7,333	7,333	7,333	
4.2 Materials <sup>3</sup>	-	-	-	-	-	-	-	-	-	-	-	
4.3 Administrative expenditure	-	-	-	266	266	266	266	266	266	266	266	
4.4 Indirect taxes & royalties	-	-	-	-	-	-	-	-	-	-	-	
4.5 Other expenditure (rents, contingencies, etc.)	-	-	-	-	-	-	-	-	-	-	-	
5 Debt service: total	-	-	-	2,142	2,054	1,966	1,878	1,789	1,701	1,613	1,525	
5.1 Interest on loans	-	-	-	882	794	706	618	529	441	353	265	
5.2 Repayment of loans & credits	-	-	-	1,260	1,260	1,260	1,260	1,260	1,260	1,260	1,260	
6 Dividends & profit taxes paid:	-	-	-	-	701	829	885	945	1,003	1,599	1,695	
										586	621	
<b>C. Surplus/Deficit (A - B)</b>	1,421	2,312	- 175	214	666	2,010	2,042	2,071	2,101	1,007	964	
<b>SURPLUS/DEFICIT ACCUMULATED</b>	1,421	4,333	4,158	4,372	5,038	7,048	9,090	11,161	13,262	14,269	15,233	

<sup>1</sup> Loans of different terms should be shown separately.  
<sup>2</sup> Annual value of production of finished goods minus annual accumulation of finished goods inventory.  
<sup>3</sup> Total production costs minus production costs of finished goods.  
<sup>4</sup> Not including interest during construction.  
<sup>5</sup> Annual purchase minus annual accumulation of materials inventory.  
<sup>6</sup> This item stands for the part of profit which is to be paid out, namely profit tax, dividends, fees of the members of the executive board, managerial staff's share in profits, etc. Actually this sum will be established after allowances have been made for depreciation which are not included under item 4. (production expenditure). The cash flow balance should be programmed, therefore, in such a way that all necessary replacement (B.1.3.) can be covered in any year by the accumulated surplus.

Comments

PROJECT: CAPROLACTAM, TEREPHTHALIC ACID/DMT AND PHTHALIC ANHYDRIDE

(Planning year: 1971 )

**I. ORIGIN OF THE STUDY**

1. This study was prepared by an expert for the government of a developing country.
2. The study was intended to evaluate the possibilities of establishing a monomer producing complex.

**3. Size of the economy considered:**

- Population (approx.): 115 million
- Per capita GDP (approx.): 100 US \$
- Other information:

**II. GENERAL DESCRIPTION****1. Products:**

Caprolactam, terephthalic acid/DMT (mainly used for the production of synthetic fibres), phthalic anhydride (mainly used in the preparation of resins, plasticisers, polyesters, etc.).

**2. Major input materials:**

Cyclohexane for caprolactam  
Para-xylene for terephthalic acid/DMT  
Ortho-xylene for phthalic anhydride

**3. Alternative technologies available and technology adopted for the study:** Caprolactam: Oxidation of cyclohexane - reaction with hydro-xylamine to the oxime which is re-arranged to caprolactam. DMT: Oxidation of para-xylene to para-toluic acid-esterification of para-toluic acid to para-methyl toluene oxidation of para-methyl toluene to mono-methyl terephthalate-esterification of monomethyl terephthalate to pure dimethyl terephthalate (DMT). This process does not involve terephthalic acid as an intermediate. Technologically the esterification of crude terephthalic acid is feasible but if only DMT is required the DMT route is cheaper. Phthalic anhydride: Mixing of ortho-xylene or naphthalene with air and passing through a catalyst bed at a controlled temperature, afterwards condensation, cooling and distillation.

**4. Locational factors:**

- Indication of particularly important factors:  
availability of water;  
electric power ( $48 \times 10^6$  kWh per year)

## - Actually proposed locality:

The plant will be located adjacent to the BTX-aromatics/refinery complex, since it is the supplier of the basic raw materials.

**III. MARKET****1. Tabulation of estimated demand on domestic and export markets:**

Product	Unit	Current annual consumption	Of which imported (%)	Projected consumption in 1980	Increase per year (%)
<u>Domestic market:</u>					
Polyester	t			20,000	
Nylon	t			17,000	
Acrylic	t			1,500	
Alkyd resins	t			8,500	

**2. Notes on methodology:**

The expected consumption of polyester, nylon and acrylic fibres was estimated on the basis of trends in the textile industry of the country and with regard to the world trends in the consumption of synthetic fibres.

**3. Selection of product-mix:**

The products were selected with regard to the output of the proposed BTX-aromatics project.

**IV. CAPACITY OF PROPOSED PLANT**

1. Nominal maximum capacity according to major process:

2. Maximum feasible capacity of the plant: 16,000 t of caprolactam  
18,000 t of terephthalic acid/DMT  
8,000 t of phthalic anhydride

3. Expected maximum output of the plant: Full capacity utilization is assumed.

**V. INVESTMENT (000 US \$)**

	Total	Foreign currency component		Total	Foreign currency component
<b>TOTAL INVESTMENT</b>	<b>60,926</b>	<b>34,152</b>			
1. Fixed assets			2. Working capital		
1.1. Land, site development	52,019	32,753	2.1. Inventories	3,167	-
1.2. Buildings	953	64	- Production materials, fuels & auxiliary materials	3,167	-
- Factory	6,433	527	- Parts & supplies for repair & maintenance	2,211	
- Office			- Work-in-process	389	
- Storage			- Finished goods	-	
- Others			2.2. Accounts receivable	-	
1.3. Machinery & equipment (details see below)	44,633	32,162	2.3. Other liquid assets	-	
Production equipment	44,331	31,966	3. Other investments *	5,740	1,399
Transport equipment	113	91	3.1. Pre-investment costs		
Office equipment	189	105	- Preliminary expenditure		
			- Planning costs		
			- Engineering costs		
			- Interest during construction		
			- Training costs		
			- Others		
			3.2. Start-up expenses		
			- Consultant fees		
			- Costs for test run		
			- Others		

\* See XII. Supplement

**Major machinery & equipment**

**Production units:**

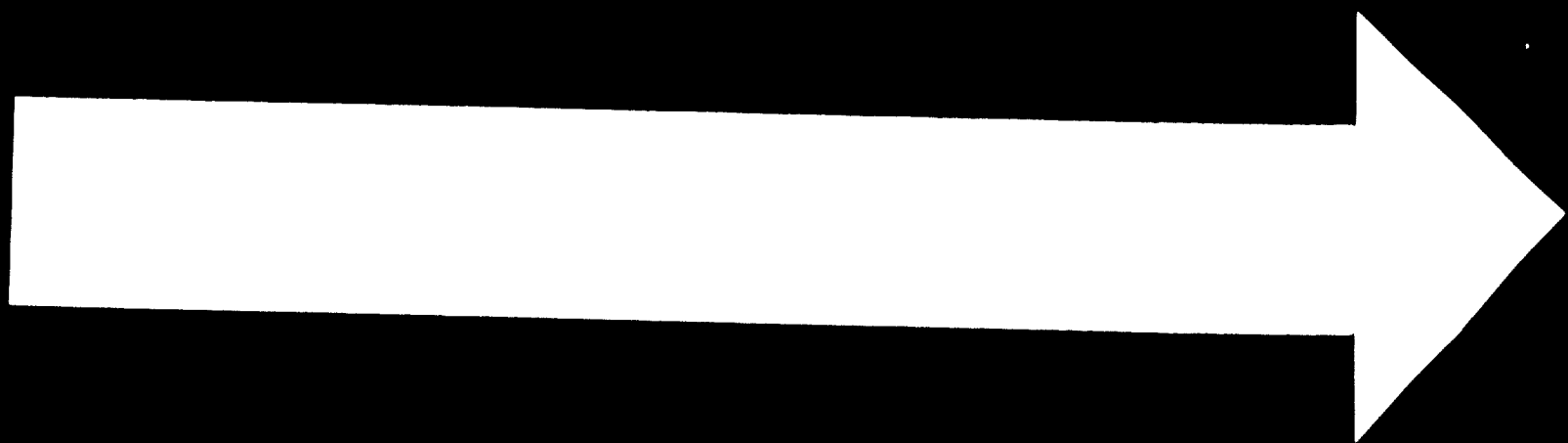
- Water supply and treatment
- Demineralliser
- Power plant
- Cooling tower
- Caprolactam plant
- Terephthalic acid/DMT plant
- Phthalic anhydride plant
- General facilities (storage, maintenance, research, etc.)

	f.o.b. supplier country's part	Transport cost (insurance freight)	Import duty	Landing, local installation cost	Total	Foreign currency component
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**VI. MANNING TABLE**

Total number of persons: 1,132

Shops	Utilities plant	Capro- lactam plant	DMT plant	TA plant	Shops	Utilities plant	Capro- lactam plant	DMT plant	TA plant
1. Primary operative shops (including supervisory staff)	76	172	178	68	2. Auxiliary operative shops	70	116	118	60
Operators	32	80	86	28	- Repair & maintenance *	70	116	118	60
Helpers	24	60	60	20	- Utilities control				
Shift engineers (foremen)	12	16	16	12	- Product & material storage				
Plant engineers (supervisors)	4	8	8	4	- Off-site transport				
Chemists	4	8	8	4	- Guards, cleaners, etc.				
					* See XII. Supplement				
					3. Administration			276	
					- Production management			10	
					- Research & development			-	
					- Sales & purchase			2	
					- General administration			264	



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111	●●●●●●	140	●●●●●●
08	●●●●●●	112	●●●●●●
70	●●●●●●	90	●●●●●●
72	●●●●●●	70	●●●●●●
	●●●●●●	58	●●●●●●
	●●●●●●	48	●●●●●●
	●●●●●●	50	●●●●●●
	●●●●●●	53	●●●●●●
	●●●●●●	84	●●●●●●
	●●●●●●	100	●●●●●●
	●●●●●●	125	●●●●●●
	●●●●●●	160	●●●●●●
180	●●●●●●		
130	●●●●●●		
100	●●●●●●		
80	●●●●●●		
50	●●●●●●		
48	●●●●●●		
98	●●●●●●		
70	●●●●●●		
90	●●●●●●		
112	●●●●●●		
140	●●●●●●		



## VII. ANNUAL PRODUCTION

## 1. Total annual expected maximum output:

Product	Domestic sales				Foreign sales		
	Unit	Quantity	Unit price ex factory (US \$)	Annual turnover (000 US \$)	Quantity	Unit price ex factory (US \$)	Annual turnover (000 US \$)
Caprolactam	t	16,000	630	10,080			
Terephthalic acid/DMT	t	18,000	567	10,206			
Phthalic anhydride	t	8,000	315	2,520			
TOTAL	t	42,000		22,806			No exports foreseen

## 2. Expected sales and inventory build-up: Capacity utilization schedule:

First year: 85%  
 Second year: 95%  
 Third year: 100%

## 3. Pricing policy:

Ex-factory selling prices are calculated on the basis of CIF prices.

## 4. Planned sales organization:

The products will be purchased by a few industrial establishments; there is, therefore, no need for an extensive sales network.

## VIII. ANNUAL OPERATING COSTS AND PROFITS

Cost item	Unit	Unit price (US \$)	Quantity (000)	Annual costs (000 US \$)	Foreign currency component (000 US \$)	Cost item	Annual costs (000 US \$)	Foreign currency component (000 US \$)
<i>Total costs</i>				15,562	-----	2. Personnel costs (*)	1,656	
1. Material costs				8,262		2.1. Wages & salaries	1,035	
Raw materials *				6,422		2.2. Contributions to social securities	621	
Utilities *				1,183		2.3. Fringe benefits		
Maintenance and supplies				615		3. Interests	-	
Packing material				42		4. Rents	-	
						5. Indirect taxes at company level	-	
						6. Depreciation	5,117	
						6.1. Buildings	313	
						6.2. Machinery & equipment	4,455	
						6.3. Office equipment	19	
						6.4. Other fixed assets	330	
						7. Administrative expenses & sales costs	202	
						8. Other costs	225	
						9. Profit before tax	7,244	
						of which - profit tax		
						- subsidies		

\* For details see XII. Supplement

(*) Categories of persons employed	Domestic		Foreign		Foreign currency component (000 US \$)
	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)	
Top managers	6	42			
Engineers	1	6			
Technicians	6	16			
Commercial staff	132	202			
Clerks and typists	80	87			
Others	51	31			
Foremen	134	426			
Skilled operatives	434	666			
Semi-skilled operatives	-	-			
Unskilled operatives	288	180			
Part-time operatives	-	-			
Other special categories	-	-			

**IX. FINANCING PROPOSAL (in US \$)**

4. Suppliers' credits: -

1. Equity capital (total): US\$ 11,225,599

2. Long term loans (total): Foreign loan: US\$ 3,000,000; local loan: US\$ 9,000,000  
 Rate of interest: Foreign: 8%; local: 8%  
 Repayment: 10 years

5. Remarks on the financing policy: Debt:equity ratio is 70 : 30

3. Other loans: -

**X. IMPLEMENTATION PLAN**

1. Technical collaboration service:

2. Project management:

The project will be a joint project with the BDX-aromatics and cyclohexane plant on the same site but with separate operational executive management. The joint project will be managed by a board of directors.

3. Recruitment and training of personnel:

Training programme provides six months of overseas training for 35 management, production and maintenance employees. Local training will be conducted in the refinery and in a fertilizer plant. Nine

4. Other items: -

5. Time schedule: Construction: 3 years

**XI. DATA FOR EVALUATION**

1. Profitability evaluation:

Check:

- Break-even point analysis  
 Return to total capital  
 Pay back  
 Rentability: return to equity capital

2. Further profitability analysis for given project life (Bankability test):

Check:

- Internal rate of return  
 Net present value  
 Any other method used

3. National economic benefit-cost analysis (National priority test):

Check:

- Direct value added and employment effects  
 Balance of payment effect  
 Social marginal productivity of capital  
 Backward and forward effects  
 Synthetic benefit cost analysis  
 Any other method used

Give a short outline of the methods used and major findings:

Break-even point: 44%

Return to total capital: 12%

Pay-back: total capital - 6.2 years

Internal rate of return: 13%

Foreign exchange savings: Year 1 (000 US\$): 11,380  
 Year 10 (000 US\$): 16,580

## XIII. SUPPLEMENT

Ad V. INVESTMENT

	Total (000 US\$)	Foreign currency component (000 US\$)
3. <u>Other investments</u>		
Pre-operating	1,912	944
Training and start-up	1,322	455
- Foreign technicians	461	344
- overseas management training	209	n.a.
- Local staff training	272	n.a.
- Start-up expense	380	n.a.
Interest during construction	2,506	-
<b>TOTAL</b>	<b>5,740</b>	<b>1,399</b>

Ad VI. MANNING TABLE

	Utilitise plant	Capro- lactam plant	DWT plant	PA plant
2. <u>Auxiliary shops</u>				
Repair and maintenance				
- Workers	32	60	62	30
- Helpers	24	40	40	20
- Engineers (foremen)	8	12	12	6
- Engineers (supervisors)	4	4	4	4

Ad VIII. ANNUAL OPERATING COSTS AND PROFITS

	Unit	Unit price (US\$)	Quantity (000)	Annual cost (000 US\$)
1. <u>Material costs</u>				
<u>Caprolactam plant</u>				
<u>Raw materials</u>				
Cyclohexane	t	85.6	13.6	1,161
Caustic soda	t	140.7	0.8	115
Oleum	t	48.7	21.6	1,052
Ammonia	t	67.2	11.4	763
Hydrogen	t	9.4	1.3	12
Boric acid	t	195.7	0.16	32
<u>Utilities</u>				
Electricity	kWh	0.008	9,600.0	81
Steam	t	1.26	228.8	268
Process water	m <sup>3</sup>	0.014	102.9	1.5
Cooling water	m <sup>3</sup>	0.006	1,840.0	12
Catalyst and chemicals	-	-	-	202
<u>Terephthalic acid/DWT plant</u>				
<u>Raw materials</u>				
Para-xylene	t	177.1	12.3	2,175
Methanol	t	34.9	10.1	352
<u>Utilities</u>				
Electricity	kWh	0.008	36,540.0	307
Steam	t	1.26	180.0	227
Cooling water	m <sup>3</sup>	0.006	684.0	4
Catalyst and chemicals	-	-	-	30
<u>Phthalic anhydride</u>				
<u>Raw materials</u>				
Ortho-xylene	t	77.0	89	687
<u>Utilities</u>				
Electricity	kWh	0.008	8,800.0	74
Cooling water	m <sup>3</sup>	0.006	64.0	0.4
Fuel	10 <sup>6</sup> Kcal	1.47	8.0	12
Catalysts and chemicals	-	-	-	19
<b>Total raw materials and utilities</b>				<b>7,805</b>



XIII. CASH FLOW TABLE (000 US \$)

	Year											Terminal value of assets
	1	2	3	4	5	6	7	8	9	10	11	
<b>A. Source of cash</b>	8,400	28,980	23,546	19,385	21,666	22,806	22,806	22,806	22,806	22,806	22,806	
1. Financial resources: total	8,400	28,980	23,546	-	-	-	-	-	-	-	-	
1.1. Loan <sup>1</sup>	-	19,950	23,100	-	-	-	-	-	-	-	-	
1.2. Equity	8,400	9,030	446	-	-	-	-	-	-	-	-	
1.3. Suppliers' credits	-	-	-	-	-	-	-	-	-	-	-	
1.4. Subsidies	-	-	-	-	-	-	-	-	-	-	-	
2. Sales revenue:	-	-	-	19,385	21,666	22,806	22,806	22,806	22,806	22,806	22,806	
<b>B. Uses of cash</b>	8,289	28,870	23,767	16,024	17,670	18,692	18,530	18,372	18,218	20,255	20,154	
1. Fixed capital expenditure: total	7,428	26,993	17,598	-	-	-	-	-	-	-	-	
1.1. Land, site improvements, & buildings	4,236	2,100	1,050	-	-	-	-	-	-	-	-	( 6,000 )
1.2. Machinery & equipment (new installation)	3,192	24,893	16,548	-	-	-	-	-	-	-	-	( 8,000 )
1.3. Machinery & equipment (replacement)	-	-	-	-	-	-	-	-	-	-	-	( )
2. Net working capital: total	-	-	3,167	-	-	-	-	-	-	-	-	
2.1. Stocks of materials	-	-	2,778	-	-	-	-	-	-	-	-	( 3,167 )
2.2. Work-in-process <sup>2</sup>	-	-	389	-	-	-	-	-	-	-	-	( )
2.3. Stocks of finished products	-	-	-	-	-	-	-	-	-	-	-	( )
3. Pre-investment & start-up expenses:	861	1,877	3,002	-	-	-	-	-	-	-	-	( 1,000 )
4. Production expenditure: total	-	-	-	8,616	9,467	10,445	10,445	10,445	10,445	10,445	10,445	
4.1. Persons' expenditure	-	-	-	-	-	1,656	1,656	1,656	1,656	1,656	1,656	
4.2. Materials <sup>3</sup>	-	-	-	-	-	8,262	8,262	8,262	8,262	8,262	8,262	
4.3. Administrative expenditure	-	-	-	9,616	9,467	202	202	202	202	202	202	
4.4. Indirect taxes & royalties	-	-	-	-	-	-	-	-	-	-	-	
4.5. Other expenditure (rents, contingencies, etc.)	-	-	-	-	-	325	325	325	325	325	325	
5. Debt service: total	-	-	-	7,408	7,098	6,788	6,478	6,167	5,857	5,546	5,236	
5.1. Interest on loans	-	-	-	3,103	2,793	2,483	2,173	1,862	1,552	1,242	931	
5.2. Repayment of loans & credits	-	-	-	4,305	4,305	4,305	4,305	4,305	4,305	4,305	4,305	
6. Dividends & profit taxes paid:	-	-	-	-	1,105	1,459	1,607	1,760	1,916	3,120	3,273	
										1,144	1,200	
<b>C. Surplus/Deficit (A - B)</b>	111	110	- 221	3,361	3,996	4,114	4,276	4,434	4,588	2,551	2,652	
<b>SURPLUS/DEFICIT ACCUMULATED:</b>	111	221	-	3,361	7,357	11,471	15,747	20,181	24,769	27,320	29,972	

<sup>1</sup> Loans of different terms should be shown separately

<sup>2</sup> Annual value of production of finished goods minus annual accumulation of finished goods inventory

<sup>3</sup> Total production costs minus production costs of finished goods.

<sup>4</sup> Not including interest during construction.

<sup>5</sup> Annual purchase minus annual accumulation of materials inventory.

<sup>6</sup> This item stands for the part of profit which is to be paid out, namely profit tax, dividends, fees of the members of the executive board, managerial staff's share in profits, etc. Actually this sum will be established after allowances have been made for depreciation which are not included under item 4 (production expenditures). The cash flow balance should be programmed, therefore, in such a way that all necessary replacement (B.1.3.) can be covered in any year by the accumulated surplus.

Comments.

☺ After the sixth year of operation 45% profit tax is charged.

PROJECT:

WALL TILES AND SANITARY WARE

(Planning year: 1969/1970 )

## I. ORIGIN OF THE STUDY

1. This study was prepared by the staff of a technical agency for the Ministry of Economy of a developing country.

2. The study was intended to investigate the technical and economic feasibility of producing wall tiles and sanitary ware from domestic clay.

## 3. Size of the economy considered:

Population (approx.) (1968) 2 million

Per capita GDP (approx.) (1968) 260 US\$

Other information

The project is export-oriented; about 60% of the output will be exported to adjacent countries (with a population of 35 million), sharing 10 - 15% of the markets.

## II. GENERAL DESCRIPTION

1. Products: Wall tiles: 150 x 150 mm and 108 x 108 mm, conforming to international standards; 80% white, 20% coloured; three quality grades.

Sanitary ware: water absorption below 1%; high mechanical strength; 80% white, commercial quality; 10% coloured, commercial quality; 10% coloured, "De luxe" quality.

## 2. Major input materials:

Body raw materials (kaolinitic clays) } local  
Quartz }  
Limestone }  
Feldspar } to be imported  
Glasses }  
Stains }

## 3. Alternative technologies available and technology adopted for the study:

The double firing method will be applied for the manufacture of wall tiles; pressed tiles (after predrying) are burnt to bisque. Glass is applied on the bisque and melted on the surface during the second firing at a comparatively low temperature. Silicious mixed body composition is suitable for the double firing process.

Sanitary ware of vitreous china are produced by the single firing method; glass is applied on the green body and during single firing not only the glass is melted, but also the desired body properties are reached.

Flow chart is in the Supplement.

## 4. Locational factors:

Indication of particularly important factor: proximity of deposits of raw materials (clays).

Actually proposed locality: The locality proposed is at a distance of 13 km from the main raw material deposits and is close to a highway; it is considered to be one of the possible future industrial estate areas. The water piping system of the nearby village will be extended in the near future by the government. The distance for connecting the site with piping system is 400 meters. To connect the plant an extension of only 1500 meters is needed. The average price of 1000 m<sup>2</sup> amounts to a maximum of US\$ 980. Manpower can be recruited from the nearby villages.

## III. MARKET

## 1. Tabulation of estimated demand on domestic and export markets:

Product	Population (mill.) Per capita GDP (US\$)	Unit	Current annual consumption 1966	Of which imported (%)	Project of demand		Average increase per year (%)
					1973	2/	
<u>Domestic market</u>							
a) Wall tiles		000 t	0.86	100	2.2		20.7
b) Sanitary ware		000 t	0.30	100	0.9		17.0
<u>Export market</u>							
a) Wall tiles							
Market (1)	(0.5, \$4,700)	000 t	6.85	100	11.6 (20)		11.1
Market (2)	(8.5, \$290)	000 t	2.3	100	2.9 (10)		4.7
Market (3)	(5.5, \$140)	000 t	3.0 2/	30	4.5 (10)		8.5
Market (4)	(n.e.)	000 t	insignificant		5.0 (0)		-
Market (5)	(7.0, \$400)	000 t	3.2 2/	100	4.5 (15)		7.1
Market (6)	(14.5, \$90)	000 t	0.31 2/	100	0.58 (10)		13.3
b) Sanitary ware							
Market (1)		000 t	17.6	100	22.2 (10)		3.4
Market (2)		000 t	1.2	100	2.25 (10)		9.4
Market (3)		000 t	0.86 2/	100	0.85 (10)		-
Market (4)		000 t	insignificant		12.0 (0)		-
Market (5)		000 t	3.32 2/	100	5.2 (10)		6.7
Market (6)		000 t	0.20	100	0.7 (10)		19.6
Market (7)	(2.5, \$480)	000 t	2.5	n.e.	3.0 (10)		2.6

1/ 1975 refers to sanitary ware.

2/ Expected share of the project's sales in the market.

3/ Market not saturated (import license regulations).

4/ In 1966.

## 2. Notes on methodology:

Extrapolation of statistical trends (6 - 10 years) checked against forecasts of governmental bodies, importers and retailers.

3. Selection of product-mix: Good export possibilities were the reason for selecting wall tiles and sanitary ware as the major products. Artistic ceramics, electro-fittings and floor tiles can possibly be produced additionally later. The manufacture of fire-clay kiln furniture will be considered after the production of wall tiles and sanitary ware has been established.

**IV. CAPACITY OF PROPOSED PLANT**

1. Nominal maximum capacity according to major process:

	Starting	Expanded
Wall tiles	6,000 t	8,000 t
Sanitary ware	4,000 t	6,000 t

2. Maximum feasible capacity of the plant: no data given

3. Expected maximum output of the plant: Full capacity utilisation is expected.

**V. INVESTMENT (000 US \$)**

	W.T. S.W.		Foreign currency component	W.T. S.W.		Foreign currency component
	Total			Total		
<b>TOTAL INVESTMENT</b>	<b>2,385</b>	<b>2,396</b>	<b>2,383</b>			
<b>1. Fixed assets</b>	<b>2,037</b>	<b>1,955</b>	<b>n.e.</b>	<b>180</b>	<b>223</b>	<b>n.a.</b>
1.1. Land, site development (W.T.: 18,200 m <sup>2</sup> S.W.: 30,800 m <sup>2</sup> )	20	31		180	223	
1.2. Buildings	592	894		56	63	
- Factory	549	877		-	-	
- Office )	24	61/				
- Storage )						
- Others	19	11				
2. Working capital						
2.1. Inventories						
- Production materials, fuel & auxiliary materials (3 months)				26	15	
- Parts & supplies for repair & maintenance				85	125	
- Work-in-process (1 month)				15	26	
- Finished goods (1 month)						
2.2. Accounts receivable						
2.3. Other liquid assets						
3. Other investments				168	218	n.a.
3.1. Pre-investment costs				65	87	
- Preliminary expenditure						
- Planning costs						
- Engineering costs )				47	69	
- Interest during construction						
- Training costs				18	18	
- Others						
3.2. Start-up expenses				103	131	
- Consultant fees (technical assistance)				52	52	
- Costs for test run						
- Others 2/ )				51	79	
1.3. Machinery & equipment (Details see below)	1,425	1,030				

1/ Storage of raw material boxes only; other buildings are included in the wall tiles plant.  
2/ Costs for geological survey and feasibility studies.

Major machinery & equipment	f.a.b. supplier country's part	Transport cost (insurance freight)	Import duty	Landing, local installation cost	Total	Foreign currency component
<b>Wall tiles</b>						
Production equipment		1,106,000	-	249,200	1,355,200	
General equipment (trucks, air compressors, etc)					26,600	
Furniture and fixtures					1,400	
Others					41,800	
					1,425,000	
<b>Sanitary ware</b>						
Production equipment		798,000	-	182,000	980,000	
General equipment					18,200	
Furniture and fixtures					11,400	
Others					29,400	
					1,030,000	

**VI. MANNING TABLE**

Shops	W.T.	S.W.	Total number of persons			Shops	W.T.	S.W.	2nd shift	3rd shift
			W.T.	S.W.	TOTAL					
			140	214						
<b>1. Primary operative shops (including supervisory staff)</b>			<b>68</b>	<b>176</b>		<b>2. Auxiliary operative shops</b>	<b>61</b>	<b>22</b>		
Pregrinding		Pregrinding	6	2		- Repair & maintenance	8	6		
Wet grinding, screening, homogenizing		Wet grinding, blunging, screening, casting slip preparation	7	5		- Utilities control	1	-		
Filter pressing and drying		Casting	4	101		- Product & material storage	3	2		
Grinding		Polishing and drying	3	8		- Off-site transport	5	-		
Pressing		Inspection and glazing	11	24		- Guards, cleaners, etc.	7	3		
Drier and firing		Firing	7	4		- Tooling shop	23	14		
Bisque sorting		Grinding and polishing	15	8		- Inspection and packaging	14	4		
Glazing		Glass preparation	12	4		- Others	11	9		
Glass preparation		Plaster moulds preparation	3	20		3. Administration	1	2 1/		
						- Production management	1	2 1/		
						- Research & development	5	3		
						- Sales & purchase	3	3		
						- General administration	2	1		

1/ 1 assistant manager

## VII. ANNUAL PRODUCTION

1. Total annual expected maximum output:

Product	Domestic sales				Foreign sales		
	Unit	Quantity	Unit price wholesale (US \$)	Annual turnover (US \$)	Quantity	Unit price ex factory (US \$)	Annual turnover (US \$)
Wall tiles	t	2,200	231.8	510,050	3,800		501,420
Sanitary ware	t	840	525.0	441,000	3,160	1/	1,071,590
1/							
Wall tiles							
Market (1)		1,900		286,220			702,610
Market (2)		300		48,890			67,280
Market (3)		400		43,680			21,060
Market (5)		600		50,400			171,660
Market (6)		600		72,240			18,820
				501,420			1,071,590

Market (4) to be entered later.

2. Expected sales and inventory build-up: Full capacity utilisation will be reached in the first year of operation.

3. Pricing policy:

Foreign sales prices: prices per ton ex factory were calculated as average CIF prices since transport costs from the factory to the border (capital) of the importing country. In the case of wall tiles the difference in transport costs accounts for differences in prices up to US\$ 30. Different product mix (white and coloured, "de luxe" and commercial quality) accounts for the remaining differences.

Domestic sales prices: fixed at the present level of average wholesale prices (CIF + import duty + transport to wholesalers).

4. Planned sales organization: Own sales department; present wholesale and retail network will be made use of.

## VIII. ANNUAL OPERATING COSTS AND PROFITS

Cost item	Unit	Unit price (US \$)	Quantity (000)	W.T. S.W.		Foreign currency component (000 US \$)	Cost item	W.T. S.W.		Foreign currency component (000 US \$)
				Annual costs (000 US \$)	Annual costs (000 US \$)			Annual costs (000 US \$)	Annual costs (000 US \$)	
<b>Total costs</b>							2. Personnel costs (*)	206	206	
1. Material costs							2.1. Wages & salaries	176	244	
a) <u>Direct material costs</u>							2.2. Contributions to social securities )	30	42	
Body raw materials							2.3. Fringe benefits			
Glazes							3. Interests (on loan)	45	47	
Stains							4. Rents	-	-	
Plaster							5. Indirect taxes at company level	-	-	
Miscellaneous							6. Depreciation	75	74	
b) <u>Auxiliary materials</u>							6.1. Buildings	20	29	
Maintenance							6.2. Machinery & equipment	42	31	
Packing materials							6.3. Office equipment )	13	14	
Power							6.4. Other fixed assets			
Water							7. Administrative expenses & sales costs	32	47	
Fuel							8. Other costs	-	-	
Others							9. Profit before tax	255	733	
							of which - profit tax			
							- subsidies			

The project is exempted from taxation during the first six years of full operation. Subsequently, a tax of 35% is applied on 75% of the profit.

**Depreciation:** Buildings and production equipment: 20 years  
Others: 10 years

(*) Categories of persons employed	Domestic		Foreign	
	W.T.	S.W.	W.T.	S.W.
	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)
Top managers	1	2	8.4	18.5
Engineers	4	1	15.1	4.0
Technicians				
Commercial staff	5	4	8.9	6.4
Clerks and typists	1	1	1.3	1.3
Foremen	4	4	10.1	10.1
Skilled operatives				
Semi-skilled operatives				
Unskilled operatives				
Part-time operatives				
Other special categories				
	125	202	130.9	204.0

**IX. FINANCING PROPOSAL (in US \$)**

4. Suppliers' credits:

1. Equity capital (total): US\$ 3.8 million

2. Long-term loans (total): US\$ 1.26 million  
Rate of interest: 8% p.a.  
Repayment: 5 years

3. Other loans:

5. Remarks on the financing policy:

**X. IMPLEMENTATION PLAN**

1. Technical collaboration service:

Technical assistance: one chief technologist for one year; one kiln engineer for nine months and one glass engineer for six months. No patents or licenses needed since the know-how was acquired during the technological research and in-plant trials with domestic raw materials.

2. Project management:

The supplier of equipment will be responsible for the preparation of engineering drawings, delivery and installation of production machinery and for trial runs. For that purpose a Resident Engineer will be nominated. Civil engineering and construction work will be subcontracted to local companies.

3. Recruitment and training of personnel:

Six technicians and foremen to be trained abroad during a six month period.

4. Other items:

5. Time schedule:

- Two steps: 1) wall tiles (construction three years)
- 2) sanitary ware (construction three years)

From signing of the contract for wall tiles to completion of the combined plant: five years

For gradual completion of the construction and for production build-up see Cash Flow, XIII, Ad. II.

**XI. DATA FOR EVALUATION**

1. Profitability evaluation:

- Check:
- Break-even point analysis
  - Return to total capital
  - Pay back
  - Rentability: return to equity capital

2. Further profitability analysis for given project life (Bankability test):

- Check:
- Internal rate of return
  - Net present value
  - Any other method used

3. National economic benefit-cost analysis (National priority test):

- Check:
- Direct value added and employment effects
  - Balance of payment effect
  - Social marginal productivity of capital
  - Backward and forward effects
  - Synthetic benefit cost analysis
  - Any other method used

Give a short outline of the methods used and major findings:

Break-even point analysis: wall tiles: 45%; sanitary ware: 25%

Return to total capital: gross average profit + interest on loan to total capital invested;  
wall tiles: 12.5%  
sanitary ware: 32%

Rentability; return to equity capital: not calculated in the study; approximately 35%  
(gross profit in an average year/total equity capital employed).

Internal rate of return: not calculated in the study; approximately 15%  
(internal rate of return on total capital employed).

Direct value added and employment effects: The annual value added of the plant will amount to US\$ 2 million. The project provides jobs for 354 domestic workers and employees.

Balance of payment effect: average annual gain in foreign exchange of US\$ 2.3 million (net of current imports).

XII. SUPPLEMENT

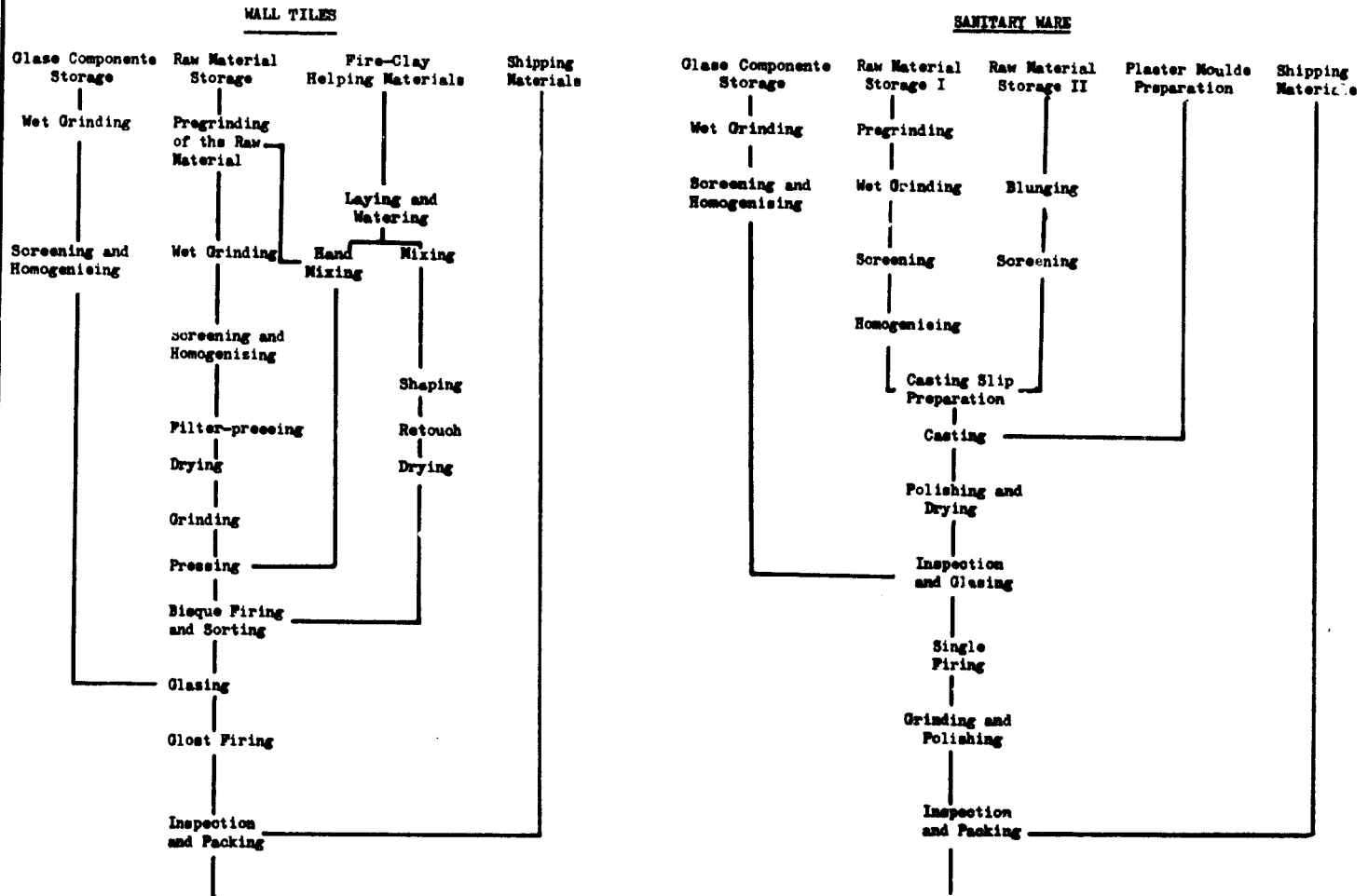
Ad VI. Manning Table

Wall tiles plant: One shift operation departments: raw material storage, pre-grinding of raw materials, glazing, glaze preparation, inspection, sorting and packing, kiln furniture manufacture. Two shift operation departments: wet grinding, screening and homogenising, filter-pressing, drying, waste grinding, pressing. Three shift operation departments: bisque, firing.

Sanitary ware plant: One shift operation departments: raw material storage, pre-grinding of raw materials, plaster mould preparation, casting, polishing and drying, glaze preparation, inspection and glazing, grinding and polishing, inspection and packing. Two shift operation departments: wet grinding and blunging of the mass, screening and homogenising, casting slip preparation. Three shift operation department: firing.

The following departments will serve both plants: central offices, storage, diesel engine, oil tank, laboratory, electricity and maintenance, water tank, fire clay kiln furniture manufacture, pre-grinding of raw material.

Ad II. Operational Flow Chart



**XIII. CASH FLOW TABLE (000 US \$)**

	Year											Terminal value of assets
	1	2	3	4	5	6	7	8	9	10	11 - 15	
<b>A. Source of cash</b>	740	1,400	1,466	1,582	1,716	2,587	2,663	2,744	2,794	2,806	2,806	
1. Financial resources: total	740	1,400	1,120	560	140	-	-	-	-	-	-	
1.1. Loan <sup>1</sup>	-	-	560	560	140	-	-	-	-	-	-	
1.2. Equity	740	1,400	560	-	-	-	-	-	-	-	-	
1.3. Suppliers' credits	-	-	-	-	-	-	-	-	-	-	-	
1.4. Subsidies	-	-	-	-	-	-	-	-	-	-	-	
2. Sales revenue: <sup>2/</sup>	-	-	346	1,022	1,576	2,587	2,663	2,744	2,794	2,806	2,806	
<b>B. Uses of cash</b>	803	1,336	1,468	1,535	1,787	1,818	1,941	1,924	1,902	1,880	1,911	
1. Fixed capital expenditure: total	797	1,319	832	826	342	-	-	-	-	-	-	
1.1. Land, site improvements, & buildings	367	319	482	482	-	-	-	-	-	-	-	( )
1.2. Machinery & equipment (new installation)	430	1,000	350	344	342	-	-	-	-	-	-	( )
1.3. Machinery & equipment (replacement)	-	-	-	-	-	-	-	-	-	-	-	( )
2. Net working capital: total	-	-	180	-	223	-	-	-	-	-	-	
2.1. Stocks of materials	-	-	57	-	63	-	-	-	-	-	-	( )
2.2. Work-in-process <sup>3</sup>	-	-	38	-	35	-	-	-	-	-	-	( )
2.3. Stocks of finished products	-	-	85	-	125	-	-	-	-	-	-	( )
3. Pre-investment & start-up expenses: <sup>4/</sup>	16	17	88	17	130	-	-	-	-	-	-	( )
4. Production expenditure: total	-	-	360	647	1,002	1,297	1,297	1,297	1,297	1,297	1,297	
4.1. Personnel expenditure	-	-	112	206	346	491	491	491	491	491	491	
4.2. Materials <sup>5</sup>	-	-	224	403	576	726	726	726	726	726	726	
4.3. Administrative expenditure	-	-	20	28	69	69	69	69	69	69	69	
4.4. Indirect taxes & royalties	-	-	-	-	-	-	-	-	-	-	-	
4.5. Other expenditure (rents, contingencies, etc.)	-	-	4	4	11	11	11	11	11	11	11	
5. Debt service: total	-	-	-	45	90	241	370	347	325	302	-	
5.1. Interest on loans	-	-	-	45	90	101	90	67	45	22	-	
5.2. Repayment of loans & credits	-	-	-	-	-	140	280	280	280	280	-	
6. Dividends & profit taxes paid: <sup>6/</sup>	-	-	-	-	-	280	280	280	280	280	336 (taxes) 280 (dividends)	
<b>C. Surplus/Deficit (A - B)</b>	37	64	- 2	47	- 71	769	722	820	892	926	893	
<b>SURPLUS/DEFICIT ACCUMULATED:</b>	37	101	99	146	75	844	1,566	2,380	3,272	4,198	5,091	

<sup>1</sup> Loans of different terms should be shown separately.  
<sup>2</sup> Annual value of production of finished goods minus annual accumulation of finished goods inventory.  
<sup>3</sup> Total production costs minus production costs of finished goods.  
<sup>4</sup> Not including interest during construction.  
<sup>5</sup> Annual purchase minus annual accumulation of materials inventory.  
<sup>6</sup> This item stands for the part of profit which is to be paid out, namely profit tax, dividends, fees of the members of the executive board, managerial staff's share in profits, etc. Actually this sum will be established after allowances have been made for depreciation which are not included under item 4. (production expenditure). The cash flow balance should be programmed, therefore, in such a way that all necessary replacement (B.1.3.) can be covered in any year by the accumulated surplus.

Comments:

## PROJECT: CEMENT PRODUCTION

(Planning year: 1966 )

## I. ORIGIN OF THE STUDY

1. This study was prepared by an independent consulting firm for a ministry of planning and co-ordination.

2. The study was intended to make use of domestic raw materials and to substitute imports.

## 3. Size of the economy considered:

- Population (approx.): 2 million
- Per capita GDP (approx.): 50 US \$
- Other information:

## II. GENERAL DESCRIPTION

1. Products: Portland cement

2. Major input materials: Raw materials needed are limestone, clay and gypsum. A sample taken from the envisaged limestone deposits showed that the limestones are in the form of massive high-grade limestone (hardness degree of 4.5, Mohs scale). Total suitable reserves are estimated to amount to more than 2 million tons. Clay deposits are nearby (17 km). The moisture in the material as delivered amounted, according to samples taken from two exploratory pits, to 6.1% and 4% respectively. Their alkali contents of 0.60 and 0.49% are low. With regard to chlorides, the figures of 0.08 and 0.10% respectively, are likewise high in both samples, and may considerably affect the heat exchange process in the kiln. The investigated reserves amount to 1.2 million tons. The raw mix would have the following theoretical composition: 56% limestone and 42% clay. No correctives are to be added. The gypsum needed for the regulation of the setting time can be gained from a nearby deposit. Details on chemical analysis of samples are given in the Supplement.

3. Alternative technologies available and technology adopted for the study: Two methods of refining prevail: the dry process and the wet process. The relatively expensive wet process is applied to wet raw materials (e.g. calcium carbonate and plastic clay). When applying the dry process the raw materials are coarse-grained, dried and fine-grained to raw flour. Apparently the quality of the local raw materials makes possible the applying of the cost-saving dry-process for preparing the combustion mixture. However, the chloride content in the raw mix requires the use of a "by-pass device" to remove a part of the gas before the material is charged to the kiln.

## 4. Locational factors:

- Indication of particularly important factors: The choice of the optimal location depends decisively on the amount of exploitation costs for raw material and their transport costs. The location of the plant in the direct neighbourhood of a town should be avoided because of inevitable air pollution. Land transport is very difficult and not economical due to the bad road connections. Average road transport rate is \$0.028/ton km.

- Actually proposed locality: The locality proposed is in the neighbourhood of a sea-harbour town not far from raw material deposits. This location has the advantage over other possible locations that the low-cost water transport to main consumption centres in the country and to potential export markets is possible. Also all raw materials deposits are clustered in the same area, close to the harbour and show good prospects for profitable exploitation.

## III. MARKET

1. Tabulation of estimated demand on domestic and export markets:

Product	Unit	Current annual consumption	Of which imported (%)	Projected demand in 1969	Increase per year (%)
Domestic consumption					
Cement	000 tons	50	100	60	approx. 7
Export possibilities					
Cement					
Ethiopia	"	91	45	n.a.	n.a.
Kenya	"	111	1	"	"
Uganda	"	73	25	"	"
Mozambique	"	170	1	"	"
Tanganyika	"	117	100	"	"
Zanzibar	"	4	100	"	"
Egypt	"	1,857	-	"	"
Sudan	"	371	75	"	"
French Somaliland	"	13	100	"	"
Aden	"	87	100	"	"
Saudi Arabia	"	370	55	"	"
Kuwait	"	618	100	"	"
Yemen	"	40	100	"	"
Pakistan	"	1,858	20	"	"
Iran	"	914	2	"	"
Iraq	"	671	1	"	"
India	"	9,304	-	"	"
Bahrain	"	68	100	"	"

2. Notes on methodology: For the domestic market, import figures for the past years were taken as a basis. Since these figures were only available for one part of the country, the average share in the whole cement consumption of that part of the country was estimated (77%). Then total imports were estimated. On the basis of information about the ports, roads and other construction projects, the increase of domestic consumption was estimated. Requirements of special cement were deducted from total projected consumption.

For the export market, only neighbouring countries were considered, since high transport costs preclude the possibility of selling at distant markets. In the neighbouring countries, the existing and planned capacities were compared with local consumption. This comparison permitted the assessment of potential export possibilities, but no definite estimate was established in the project study considered.

3. Selection of product-mix: Only the production of Portland cement has been considered. Packaging materials (sacks) are to be imported.



**IV. CAPACITY OF PROPOSED PLANT**

1. Nominal maximum capacity according to major process: The daily capacity of the plant is 200 tons. Under normal conditions one may assume 330 working days per annum, so that the nominal maximum capacity amounts to 66,000 tons per annum. Crude investment and production cost figures for a plant with a daily capacity of 300 tons are given in Supplement.

2. Maximum feasible capacity of the plant: Having due regard to normal stoppage time, 300 working days may be considered reasonable, which means an annual feasible capacity of 60,000 tons.

3. Expected maximum output of the plant: On account of the extremely unfavourable climatic conditions in the country considered, it is advisable to take as a basis of calculation for annual capacity only 280 working days. This results in an expected maximum output of 56,000 tons per annum.

**V. INVESTMENT (000 US \$)**

	Total	Foreign currency component		Total	Foreign currency component
<b>TOTAL INVESTMENT</b>	5,196	n.e. 1/			
1. Fixed assets	4,912	n.a.	2. Working capital	224	n.a.
1.1. Land, site development	25	n.a.	2.1. Inventories	105	
1.2. Buildings	1,700	n.a.	Production materials, fuels & auxiliary materials	56	
- Factory	1,250		Parts & supplies for repair & maintenance	-	
- Office	-		Work-in-process	-	
- Storage (fuel tanks)	262		Finished goods (half a month)	49	
- Others	-		2.2. Accounts receivable (one month)	28	
Road connexion (approx. 5 km)	188		2.3. Other liquid assets	21	
1.3. Machinery & equipment (details see below)	3,187	n.a. 2/	3. Other investments	60	n.a.
			3.1. Pre-investment costs		
			Preliminary expenditure		
			Planning costs		
			Engineering costs		
			Interest during construction		
			Training costs		
			Others (costs for unlocking of raw materials)	60	
			3.2. Start-up expenses		
			Consultant fees		
			Costs for test run		
			Others		

1/ See XI. Balance of payment effect.

2/ Obviously the proposal assumed that all the machines and equipment would be imported. The landing, local transport and a part of the installation cost may be the only local currency component (some \$300,000).

Major machinery & equipment	f.o.b. supplier country's port	Transport cost (insurance freight)	Import duty	Landing, local installation cost	Total	Foreign currency component
<b>Cement machines and quarry equipment:</b>						
- Quarry machines	175	17		44	236	n.a.
- Two heavy lorries for quarry	117	12		29	158	"
- Crushing plant	69	7		17	93	"
- Deposit for raw materials	73	7		18	98	"
- Machines for rough grading	120	12		30	162	"
- Silos for rough graded material	62	6		16	84	"
- Rotary kiln	500	50		125	675	"
- Cement mill	150	15		37	202	"
- Cement silos	38	4		9	51	"
- Packing machines	38	4		9	51	"
- Miscellaneous	88	10		22	120	"
- Spare parts	125	12		31	168	"
Auxiliaries: - Repair shop	31	3		8	42	"
- Laboratory	30	3		7	40	"
- Water supply	20	2		5	27	"
Electrical equipment	275	27		69	371	"
Diesel power plant	300	30		75	405	"
Vehicles: - 7 x 10-ton lorries without trailers	88	9			97	"
- 4 x 10-ton lorries with 5-ton trailers	60	6			66	"
- 1 tank lorry	25	2			27	"
- 5 passenger cars	13	1			14	"

**VI. MANNING TABLE**

Total number of persons: 122

Shop	Total number of persons			Shop	Total number of persons		
	1st shift	2nd shift	3rd shift		1st shift	2nd shift	3rd shift
1. Primary operative shops (including supervisory staff)	55	16	16	2. Auxiliary operative shops	6	-	-
quarrying	38	-	-	Repair & maintenance			
Plant operation and auxiliaries	17	16	16	Utilities control			
				Product & material storage	6		
				Off-site transport			
				Guards, cleaners, etc.			
				3. Administration	29	-	-
				Production management	8		
				Research & development	3		
				Sales & purchase	5		
				General administration	13		

1/ Including transport crew.

VII. ANNUAL PRODUCTION

1. Total annual expected maximum output: \$1,456,000

Product	Domestic sales				Foreign sales		
	Unit	Quantity	Unit price ex factory (US \$)	Annual turnover (000 US \$)	Quantity	Unit price ex factory (US \$)	Annual turnover (000 US \$)
Cement	tone	56,000	26	1,456			(Some export potential, but the production programme was geared to the domestic market only.)

2. Expected sales and inventory build-up: No time schedule was explicitly mentioned.

3. Pricing policy: It is assumed that potential investors would content themselves with a retained profit just enough to repay the loans within a period of 15 years. This net profit has to remain after deduction of income tax. Therefore, income tax, which amounts to 3% on gross profits after the tax exemption until the 10th year, has to be added. Thus, sales prices are calculated on the basis of operating costs plus minimum gross profit for payment of taxes and repayment of loans. But the price for cement cannot be too much above the existing import prices. Therefore, measures are suggested to lower distribution costs. The present import price including harbour fees and 15% customs duty is \$25.8. The official selling price is \$36.4, but actual delivery prices amount sometimes up to \$46 per ton. For about 77% of production, \$8.7 has to be added to the envisaged ex-factory price of \$26 for inland sea-transport and port charges.

4. Planned sales organization: The establishment of an own marketing organization and the total elimination of the wholesalers was taken into consideration. This alternative seems not realistic at present because of the importance of the established firms. On the other hand, the establishment of an own marketing organization would burden the company with considerable additional investments and operating costs. This does not exclude, however, the possibility of establishing such an organization in the long run.

VIII. ANNUAL OPERATING COSTS AND PROFITS

Cost item	Unit	Unit price (US \$)	Quantity	Annual costs (000 US \$)	Foreign currency component (000 US \$)	Cost item	Annual costs (000 US \$)	Foreign currency component (000 US \$)
<b>Total costs (1-8)</b>							1,187	183
<b>1. Material costs <sup>1/</sup></b>							318	126
Crude oil (heating power about 10,300 kcal/kg; specific gravity about 940 gr/l)	hl.	2.6	49,200	127	-	2. Personnel costs (*)	188	57
Diesel oil (heating power about 10,400 kcal/kg; specific gravity about 850 gr/l)	hl.	3.5	18,500	65	-	2.1. Wages & salaries	188	57
Pecking material (sacks of 50 kg)	pieces	0.075	1,120,000	84	84	2.2. Contributions to social securities (included in 2.1.)	-	-
Lubricants and other supplies	tone	0.75	56,000	42	42	2.3. Fringe benefits (included in 2.1.)	-	-
						3. Interests	118	-
						4. Rents	-	-
						5. Indirect taxes at company level (included in 7.)	-	2/
						6. Depreciation (linear depreciation method)	427	-
						6.1. Buildings 4% per annum	68	-
						6.2. Machinery & equipment 10% per annum	319	-
						6.3. Office equipment	-	-
						6.4. Other fixed assets 20% per annum	40	-
						7. Administrative expenses & sales costs	35	-
						8. Other costs (spare parts and repairs) 25% of deprec.	100	-
						9. Profit before tax of which - profit tax subsidies	269 2/	-

<sup>1/</sup> Limestones, clay and gypsum are internally supplied; the quarrying costs are included in respective cost items.  
<sup>2/</sup> The first 10 years are free of taxation, thereafter income tax amounts to 3% of profit.

(*) Categories of persons employed	Domestic		Foreign		Foreign currency component (000 US \$)
	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)	
Top managers	-	-	3	50	25
Engineers	3	5	2	24	12
Technicians	6	8	4	40	20
Commercial staff	4	7	-	-	-
Clerks and typists	13	13	-	-	-
Foremen	-	-	-	-	-
Skilled operatives	24	20	-	-	-
Semi-skilled operatives	-	-	-	-	-
Unskilled operatives	63	21	-	-	-
Part-time operatives	-	-	-	-	-
Other special categories	-	-	-	-	-

<p><b>IX. FINANCING PROPOSAL (in US \$)</b></p> <p>1. Equity capital (total): (about 2% of fixed assets) 1,260,000</p> <p>2. Long-term loans (total): (about 60% of fixed assets) 2,870,000                  Rate of interest 4% per annum                  Repayment 15 years maturity, first 5 years without redemption.</p> <p>3. Other loans: Medium and short-term loans                  (a) credits by suppliers of machinery, about 1% of fixed assets, 8% interest per annum 840,000                  (b) bank credits, covering roughly receivables and ready money, 8% interest per annum 126,000</p>	<p>4. Suppliers' credits: Interest-free suppliers' credit, \$100,000, roughly covering inventories.</p> <p>5. Remarks on the financing policy: No other information is given.</p>
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<p><b>X. IMPLEMENTATION PLAN</b></p> <p>1. Technical collaboration service: For a precise programme of exploitation of the different raw materials deposits, an extensive drilling programme has to be done. Such a programme is supposed to be undertaken by a foreign specialized firm.</p> <p>2. Project management: No information is given.</p> <p>3. Recruitment and training of personnel: After an initiating period of about 6 to 12 months, the proportion of the local and foreign staff as indicated in the manning table should be sufficient. Further replacement of foreign staff by local personnel should be done in subsequent years, as soon as suitable local staff is available. No further information is given.</p> <p>4. Other items: -</p> <p>5. Time schedule: No information is given.</p>	
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<p><b>XI. DATA FOR EVALUATION</b></p>		
<p>1. Profitability evaluation.                  Check  <input type="checkbox"/> Break-even point analysis  <input type="checkbox"/> Return to total capital  <input type="checkbox"/> Pay back  <input type="checkbox"/> Rentability: return to equity capital</p>	<p>2. Further profitability analysis for given project life (Bankability test).                  Check  <input type="checkbox"/> Internal rate of return  <input type="checkbox"/> Net present value  <input type="checkbox"/> Any other method used</p>	<p>3. National economic benefit cost analysis (National priority test).                  Check  <input type="checkbox"/> Direct value added and employment effects  <input type="checkbox"/> Balance of payment effect  <input type="checkbox"/> Social marginal productivity of capital  <input type="checkbox"/> Backward and forward effects  <input type="checkbox"/> Synthetic benefit cost analysis  <input type="checkbox"/> Any other method used</p>
<p><i>Give a short outline of the methods used and major findings.</i></p> <p><b>Break-even point analysis:</b> Total costs are split up into fixed costs and variable costs. By comparing total costs at different production levels with sales return at these levels, it is indicated that for a plant of 200 tone production per day, the break-even point will be reached after 204 productive days annually, i.e. 40,800 tons annually.</p> <p><b>Rentability: return on equity capital:</b> Taking into account the assumptions on price policy indicated in VII.3., 280 production days per annum, and the financing proposal indicated in IX., net profit after taxes and depreciation varies between 16 and 27% of equity capital, averaging approximately 20%.</p> <p><b>Direct value added and employment effects:</b> The cement industry is one of the most capital intensive industrial branches. Two kinds of labour are needed: labour with very high skill, and unskilled, robust labourers. 113 local workers would be employed by the factory. More than \$42,000 would have to be invested for each job created. Thus, the direct employment effect must be considered comparatively small. A possible indirect employment effect by settlement of sub-contractors or processing industries is limited too.</p> <p><b>Balance of payment effects:</b> Effects on the balance of payments in two ways: positively by saving cement imports (and earning foreign currency for exported cement); negatively by import of fuel, supplies, payment of salaries for foreigners, capital service, depreciation of reported assets. The effect on the balance of payment may be quantified roughly as follows: Savings of foreign currency \$1,219,000; Required foreign currency - 50% of salaries of foreign employees (\$56,000), fuel (\$193,000), packing material (\$84,000), supplies (\$42,000), depreciation (\$130,000), spare parts (\$100,000), interest (\$118,000), redemption of loans (\$256,000). Thus, net savings of foreign currency amounts to approximately \$60,000 annually. If the inland shipment would have to be paid in foreign currency, this would further reduce the net savings of foreign currency. After redemption of loans and the substitution of foreign employees and imported supplies, additional savings of at least \$280,000 can be expected.</p>		

XII. SUPPLEMENT

II.2. Chemical analysis of raw material samples:

Constituente	Limestone	Clay	Clay	Gypsum
Loss on ignition	43.19	24.48	16.98	15.23
SiO <sub>2</sub>	0.92	30.03	49.81	-
Al <sub>2</sub> O <sub>3</sub>	0.34	8.72	8.83	0.06
Fe <sub>2</sub> O <sub>3</sub>	0.11	4.48	3.34	0.22
TiO <sub>2</sub>	-	0.48	0.63	-
CaO	54.91	26.92	16.54	35.84
MgO	0.08	2.67	2.72	-
SO <sub>3</sub>	0.10	1.21	0.41	48.73
K <sub>2</sub> O	0.11	0.39	0.37	0.02
Na <sub>2</sub> O	0.22	0.21	0.12	traces
Cl	0.03	0.08	0.10	traces
Silicate Modulus	-	2.2	4.1	-

IV.1. Data for a cement plant with a capacity of 84,000 tons per annum

The study also gives estimates for investments, as well as earnings forecast for a factory producing 84,000 tons of cement annually. For this capacity investment would be:

	000 US \$
Real estates	25
Costs of unloading of raw materials	60
Cement machines and quarry equipment	2,210
Auxiliaries	145
Electrical equipment	330
Diesel power station	410
Assemblage	705
Constructions	1,625
Fuel tanks	350
Road connexion	188
Vehicles	250
Working capital	320

Total investment thus amounts to approximately \$6.6 million. Production costs are estimated as follows:

	000 US \$
Wages	54 (30 skilled and 85 unskilled workers)
Salaries	145
Fuel	285
Packing material	125
Supplies	63
Depreciation	510
Spare parts and repairs	128
Interest (average)	152
Administration and marketing costs	52

Production costs thus amount to approximately \$1.5 million. At this capacity it is assumed that 60,000 tons can be sold on the home market and 24,000 tons be exported at a price of \$14.7 per ton. This export price is so low due to considerable competition. Under these assumptions, sales returns would amount to approximately \$1.9 million. Thus, return to total capital would be 6% on the average.

XIII. CASH FLOW TABLE (000 US \$)		INFORMATION NOT AVAILABLE					Terminal value of assets
	Year						
<b>A. Source of cash</b>							
-----							
-----							
<b>1. Financial resources:</b>							
cash/							
-----							
1.1	Loan <sup>1</sup>						
1.2	Equity						
1.3	Suppliers' credits						
1.4	Subsidies						
<b>2. Sales revenue:<sup>2</sup></b>							
-----							
<b>B. Uses of cash</b>							
-----							
<b>1. Fixed capital expenditure:</b>							
cash/							
-----							
1.1	Land, site improvements, & buildings					( )	
1.2	Machinery & equipment (new installation)					( )	
1.3	Machinery & equipment (replacement)					( )	
<b>2. Net working capital:</b>							
cash/							
-----							
2.1	Stocks of materials					( )	
2.2	Work-in-process <sup>3</sup>					( )	
2.3	Stocks of finished products					( )	
<b>3. Pre-investment &amp; start-up expenses:<sup>4</sup></b>							
-----							
<b>4. Production expenditure:</b>							
cash/							
-----							
4.1	Personnel expenditure						
4.2	Materials <sup>5</sup>						
4.3	Administrative expenditure						
4.4	Interest taxes & royalties						
4.5	Other expenditure (fruits, contingencies, etc.)						
<b>5. Debt service:</b>							
cash/							
-----							
5.1	Interest on loans						
5.2	Repayment of loans & credits						
<b>6. Dividends &amp; profit taxes paid:<sup>6</sup></b>							
-----							
<b>C. Surplus/Deficit (A - B)</b>							
-----							
<b>SURPLUS/DEFICIT ACCUMULATED.</b>							
-----							

<sup>1</sup> Loans of different terms should be shown separately

<sup>2</sup> Annual value of production of finished goods minus annual accumulation of finished goods inventory

<sup>3</sup> Total production costs minus production costs of finished goods

<sup>4</sup> Net including interest during construction

<sup>5</sup> Annual purchase minus annual accumulation of materials inventory

<sup>6</sup> This item stands for the part of profit which is to be paid out, namely profit tax, dividends, fees of the members of the executive board, managerial staff's share in profits, etc. Actually this sum will be established after allowances have been made for depreciation which are not included under item 4. (production expenditure). The cash flow balance shown is programmed, therefore, in such a way that all necessary replacement (B.1.3.) can be covered in any year by the accumulated surplus.

Comments

The original study included no cash flow table.

## PROJECT

## ALLOY STEELS

(Planning year: 1970 )

## I. ORIGIN OF THE STUDY

1. This study was prepared by an independent consulting firm for a ministry of a developing country.

2. The study was intended to assess the feasibility of establishing an alloy steel plant.

## 3. Size of the economy considered:

- Population (approx.) (1968) 27 million
- Per capita GDP (approx.) (1968) US \$ 120
- Other information:

## II. GENERAL DESCRIPTION

## 1. Products:

Alloy and special steels; classification applied to this project see in the Supplement.

## 2. Major input materials:

- a) Steel scrap
- b) Ferro-alloys
- c) Fluxes, carburisers, etc.

## 3. Alternative technologies available and technology adopted for the study:

There are several processes available for steelmaking, such as open-hearth, basic converter, oxygen converter, electric arc furnace and coreless induction furnace. Open-hearth and converter processes are suitable for tonnage production of plain carbon mild steels. Electric arc furnace and induction furnace are more suited for alloy and special steelmaking. Induction melting is, however, not feasible with purchased scrap of commercial quality because the charge must consist of clean, high-grade steel scrap of known analysis. Therefore, the electric arc furnace process was selected.

## 4. Locational factors:

Indication of particularly important factors:

- e) Scrap supplies (approximately 65,000 t/yr.)
- b) Electric power (30,000 kVA - maximum consumption)
- c) Water (300 m<sup>3</sup>/hr.)
- d) Fuel (natural gas - 6.25 m<sup>3</sup>/hr. x 10<sup>3</sup>)

Actually proposed locality:

A location near a harbour with good access to imported and local scrap and sufficient water supply from a river two km distant. Construction of a power sub-station in the vicinity is planned.

## III. MARKET

## 1. Tabulation of estimated demand on domestic and export markets:

Product	Unit	Current annual consumption (1968/1969)	Of which imported (%)	Projected demand in 1977/78	Increase per year (%)
<u>Domestic market</u>					
Alloy and special steels	000 t	10	100	78	25.5

## 2. Notes on methodology:

The current annual consumption figure shows only the direct imports. About 24,000 t of indirect imports in the form of finished metal products like transport equipment, industrial machinery, electrical machinery, etc., would have to be added.

The preliminary estimate of the projected demand was based on the production programme of existing industrial units and new units planned, applying end-use analysis with due consideration to the proportion of imported parts and components. The norms of alloy steel consumption have been established through contacts with various consumers. For some items appropriate norms from other countries were applied.

## 3. Selection of product-mix:

Product-mix is primarily based on the requirements of the automobile sector. However, production facilities could permit considerable flexibility in the mix as regards grades of steel and the mill shapes and sizes.

**IV. CAPACITY OF PROPOSED PLANT**

1. Nominal maximum capacity according to major process:  
50,000 t finished alloy steels (25,000 t ingot steels)  
3 shifts per day, 330 days per year

2. Maximum feasible capacity of the plant

3. Expected maximum output of the plant 50,000 t finished Alloy steels

**V. INVESTMENT (000 US \$)**

	Stage I	Stage II	Foreign currency component		Stage I	Stage II	Foreign currency component
	Total				Total		
<b>TOTAL INVESTMENT</b>	45,070	6,130	n.a.				
1. Fixed assets	35,770	4,230	n.a.	2. Working capital	3,300	900	
1.1 Land, site development (110 ha)	550	-		2.1 Inventories			
1.2 Buildings	11,230	1,300		Production materials, fuel & auxiliary materials			
Factory				Parts & supplies for repair & maintenance	3,300	900	
Office (incl. site development)	11,490	1,300		Work-in-process			
Storage				Finished goods			
Others				2.2 Accounts receivable			
				2.3 Other liquid assets			
1.3 Machinery & equipment (details see below) (incl. spare parts)	21,740	2,930		3. Other investments	6,000	1,000	n.a.
				3.1 Pre-investment costs	4,700	700	
				Planning expenditure	380	70	
				Engineering costs (incl. in 1.3)			
				Interest during construction	2,200	600	
				Training costs	120	30	
				Others (Contingencies)	2,000	-	
				3.2 Start-up expenses	1,300	300	
				Consultant fees	1,100	200	
				Costs for test run			
				Others			

Major machinery & equipment	f.o.b. supplier country's part	Transport cost (insurance freight)	Import duty	Lending, local installation cost	Total	Foreign currency component
<b>Stage I<sup>1</sup>:</b>						
Steel melt shop	1,560	1,690	-	3,290	22,835	n.a.
Soaking pits and cogging mill	4,914					
Billet conditioning	562					
Bar mills	5,328					
Heat treatment and finishing	970					
Chemical and testing laboratory	137					
Roll turning and maintenance shop	60					
Transport equipment	473					
Equipment for power, water, gas, air, etc.	2,160					
	16,070					
<b>Stage II:</b>						
Arc furnace (1), forge press (1), hammers (2), manipulators (2), mobile crane (1), hand-operated mill (1), mobile charger (1), heating furnaces (3), annealing furnaces (3), cranes, billet grinder (1), wing grinders (2), equipment for power, water, gas, air, etc.						

<sup>1</sup> excl. spare parts (\$890,000) and equipment purchased with local currency (\$1,785,000)

**VI. MANNING TABLE**

Total number of persons: 1,270<sup>1</sup> / (Stage I), 250<sup>2</sup> / (Stage II)

Stage I:	Total	1st shift	2nd shift	3rd shift	Stage	Total	1st shift	2nd shift	3rd shift	
<b>1. Primary operative shops (including supervisory staff)</b>	890	54	308	312	216	<b>2. Auxiliary operative shops</b>	110	94	8	8
Steel melt shop <sup>3</sup>	258	10	93	83	90	Repair & maintenance	49	49	-	-
Blooming mill and soaking pit	116	12	41	41	22	Utilities control (incl. in General Services)	7	5	1	1
Billet conditioning	158	3	52	52	51	Product & material storage	29	15	7	7
Bar mills	230	19	76	80	55	Off-site transport	-	-	-	-
Heat treatment, bar finishing, inspection, warehouse and finishing	128	8	56	56	8	Guards, cleaners, etc.	25	25	-	-
						Plant general services (chief metallurgist, electrical and mechanical superintendent, inspectors, etc.)	143	127	8	8
						<b>3. Administration</b>	15	15	-	-
						Production management	128	112	8	8
						Research & development				
						Sales & purchase				
						General administration				

<sup>1</sup> incl. approximately 10% extra for leave and absenteeism

<sup>2</sup> S = supervisory staff and foremen

<sup>3</sup> incl. 4<sup>th</sup> extra men to allow for weekly day off, since the shop works seven days per week

## VII. ANNUAL PRODUCTION

1. Total annual expected maximum output: US\$ 23,200,000 (Stage I)  
US\$ 5,900,000 (Stage II)

Product	Unit	Quantity	Domestic sales		Foreign sales	
			Unit price ex factory (US \$)	Present selling prices (000 US \$)	Quantity	Unit price ex factory (US \$)
<b>Stage I</b>						
<b>Constructional</b>						
Carbon (En-8)	t	8,000	400 ( 600)	3,200		
Low alloy (En-19)	t	8,000	550 (1,000)	4,400		
Medium alloy (En-25)	t	2,000	700 (1,000)	1,400		
Case hardening (En-16B)	t	5,000	700 (1,000)	3,500		
Free cutting (En-1A)	t	2,000	400 ( - )	800		
<b>Spring steel</b>						
High carbon (En-44)	t	5,000	450 ( - )	2,250		
Silico - Mn (En-45)	t	12,000	500 (1,350)	6,000		
Chrome - V (En-47)	t	3,000	555 ( - )	1,650		
Total		45,000		23,200		
<b>Stage II</b>						
High-speed steel (AISI-T1)	t	200	4,000 (5,500)	800		
Hot die steel (AISI-H21)	t	300	2,500 (3,500)	750		
Cold work die steel (AISI-D3)	t	1,000	1,500 (1,860)	1,500		
Low alloy tool steel (AISI-S1)	t	1,000	1,000 (1,500)	1,000		
Die blocks (1.45% Ni, 0.45% Cr)	t	500	900 ( - )	450		
Carbon tool steel	t	2,000	700 ( 930)	1,400		
Total		5,000		5,900		
Total (Stage I + Stage II)		50,000		29,100		

no exports foreseen

## 2. Expected sales and inventory build-up:

Inventory will have to be built up in the first years of operation. Full scale output will be achieved in the third year (Stage I) and fifth year (Stage II) of operation.

## 3. Pricing policy:

Selling prices will be lower than present prices on the domestic market (which are high because of high expenses for selling, warehouses, credit arrangements, etc.). Protection of 20 - 30% customs duty is required for the initial years. CIF prices are not given. Present selling prices see under VII.1.

## 4. Planned sales organization:

No details available

## VIII. ANNUAL OPERATING COSTS AND PROFITS

Cost item	Unit	Unit price (US \$)	Quantity (000)	St. I	St. II	St. I	St. II	Stage I Annual costs (000 US \$)	Stage II Annual costs (000 US \$)	Foreign currency component (000 US \$)																																																																												
				Annual costs (000 US \$)	Foreign currency component (000 US \$)	Annual costs (000 US \$)	Foreign currency component (000 US \$)																																																																															
<b>Total costs</b>				19,205	4,174	n.a.	n.a.																																																																															
<b>1. Material costs</b>				8,750	2,510	n.a.	n.a.																																																																															
<b>Raw materials</b>																																																																																						
Plant return scrap	t	n.a.	0.22 <sup>1/2</sup>	598	217	-	-																																																																															
Purchased steel scrap	t	50	0.82 <sup>2/3</sup>	1,868	192	1,868	192																																																																															
Other metallics (Hi-carbon, Fe-Cr, low carbon Fe-Cr, ferro-molybdenum, ferro-vanadium, etc.)	t	n.a.	n.a.	1,277	743	n.a.	n.a.																																																																															
Fluxes, carburizers, etc	t	n.a.	n.a.	167	27	n.a.	n.a.																																																																															
Others				1,090	638	n.a.	n.a.																																																																															
Power, fuel and utilities	n.a.	n.a.	n.a.	1,037	19 <sup>a</sup>	n.a.	n.a.																																																																															
Refractories, rolls, electrodes and supplies	n.a.	n.a.	n.a.	1,315	252	n.a.	n.a.																																																																															
Repair and maintenance material	n.a.	n.a.	n.a.	1,400	263	n.a.	n.a.																																																																															
<b>2. Personnel costs (*)</b>								1,855	500	n.a.																																																																												
2.1. Wages & salaries								928	250	n.a.																																																																												
2.2. Contributions to social securities																																																																																						
2.3. Fringe benefits								927	250	n.a.																																																																												
3. Interests								2,236	220	n.a.																																																																												
4. Rents								-	-	-																																																																												
5. Indirect taxes at company level								-	-	-																																																																												
6. Depreciation (R <sup>2</sup> )								3,316	400	n.a.																																																																												
6.1. Buildings excl. land																																																																																						
6.2. Machinery & equipment																																																																																						
6.3. Office equipment																																																																																						
6.4. Other fixed assets																																																																																						
7. Administrative expenses & sales costs								696	177	n.a.																																																																												
8. Other costs (general plant costs, deferred charges, etc.)								3,050	347	n.a.																																																																												
9. Profit before tax								3,295	1,726																																																																													
of which profit tax subsidies																																																																																						
<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">Categories of persons employed</th> <th colspan="2">Domestic</th> <th colspan="2">Foreign</th> <th rowspan="2">Foreign currency component (000 US \$)</th> </tr> <tr> <th>No. of persons</th> <th>Annual wages &amp; salaries &amp; fringe benefits (000 US \$)</th> <th>No. of persons</th> <th>Annual wages &amp; salaries &amp; fringe benefits (000 US \$)</th> </tr> </thead> <tbody> <tr> <td>Top managers</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Engineers</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Technicians</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Commercial staff</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Clerks and typists</td> <td></td> <td></td> <td></td> <td></td> <td>n.a.</td> </tr> <tr> <td>Foremen</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Skilled operatives</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Semi-skilled operatives</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Unskilled operatives</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Part-time operatives</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Other special categories</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>											Categories of persons employed	Domestic		Foreign		Foreign currency component (000 US \$)	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)	Top managers						Engineers						Technicians						Commercial staff						Clerks and typists					n.a.	Foremen						Skilled operatives						Semi-skilled operatives						Unskilled operatives						Part-time operatives						Other special categories					
Categories of persons employed	Domestic		Foreign		Foreign currency component (000 US \$)																																																																																	
	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)																																																																																		
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<sup>1/2</sup> Quantity per ton of ingot

<sup>2/3</sup> Average quantity per ton of ingot

<sup>1/2</sup> During the first five years of operation profits will be exempted from taxation and from the sixth year onwards an income tax of 35% will be levied.



**IX. FINANCING PROPOSAL (in US \$)****4. Suppliers' credits:****1. Equity capital (total):**

US \$ 23 million

**2. Long-term loans (total):** US\$ 28.2 million

Rate of interest 8% p.a.  
 Repayment starting in the first year of operation

**5. Remarks on the financing policy:****3. Other loans:** US\$ 900,000 short-term loan**X. IMPLEMENTATION PLAN****1. Technical collaboration service:**

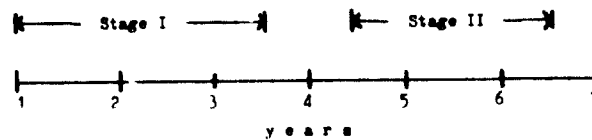
The plant requires specialized techniques of steelmaking, metallurgical control, conditioning, heat-treatment, production planning, etc. The foreign production advisers should have experience in producing the complete range of alloy steels proposed for the new plant and should have experience in production facilities comparable to those of this project.

**2. Project management:**

No turn-key arrangement foreseen. A local organization will be set up to implement the project in accordance with the designs and overall supervision of the consulting engineers. For the purpose of overall supervision of the construction, the consulting engineers will nominate a resident engineer and adequate technical personnel. The local (site) organization will be staffed with technical and administrative personnel for overall co-ordination of the project. The work undertaken by them will include clearing of site, obtaining sanctions, permits, authorization from local bodies, arranging import and local licenses, procurement of railway wagons, clearing of equipment, stores keeping, security, as well as for arrangements outside the plant boundary and the payment of contractors bills, etc.

**3. Recruitment and training of personnel:**

About 50 technical personnel have to be specially trained abroad. 16 technical and supervisory personnel have to be trained for at least six months and 34 operators and skilled workers for at least three months.

**4. Other items:****5. Time schedule:****XI. DATA FOR EVALUATION****1. Profitability evaluation:**

Check:  
 Break-even point analysis  
 Return to total capital  
 Pay back  
 Rentability: return to equity capital

**2. Further profitability analysis for given project life (Bankability test):**

Check:  
 Internal rate of return  
 Net present value  
 Any other method used

**3. National economic benefit-cost analysis (National priority test):**

Check:  
 Direct value added and employment effects  
 Balance of payment effect  
 Social marginal productivity of capital  
 Backward and forward effects  
 Synthetic benefit cost analysis  
 Any other method used

Give a short outline of the methods used and major findings:

**Break-even point analysis:** The plant is expected to break-even when operating at about 70% capacity

**Return to total capital:** 15%

**Pay-back (of total capital):** 8 years

**Rentability, return to equity capital:** 22%

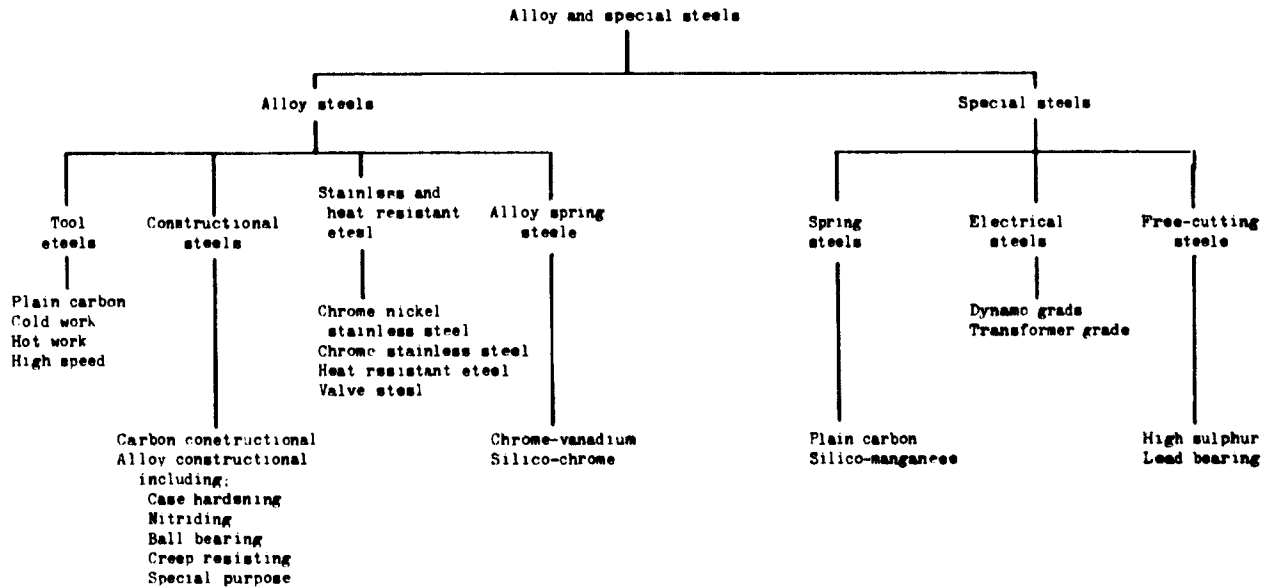
**Internal rate of return:** 12%

**Net present value:** (at a rate of 8%): US\$ 12.5 million

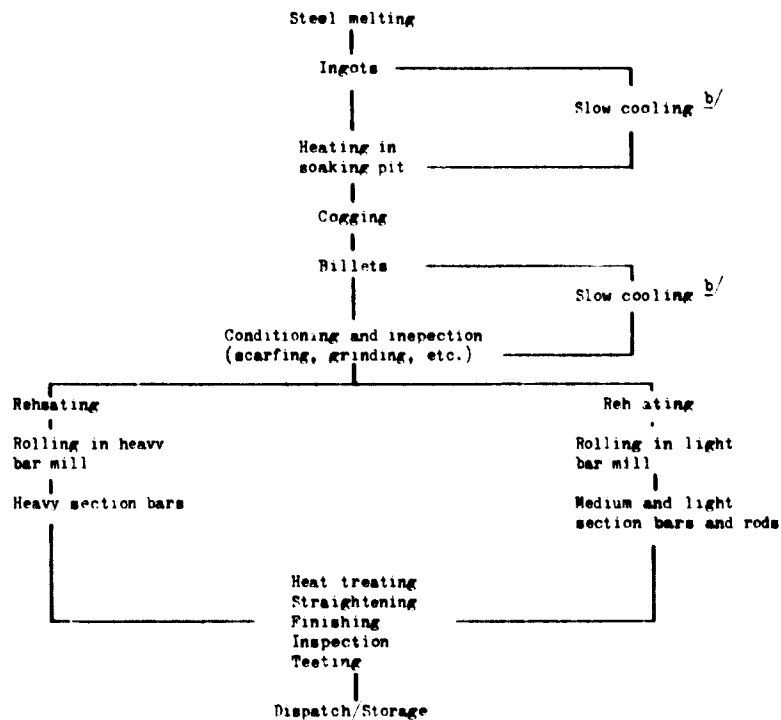
**Balance of payment effect:** Annually the project will bring about savings in foreign exchange of approximately \$4 million. In 15 years of operation the total saving will amount to approximately \$28 million (net of original investment).

XII. SUPPLEMENT

Ad II.1. Classification of Alloy and Special Steels for this Project



Ad II.3. Process Flow Sheet for Proposed Alloy and Special Steels



a/ Steels included are carbon and alloy constructional steel, case hardening steel and spring steel as well as tool and die steels as discussed under product-mix chapter.

b/ Those steels which need slow cooling such as Ni-Cr or Cr-Mn constructional steels and tool steels are slow cooled at each stage of manufacture.

**XIII. CASH FLOW TABLE (000 US \$)**

Terminal  
value of  
assets

	Year											
	1	2	3	4	5	6	7	8	9	10	11 <sup>B/</sup>	
<b>A. Source of cash</b>	6,000	12,000	22,000	13,733	18,047	25,600	29,160	29,100	29,100	29,100	29,100	
1. Financial resources: total	6,000	12,000	22,000	6,000	-	2,400	3,600	-	-	-	-	
1.1. Loan <sup>1</sup>	-	-	17,000	5,200 <sup>A/</sup>	-	2,400	3,600	-	-	-	-	
1.2. Equity	6,000	12,000	5,000	-	-	-	-	-	-	-	-	
1.3. Suppliers' credits	-	-	-	-	-	-	-	-	-	-	-	
1.4. Subsidies	-	-	-	-	-	-	-	-	-	-	-	
2. Sales revenue	-	-	-	7,733	18,044	21,200	25,560	29,100	29,100	29,100	29,100	
<b>B. Uses of cash</b>	4,330	12,740	16,230	18,899	17,912	21,989	20,801	22,763	24,370	24,219	27,068	
1. Fixed capital expenditure: total	4,030	12,410	15,830	3,600	2,400	1,800	-	-	-	-	-	
1.1. Land, site improvements, & buildings	4,030	4,000	4,000	-	800	500	-	-	-	-	-	( )
1.2. Machinery & equipment (new installation)	-	8,340	11,830	3,600	1,600	1,300	-	-	-	-	-	( )
1.3. Machinery & equipment (replacement)	-	-	-	-	-	-	-	-	-	-	-	( )
2. Net working capital: total	-	-	-	3,300	-	900	-	-	-	-	-	
2.1. Stocks of materials	-	-	-	-	-	-	-	-	-	-	-	( )
2.2. Work-in-process <sup>2</sup>	-	-	-	3,300	-	900	-	-	-	-	-	( )
2.3. Stocks of finished products	-	-	-	-	-	-	-	-	-	-	-	( )
3. Pre-investment & start up expenses: <sup>4/</sup>	300	400	400	1,900	400	800	-	-	-	-	-	( )
4. Production expenditure: total	-	-	-	8,019	12,112	13,953	15,209	17,407	17,407	17,407	17,407	
4.1. Personnel expenditure	-	-	-	1,855	1,855	1,855	2,355	2,355	2,355	2,355	2,355	
4.2. Materials <sup>5</sup>	-	-	-	4,015	7,311	8,752	9,995	11,282	11,282	11,282	11,282	
4.3. Administrative expenditure	-	-	-	232	541	696	767	873	873	873	873	
4.4. Indirect taxes & royalties	-	-	-	-	-	-	-	-	-	-	-	
4.5. Other expenditure (rents, contingencies, etc.)	-	-	-	1,917	2,405	2,650	2,792	2,897	2,897	2,897	2,897	
5. Debt service: total	-	-	-	2,080	3,000	4,536	4,892	5,356	5,124	4,892	4,660	
5.1. Interest on loans	-	-	-	2,080	2,200	2,236	2,592	2,456	2,224	1,992	1,760	
5.2. Repayment of loans & credits	-	-	-	-	800	2,300	2,300	2,900	2,900	2,900	2,900	
6. Dividends & profit taxes paid: <sup>6/</sup>	-	-	-	-	-	-	-	-	1,839	1,920	2,001	
<b>C. Surplus/Deficit (A - B)</b>	1,670	- 740	5,770	-5,166	132	3,611	8,359	6,337	4,730	4,881	5,032	
<b>SURPLUS/DEFICIT ACCUMULATED:</b>	1,670	930	6,700	1,534	1,666	5,277	13,636	19,973	24,703	29,584	34,616	

<sup>1</sup> Loans of different terms should be shown separately.  
<sup>2</sup> Annual value of production of finished goods minus annual accumulation of finished goods inventory.  
<sup>3</sup> Total production costs minus production costs of finished goods.  
<sup>4</sup> Not including interest during construction.  
<sup>5</sup> Annual purchase minus annual accumulation of materials inventory.  
<sup>6</sup> This item stands for the part of profit which is to be paid out, namely profit tax, dividends, fees of the members of the executive board, managerial staff's share in profits, etc. Actually this sum will be established after allowances have been made for depreciation which are not included under item 4. (production expenditure). The cash flow balance should be programmed, therefore, in such a way that all necessary replacement (B.1.3.) can be covered in any year by the accumulated surplus.

**Comments:**

<sup>1/</sup> short-term loan  
<sup>8/</sup> In the study itself the cash flow was prepared for 15 years of operation.

PROJECT: PRODUCTION OF FLAT INTERMEDIATES OF ALUMINIUM

(Planning year: 1967 )

**I. ORIGIN OF THE STUDY**

1. This study was prepared by an independent consulting firm for a national investment bank.

2. The study was intended to substitute imports. The production of intermediates of Aluminium has been the missing link in the chain of Aluminium-based industries in the country. Raw material is available from a local smelter. Finished products such as roofings, household utensils, building sections are manufactured from imported intermediates.

3. Size of the economy considered:

Population (approx.) 8 million  
Per capita GDP (approx.) 220 US \$  
Other information.

**II. GENERAL DESCRIPTION**

1. **Products:** Aluminium coils 0.5 mm thick with a maximum width of 1,250 mm for the manufacture of roofing sheets and circles 0.6 - 1.8 mm thick with a diameter of 180 - 900 mm for the manufacture of pots and pans out of "insensitive" Aluminium alloys, such as AA 3003 and AA 5005.

2. **Major input materials:** The plant can either use locally-produced Aluminium pigs or if situated near the smelter, molten virgin Aluminium.

3. **Alternative technologies available and technology adopted for the study:** Besides the conventional casting, milling and rolling process, considerations were given to the recently developed strip casting process. A comparative evaluation of different processes was conducted (see Supplement), and the Hunter strip casting process was suggested for this project, due to outstanding cost advantages. The range of alloys which can be produced by the Hunter process, up to now is relatively small and comprises no products of high quality requirements. In the cold rolling and finishing department, the conventional equipment, not highly mechanized, is to be used.

4. **Locational factors:**

- Indication of particularly important factors: The value per ton of product is high, but the ratio of value added to the value of production is relatively low. About 6,000 tons of Aluminium pigs and 1,500 tons of scrap are to be transported. The total weight of finished products is in the same range. Taking the purchase of molten Aluminium into consideration, a location in the direct vicinity of the smelter is advisable to enjoy the maximum cost advantage. For the transportation of molten Aluminium, special vehicles are necessary. Large quantities of cooling water are needed in the strip casting process. The actual water consumption is kept low by re-circulating the cooling water.

- Actually proposed locality: A location in the direct vicinity of the existing smelter is proposed. The area has an additional advantage in that the main customers are situated in the same area.

**III. MARKET**

1. Tabulation of estimated demand on domestic and export markets:

Product	Unit	Current annual consumption	Of which imported (%)	Projected demand in 1970	Increase per year (%)
Aluminium roofing sheets	000 tone	5,500	100	6,000	
Galvanized corrugated sheets (substitution product)	000 tone	1,000	100	none	
Aluminium circles	000 tone	900	100	1,000	
Aluminium extrusion products (building sections)	000 tone	310	100		

No export is envisaged.

2. **Notes on methodology:** The main factors influencing the development in demand for Aluminium roofing sheets and household utensils are: population development, purchasing power, and scope of substitution of Aluminium products for other goods. Political and economic uncertainties lead to the assumption that no essential growth in demand can be expected in the next three years. With favourable economic conditions (increase of number of dwelling houses by 8% per year) the demand could rise to 15,000 - 20,000 tons by 1980. The demand analysis and projection is based on a fairly detailed market research (field studies, in which all consumers of Aluminium intermediate products were contacted).

3. **Selection of product-mix:** The main field of application for Aluminium will be: roofing sheets and sidings, household utensils, construction and building sections, packagings like tubes and cans, foils, conduction wires. Flat intermediates form the majority of all Aluminium products imported now. The minimum capacity of an extrusion plant, about 1,000 tons per year, does not allow a profitable production of building sections and intermediates for packagings and wire during the next decade. Therefore, the project is designed to produce Aluminium coils with a thickness of 0.5 mm to 1.8 mm. Sheets and circles are produced from these coils on separate finishing lines.

**IV. CAPACITY OF PROPOSED PLANT**

1. Nominal maximum capacity according to major process. The planned maximum capacity is 30 tons per day of coils in a three-shift operation.

2. Maximum feasible capacity of the plant. The capacity is limited by the Hunter casting machine to 8,000 tons per year. The maximum capacity of all other machinery and equipment ranges from 16,000 to 24,000 tons per year (three-shift operation). An expansion is planned to take place as demand grows. The installation of a second caster would increase the maximum capacity to 16,000 tons of coils per year.

3. Expected maximum output of the plant. The expected maximum output is 80% of maximum feasible capacity.

**V. INVESTMENT (000 US \$)**

	Total	Foreign currency component	Total	Foreign currency component
<b>TOTAL INVESTMENT</b>	<b>5,336</b>	<b>4,056</b>		
1. Fixed assets <sup>1</sup>	4,219	3,055	1,657	168
11. Land site development <sup>2</sup> (1.3 ha)	23	-	76	168
12. Buildings	222	129	364	168
Factory (1,400 m <sup>2</sup> , \$35 m <sup>2</sup> )	171	100	-	-
Office (110 m <sup>2</sup> , \$15.7 m <sup>2</sup> )	5	1	-	-
Storage	-	-	-	-
Others	-	-	403	-
Auxiliary departments (14 m <sup>2</sup> , \$31.7 m <sup>2</sup> )	19	4	316	-
2. Working capital				
21. Inventories			69	
Production materials, fuels & auxiliary materials (112 months)				
Parts & supplies for repair & maintenance				
Work-in-process				
Finished goods (1 month)				
22. Accounts receivable (1 month)				
23. Other liquid assets (cash for unforeseeable payments)			69	
3. Other investments			755	533
31. Pre-investment costs				
Preliminary expenditure			159	159
Planning costs				
Engineering costs during construction			7	34
Interest during construction (8% per annum)			364	342
Training costs			51	25
Others (know-how contract and contingencies)			280	64
32. Start-up expenses				
Consultant fees				
Costs for test run				
Others				

<sup>1</sup> No import duty is calculated on assets. It is assumed that the project is granted exemption from import duty under an investment promotion decree.

<sup>2</sup> No land is sold for industrial sites, rental system.

<sup>3</sup> The auxiliary installations consist of a transformer station 11 KV, 2,500 KVA, fuel oil tank, air compressor, water supply, repair shop and laboratory.

Major machinery & equipment	Installed capacity	Job supplier count, %	Transport cost (insurance freight)	Import duty	Landing, local installation cost	Total	Foreign currency component
Melting and holding furnace	13 kW	12	-	-	14	148	113
Hunter caster complete	20 kW	53	38	-	87	665	613
Cold rolling plant	1,000 kW	1,000	73	-	167	1,283	1,232
Stretcher leveler and slitter	1,000 kW	903	56	-	129	493	448
Sheet and circle line	20 kW	23	19	-	16	275	267
Packaging and delivery	35 kW	12	1	-	3	24	16
Contingencies	-	-	-	-	-	24	16
Auxiliary installations <sup>1</sup>	100 kW	152	23	-	52	124	119
Office equipment and other equipment	55 kW	46	2	-	3	51	50
Transportation facilities	-	18	4	-	1	23	22

**VI. MANNING TABLE**

Total number of persons: 123

Shop	1st shift	2nd shift	3rd shift	Shop	1st shift	2nd shift	3rd shift
1. Primary operative shops (including supervisory staff)	43	20	12	2. Auxiliary operative shops	24	-	-
Melting and casting department	11	2	9	Repair & maintenance	14		
Rolling and heat treatment	9	3	3	Utilities control			
Finishing department	23	8	-	Product & material storage			
				Off-site transport	4		
				Guards, cleaners, etc.	6		
				3. Administration	24	-	-
				Production management	4		
				Research & development	6		
				Sales & purchase	3		
				General administration	11		

VII. ANNUAL PRODUCTION

1. Total annual expected maximum output: \$6,640,000

Product	Domestic sales				Foreign sales		
	Unit	Quantity	Unit price as factory (US \$)	Annual turnover (000 US \$)	Quantity	Unit price as factory (US \$)	Annual turnover (000 US \$)
Coils for roofing sheets	tone	6,000	920 per ton	5,500	No exports foreseen		
Coils for circles <sup>1/</sup>	tone	1,000	1,000 - 1,200 per ton	1,140			

<sup>1/</sup> For the production of 1,000 tons of circles, 1,500 tons of circle sheets are necessary.

2. Expected sales and inventory build up (000 US \$)	Year of operation			
	1st	2nd	3rd	following years
- Production	4,050	5,760	6,640	6,640
- Net inventory accumulation (finished products)	282	81	40	-

3. Pricing policy: The c.i.f. prices of imported products are taken as the basis, in which 2% landing and handling charges and 20% customs duty are included. If c.i.f. prices plus landing costs, excluding customs duty, were taken as the basis, the annual turnover would fall to \$5,564,000.

4. Planned sales organization: There are only a few main customers for flat intermediates, all located in the same area. Therefore, the sales organization was considered as being a relatively simple matter.

VIII. ANNUAL OPERATING COSTS AND PROFITS

Cost Item	Unit	Unit price (US \$)	Quantity	Annual costs (000 US \$)	Foreign currency component (000 US \$)
<b>Total costs (1-10)</b>					
				5,054	618
<b>1. Material costs</b>					
				4,020	569
Raw material					
Aluminium pigs <sup>1/</sup>	tone	551	5,740	3,163	
Aluminium scrap <sup>1/</sup>	tone	395	1,440	569	569
Operating and general supplies					
				67	
Energy costs					
Electric energy	Kwh	0.013	5,444,000	71	
Fuel oil	tone	80	2,463	197	
Compressed air	9 cu.m./min. at 8 ata.			7	
Water <sup>2/</sup>	cu.m.	0.25	88,000	22	

<sup>1/</sup> In addition there are 1,650 tons re-circulating material at an annual production of 7,000 tons end product.

<sup>2/</sup> Cooling water is re-circulated.

<sup>3/</sup> Industrial sites are to be rented from a Development Corporation.

<sup>4/</sup> Sales tax does not apply to industrial intermediates.

<sup>5/</sup> Linear depreciation, in general: 3.4% for buildings and site development; 7% for machinery and equipment and other investment; 2% for factory and office equipment and of vehicles.

<sup>6/</sup> In general: 2% of building costs; 5% of investment costs of equipment.

Cost Item	Annual costs (000 US \$)	Foreign currency component (000 US \$)
2. Personnel costs (*)	214	42
2.1 Wages & salaries	140	49
2.2 Contributions to social securities	37	
2.3 Fringe benefits	37	
3. Interests (\$1,180,000 at 8.5%)	100	
4. Rents for site <sup>3/</sup>	1	
5. Indirect taxes at company level <sup>4/</sup>	-	
6. Depreciation <sup>5/</sup>	150	
6.1 Buildings	36	
6.2 Machinery & equipment (including transportation)	274	
6.3 Office equipment	13	
6.4 Other investment	27	
7. Administrative expenses & sales costs	84	
8. Other costs (maintenance, repair and contingencies) <sup>6/</sup>	207	
9. Profit before tax	1,586	
of which profit tax 50% subsidies	793	

(*) Categories of persons employed	Domestic		Foreign		Foreign currency component (000 US \$)
	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)	
Top managers	2	20	1	25	22
Engineers			2	50	26
Technicians	1	3			
Commercial staff	3	10			
Clerks and typists	10	12			
Foremen	5	11			
Skilled operatives	41	60			
Semi-skilled operatives	20	20			
Unskilled operatives	38	28			
Part-time operatives					
Other special categories					

**IX. FINANCING PROPOSAL (in US \$)**

1. Equity capital (total): 3,316,000 (of which foreign currency component: 2,155,000)
2. Long-term loans (total): 1,505,000
  - Rate of interest: 8% per annum
  - Repayment: Over six years, starting in the third year of production.
3. Other loans: -
4. Suppliers' credits: 2,321,000, of which foreign currency component: 2,321,000. Assumes a machine supplier's credit 70% of the c.i.f. value of the production machinery. The remaining 30% is paid as follows: 10% cash down when ordering, 10% upon delivery, 10% when machinery is ready for operation.
5. Remarks on the financing policy: This is only a crude financing proposal.

**X. IMPLEMENTATION PLAN**

1. Technical collaboration service: Technical collaboration with the patent owner, the Hunter Engineering Corp. USA, is indispensable. The costs of a know-how contract are estimated at \$64,000.
2. Project management: No special project management is envisaged. The technical supervision and control of the construction are to be handled by the collaborating foreign corporation.
3. Recruitment and training of personnel: Three expatriates will run the company. One supervisor and three foremen will be trained abroad for up to a one and a half year period. The costs of this programme are estimated at \$25,000. But due to the sophisticated production technique, the expatriates should not be replaced by domestic staff in the first years of production.
4. Other items:
5. Time schedule: For the realisation of the project a total period of 30 months will be necessary: i.e.
 

Planning and awarding of contract	9 months
Construction period, buildings, simultaneous delivery and shipping of machines	14 months
Assembly of machines and test runs	7 months

Extension phase: An extension of the casting capacity is possible without disturbing the production flow ("building block" system). The timing of the extension phase depends on the growth of demand.

**XI. DATA FOR EVALUATION**

1. Profitability evaluation:
  - Check:
    - (x) Break-even point analysis
    - ( ) Return to total capital
    - ( ) Pay back
    - (x) Rentability return to equity capital
2. Further profitability analysis for given project life (Bankability test):
  - Check:
    - ( ) Internal rate of return
    - ( ) Net present value
    - ( ) Any other method used
3. National economic benefit cost analysis (National priority test):
  - Check:
    - (x) Direct value added and employment effects
    - (x) Balance of payment effect
    - (x) Social marginal productivity of capital
    - (x) Backward and forward effects
    - ( ) Synthetic benefit cost analysis
    - ( ) Any other method used

Give a short outline of the methods used and major findings:

**Break-even point analysis:** The fixed costs of \$1,054,000 consist of indirect labour, administrative, selling and general expenses, maintenance and repair, depreciation and interest. The variable costs at full production (7,000 tons) of \$4,156,000 include direct labour, materials and supplies. An allowance for contingencies of 5% is added. The price for finished products are \$920 per ton for sheets and \$1,115 per ton on average for circles. A constant proportion of output of sheets and circles is assumed at all degrees of capacity utilization. Thus the break-even point lies at an annual production of 2,900 tons of roofing coils and 500 tons of circles, i.e. 45% of maximum feasible capacity. The possibility of cost reduction by buying molten Aluminium is not taken into consideration in this calculation.

**Rentability: return to equity capital:** Assuming a tax holiday of five years, the yield on equity capital is in the first year of operation 8%, in the second year 27%, in the third year 37%, in the long run 22% on an average.

**Direct value added and employment effects:** The net value added at factor costs amounts to \$1,900,000, i.e. wages and salaries \$214,000, interest \$100,000, profit before taxes \$1,586,000. The project provides work for 120 domestic employees, 38 of which are unskilled and 20 of which are semi-skilled.

**Balance of payment effect:** The savings per annum from the substitution of imports of Aluminium semi-processed products amount to some \$6,000,000 (c.i.f. value), after deduction of the exchange expenses for the import of scrap (\$569,000) and for the salaries of the European management (\$49,000). The net savings will be reduced by some \$550,000 if the transfer of profit of a foreign partner, holding 6% of the equity capital (\$184,000) is taken into account.

**Social marginal productivity of capital:** Each \$100 of capital investment creates \$25 of additional domestic income from profit, taxes and wages and salaries, excluding the salary of the European management staff.

**Backward and forward effects:** The Aluminium semi-processing plant closes the gap between the production of raw Aluminium and the manufacturing of finished goods.

XII. SUPPLEMENT

II.3 Comparison of Processes

a) From the technological standpoint

During the last few years, strip casting processes have been developed. These processes are especially suitable for the manufacture of semi-finished goods of insensitive aluminium alloys (restricted solidification range, particularly low-alloyed Al). For the comparison, the Hazelett Casting Process and the Hunter Engineering Process were selected as the unconventional processes. Cold-rolled coils and sheets of casted strips produced by the two processes are generally used for the following purposes:

- Deep-drawing products : household utensils, cans
- Building materials : roofing sheets, sidings, frames, ventilating pipes
- Miscellaneous : painted sheets, packagings, welded pipes for irrigation purposes, foils.

In all cases the requirements in terms of the product quality are not very high. Anodizing is possible, but with some difficulty, since unavoidable surface irregularities which occur during casting impair the surface quality of the end product.

b) From the economic standpoint

In order to determine the most favourable process, the comparison of processes was based on the expected demand in 1980 of approximately 17,000 t flat intermediate.<sup>1/</sup> The costs more or less invariable for all the three processes were left out of consideration. The conventional process involves very high investment and operating costs but offers the advantage of a versatile production programme. The Hunter Engineering Process seems the most profitable solution since in the presented case the demand is limited to few Al-alloys with no special quality requirements and there is a clear cost advantage.

Comparison of Investment Costs (fixed assets) and Conversion Costs in 000 US \$

Process	Type of investment	Raw Material and Heating			
		1. Raw material Al pigs and scrap		1. Raw material molten Al.	
		2. Furnace electric	oil	2. Furnace electric	oil
1. Conventional	Technical equipment	5,750	5,430	5,050	
	Buildings <sup>2/</sup>	2,200	2,200	2,050	
Total		7,950	7,630	7,100	
Conversion costs ct/kg		11.8	11.2 <sup>3/</sup>	9.5	
2. Hunter Engineering	Technical equipment		4,180		4,250
	Buildings <sup>2/</sup>		1,400		1,300
Total			5,780		5,550
Conversion costs ct/kg			10.1		8.0
3. Hazelett Casting	Technical equipment		5,850		5,650
	Buildings <sup>2/</sup>		1,200		1,130
Total			7,050		6,780
Conversion costs ct/kg			.. 4/ <sup>4/</sup>		.. 4/ <sup>4/</sup>

<sup>1/</sup> Assuming favourable economic conditions, among others a growth rate of the number of dwelling houses of 8% per year.

<sup>2/</sup> The costs of the buildings are based on a price of \$35.3/m<sup>3</sup> and a hall height of 6 m. Only the space required for the production plant was taken into consideration.

<sup>3/</sup> The local price for fuel oil far exceeds the world market price. Otherwise the conversion costs would be 11.8 ct/kg.

<sup>4/</sup> Since the plant for the Hazelett Process is intended for mass production only, 25% of its capacity is utilized by the production volume used in the comparison. The investment costs alone are thus so high that the process can be excluded from further comparison.



XIII. CASH FLOW TABLE (000 US \$)												Terminal value of assets
	Construction year			Production year								
	1st	2nd	3rd(half)	1st	2nd	3rd	4th	5th	6th	7th	8th	
<b>A. Source of cash</b>	3,316	-	3,826	3,718	5,679	6,640	6,640	6,640	6,640	6,640	6,640	
1 Financial resources total	3,316	-	3,826	-	-	-	-	-	-	-	-	
11 Loan <sup>1</sup>			1,505									
12 Equity	3,316											
13 Suppliers credits			2,321									
14 Subsidies												
2 Sales revenue <sup>2</sup>				3,718	5,679	6,640	6,640	6,640	6,640	6,640	6,640	
<b>B. Uses of cash</b>	792	1,640	4,244	3,684	5,795	6,530	6,357	5,521	5,778	5,778	5,835	
1 Fixed capital expenditure total	474	1,464	3,031	-	-	-	-	76	-	-	76	( 2,180 )
11 Land, site improvements, & buildings	104	914										( 677 )
12 Machinery & equipment (new installation)	370	550	3,031									( 1,250 )
13 Machinery & equipment (replacement)								76			76	( 34 )
2 Net working capital total	-	-	947	287	352	176	-	-	-	-	-	( 1,762 )
21 Stocks of materials			250	5	73	36						( 364 )
22 Work in-process <sup>3</sup>												( - )
23 Stocks of finished products				282	81	40						( 403 )
3 Pre-investment & start-up expenses <sup>4</sup>	368	176	798	-	198	100	-	-	-	-	-	( 1,210 )
4 Production expenditure total				3,080	4,248	4,787	4,787	4,787	4,787	4,787	4,787	
41 Personnel expenditure				214	214	214	214	214	214	214	214	
42 Materials <sup>5</sup>				2,469	3,568	4,096	4,096	4,096	4,096	4,096	4,096	
43 Administrative expenditure				105	105	105	105	105	105	105	105	
44 Indirect taxes & royalties												
45 Other expenditure (outside repair works)				112	112	112	112	112	112	112	112	
(contingencies)				180	231	260	260	260	260	260	260	
5 Debt service total	-	-	159	317	1,029	1,215	1,215	326	326	326	307	
51 Interest on loans			159	317	317	257	175	76	66	45	21	
52 Repayment of loans & credits					712	958	1,060	240	260	281	286	
6 Dividends & profit taxes paid <sup>6</sup>	-	-	-	-	166	332	332	332	665	665	665	
<b>C. Surplus/Deficit (A - B)</b>	2,524	-1,640	-418	34	-116	110	273	1,119	862	862	805	
<b>SURPLUS/DEFICIT ACCUMULATED</b>	2,524	884	466	500	384	494	767	1,886	2,748	3,610	4,415	

<sup>1</sup> Loans of different terms should be shown separately  
<sup>2</sup> Annual value of production of finished goods minus annual accumulation of finished goods inventory  
<sup>3</sup> Total production costs minus production costs of finished goods  
<sup>4</sup> Not including interest during construction  
<sup>5</sup> Annual purchase minus annual accumulation of materials inventory  
<sup>6</sup> This item stands for the part of profit which is to be paid out, namely profit tax, dividends, fees of the members of the executive board, managerial staff's share in profits, etc. Actually this sum will be established after allowances have been made for depreciation which are not included under item 4 (production expenditure). The cash flow balance should be programmed, therefore, in such a way that all necessary replacement (B.13) can be covered in any year by the accumulated surplus.

Comments

PROJECT:

COPPER WIRE ROD

(Planning year: 1970 )

**I. ORIGIN OF THE STUDY**

- This study was prepared by an independent consulting firm for the government of a developing country.
- The study was intended to assess the feasibility of producing copper and copper alloys semi-finished products. The copper wire rod project turned out to be the most feasible alternative. Copper refining was considered as a separate project.
- Size of the economy considered:
 

Population (approx.)	27 million (in 1968)
Per capita GDP (approx.)	300 US \$
Other information:	

**II. GENERAL DESCRIPTION****1. Products:**

Copper wire rod with diameters of 5/16 inches to 3/8 inches suitable for subsequent drawing to fine wire.

**2. Major input materials:**

- Electrolytic cathodes or a blend of cathodes with a nominal amount of high quality scrap
- Fuels
- Electricity
- Water

**3. Alternative technologies available and technology adopted for the study:**

Three processes are available for the manufacture of wire rod: conventional, hot rod rolling from wire bar; extrusion from billet; continuous casting and rolling from cathodes. Because of the expected level of output (30,000 t), the extraction process was eliminated. Economic parameters of the conventional and casting and rolling processes (Southwire SCR and General Electric Dip Forming) are compared in the Supplement. Southwire SCR-9 was selected (proven viability, lower requirements for water and electricity).

**4. Locational factors:**

Indication of particularly important factors:

- Electricity (1350 kW)
- Water (6000 l/hour)
- Gas (554 m<sup>3</sup>/hour)
- Proximity of sales markets (high transport charges)

Actually proposed locality:

About 1,000 km from the capital and about 500 km from the harbour. Utilities available.

**III. MARKET****1. Tabulation of estimated demand on domestic and export markets:**

Product	Unit	Current annual consumption	Of which imported (%)	Projected demand in 1977	Increase per year (%)
a) <u>Domestic market</u>					
Copper wire	tons	4087	100	28,000	27

**b) Export market**

Excluding North America, 250,000 tons of semi-finished products were internationally traded in 1969. It is estimated that the country's export of copper and copper alloys semi-finished products could reach 15,000 tons by the end of the 1970's. Copper wire rod would represent more than 50% of all the semi-finished products.

**2. Notes on methodology:**

The 1969 and 1977 requirements for copper and copper alloys semi-finished products (wire, sheets and strips, rods, bars, sections, tubes) were derived from an end-use analysis (major consumption sectors being electrical engineering, domestic appliances, transport equipment and construction.) The 1969 figures are almost identical with the import figures. The results of end-use analysis for 1977 were compared with forecasts based on cross-sectional analysis and on time series:

End-use analysis	48,000 t
Cross-sectional analysis on GNP	35,000 t
on electricity production	43,000 t
Time series on GNP	27,000 t
on electricity production	36,000 t

From 48,000 tons of all copper and copper alloys semi, about 28,000 tons represent wire.

**3. Selection of product-mix:**

Copper semi-finished products can be divided into two distinct product types. The first, copper wire-rod, requires a high output plant dealing with a single product. Conversely, the other semi, sheet, strip, tube, rod, bar, section, require flexibility of manufacture to deal with a wide product range and, in many cases, small order quantities.

**IV. CAPACITY OF PROPOSED PLANT**

1. Nominal maximum capacity according to major process: 9 t per hour

2. Maximum feasible capacity of the plant: 75% of the nominal maximum capacity

3. Expected maximum output of the plant: 32,760 tons per year (two shifts of eight hours each, 300 working days)

**V. INVESTMENT (000 US \$)**

	Total	Foreign currency component		Total	Foreign currency component			
<b>TOTAL INVESTMENT</b>	<b>4645</b>	<b>n.a.</b>						
1. Fixed assets	2669	n.a.	2. Working capital	1600	n.a.			
1.1 Land, etc. development (23,226 m <sup>2</sup> )	64	n.a.	2.1 Inventories	1600	n.a.			
1.2 Buildings	264	n.a.	Production materials, fuels & auxiliary materials (0.5 month)	500				
Factory (2323 m <sup>2</sup> )	232		Parts & supplies for repair & maintenance (12 years)	100				
Office (139 m <sup>2</sup> )	15		Work-in-process	-				
Storage (167 m <sup>2</sup> )	-	n.a.	Finished goods (0.5 month)	1000				
Others (Welfare area)	17		2.2 Accounts receivable	-				
			2.3 Other liquid assets	-				
1.3 Machinery & equipment (details see below)	2341	n.a.	3. Other investments	406	n.a.			
			3.1 Pre-investment costs	136	n.a.			
			Preliminary expenditure	6	n.a.			
			Planning costs	100	n.a.			
			Engineering costs	-				
			Interest during construction	30				
			Training costs	-				
			Others	-				
			3.2 Start-up expenses	-				
			Consultant fees	-				
			Costs for test run	-				
			Others	-				
			3.3 Contingencies	270				
			f.o.b. supplier country's port	Transport cost (insurance freight)	Import duty	Landing, local installation cost	Total	Foreign currency component

**Major machinery & equipment**

**Primary shops**

Furnace system	1738	17	87	290	2341	n.a.
Casting and rolling mill system						
Ancillary equipment						
Control equipment						
Mechanical handling equipment						

**Auxiliary shops**

Maintenance and workshop equipment	134	1	7	290	2341	n.a.
Site service facilities	35	1	2			
Laboratory equipment	26	1	2			
	1933	20	98			

**VI. MANNING TABLE**

Total number of persons: 42

Shops	Total number of persons			Shops	Total number of persons		
	1st shift	2nd shift	3rd shift		1st shift	2nd shift	3rd shift
1. Primary operative shops (including supervisory staff)	9	8		2. Auxiliary operative shops	11	4	
Operating crew	9	8		- Repair & maintenance	5	3	
				- Utilities control	-	-	
				- Product & material storage	-	-	
				- Off-site transport	-	-	
				- Guards, cleaners, etc.	6	1	
				3. Administration	10		
				- Production management	3		
				- Research & development	-		
				- Sales & purchase	1		
				- General administration	6		

**VII. ANNUAL PRODUCTION**

1. Total annual expected maximum output: US \$42,751,800

Product	Domestic sales				Foreign sales		
	Unit	Quantity	Unit price ex factory (US \$)	Annual turnover (000 US \$)	Quantity	Unit price ex factory (US \$)	Annual turnover (000 US \$)
Copper wire rod	tons	27,000	1,305	35,235	5,760	1,305	7,517

**2. Expected sales and inventory build-up:**

Deliveries will start three months after production begins. This will enable building up a stock of finished products equalling 0.5 month of full-scale production. No sales credit is assumed for domestic sales.

**3. Pricing policy:**

Over the last year the price for cathodes fluctuated around \$1200 per ton and for copper wire rod around \$1305. This price was applied as the selling price for this project as well. The selling price will be applied as FOB harbour (for exports) or as "at customer's works" (including transportation in the country).

**4. Planned sales organization:**

A sales office will be set up in the capital run by the sales manager.

**VIII. ANNUAL OPERATING COSTS AND PROFITS**

Cost Item	Unit	Unit price (US \$)	Quantity (000)	Annual costs (000 US \$)	Foreign currency component (000 US \$)	Cost Item	
						Annual costs (000 US \$)	Foreign currency component (000 US \$)
<b>Total costs</b>				41,353	n.a.		
<b>1. Material costs</b>				39,888	n.a.		
Copper cathodes	tons	1,200	33 <sup>1/</sup>	39,390	n.a.	4. Personnel costs (*)	153
Fuel (gas)	mill. BTU	0.39	69	26	n.a.	2.1. Wages & salaries	124
Electricity	(00) KWh	2	50	100	n.a.	2.2. Contributions to social securities	19
Water	(000) gallons	0.19	6	1	n.a.	2.3. Fringe benefits	10
Mould coating	(00) cu. ft.	4.5	3	13	n.a.	3. Interests <sup>2/</sup>	255
Compressed air	-	-	-	2	n.a.	4. Rents	97
Mechanical handling	-	2.0	4.8	10	n.a.	5. Indirect taxes at company level	2
Pickling and coating	tons	0.22	33	7	n.a.	6. Depreciation	304
Packaging	tons	2.97	33	97	n.a.	6.1. Buildings (9% p.a.)	26
Maintenance, materials and worn parts	-	-	-	242	n.a.	6.2. Machinery & equipment (10% p.a.)	278
						6.3. Office equipment	
						6.4. Other fixed assets	
						7. Administrative expenses & sales costs <sup>3/</sup>	654
						8. Other costs	-
						9. Profit before tax of which - profit tax - subsidies	1,399

<sup>1/</sup> Annual input 32,825 tons  
 Re-cycled scrap 590 "  
 Tonnage processed 33,415 tons  
 Scrap loss 65 tons

<sup>2/</sup> Annual average for a seven year period of production

<sup>3/</sup> Including freight

<sup>4/</sup> Not including fringe benefits

(*) Categories of persons employed	Domestic		Foreign		Foreign currency component (000 US \$)
	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)	
Top managers	3	38			
Engineers	1	11			
Technicians	6	18			
Commercial staff	2	9			
Clerks and typists	2	4			
Foremen	2	10			
Skilled operatives	5	10			
Semi-skilled operatives	4	4			
Unskilled operatives	11	8			
Part-time operatives	-	-			
Other special categories	6	12			

**IX. FINANCING PROPOSAL (in US \$)**

1. Equity capital (total): \$ 42,000
2. Long-term loans (total): \$ 330,000  
Rate of interest: 9% p.a.  
Repayment: within five years; first payment due one year after the start of construction with yearly repayments.
3. Other loans: short-term bank loan (up to 4,200,000) at 12% p.a. interest.

4. Suppliers' credits: \$ 2,786,000 (spare parts, machinery, pre-investment expenditure); 7% p.a.; repayable in 14 equal half-yearly repayments, the first being due six months after completion of the plant.

5. Remarks on the financing policy: No justification was given for the extremely low share of equity capital in the total capital employed.

**X. IMPLEMENTATION PLAN**

1. Technical collaboration service:  
Technical and engineering assistance can be provided by Southwire Company (license holder) and plant manufacturers (in USA, Europe and Japan).
2. Project management:  
Southwire Company itself takes full responsibility for all SCR plant installations and guarantees full production within a specified time.
3. Recruitment and training of personnel:  
Southwire personnel provide training of the staff during the first three months of production.
4. Other items:  
Copper wire rod will be produced from the copper cathodes. As a pre-requisite of this project an electrolytic copper refinery with a minimum capacity of 60,000 tons of cathode would have to be established. Estimated capital expenditure: \$ 35 million.

5. Time schedule: (months)

0	1	2 - 12	13 - 24	25 - 26	27	28 - 35	36 and following
Purchase land, register company, incur preliminary expense, sign major construction, plant, and machinery contracts, employ general manager and secretary	Start of construction on site	All building and civile completed; employ sales manager, works manager, two foremen, plant engineers and secretary	All plant and machinery erection and installation complete; employ all other personnel	Start-up trials, training period	Southwire personnel leave plant; sales begin	Production increase to 2,730 tone per month	Reach full planned production

**XI. DATA FOR EVALUATION**

1. Profitability evaluation:  
Check:  
 Break-even point analysis  
 Return to total capital  
 Pay back  
 Rentability: return to equity capital
2. Further profitability analysis for given project life (Bankability test):  
Check:  
 Internal rate of return  
 Net present value  
 Any other method used
3. National economic benefit-cost analysis (National priority test):  
Check:  
 Direct value added and employment effects  
 Balance of payment effect  
 Social marginal productivity of capital  
 Backward and forward effects  
 Synthetic benefit cost analysis  
 Any other method used

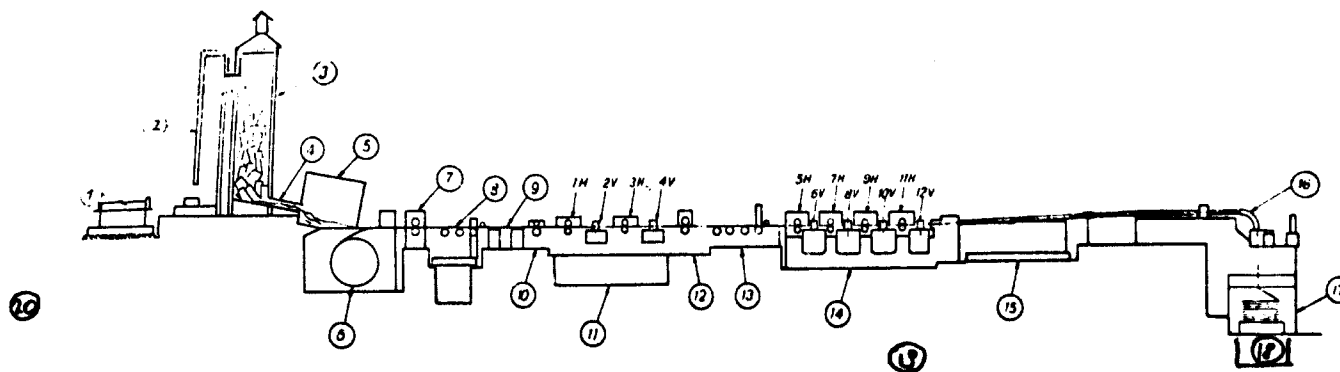
Give a short outline of the methods used and major findings:

Return to total capital: 37% (gross profit at full-scale operation to total capital)  
Pay back: five years  
Internal rate of return: 19% (on total capital employed)  
Net present value: approximately \$ 3 million (after nine years of operation at 10% discount rate)  
Direct value added and employment effects: approximately \$ 1.9 million of value added consists mainly of profit. Employment effect is not very important (42 jobs)

## XII. SUPPLEMENT

## Ad II.3. Comparative Economies of Wire Rod Plants

Process and Plant	Output in Tons		Total Estimate Capital Cost \$000's	Estimated Con- version per metric ton (cathode to wire rod) \$ per ton
	Nominal Per Hour	Per Year		
Southwire SCR-9 (2 shifts)	9	32,760	3,150	54.5
Southwire SCR-2 (1 shift)	15	26,730	4,145	61.3
Conventional Rod Rolling (1 shift)	16½	29,700	3,625	75.0
G.E. Dip Forming (2 shifts)	9	32,760	3,179	52.6

Schematic Plant Layout:

Key:

- 1 - Cathode transfer unit
- 2 - Cathode loading unit
- 3 - ASARCO cathode melting furnace
- 4 - Hot metal transfer launder
- 5 - Holding furnace and pouring pot
- 6 - Casting wheel
- 7 - Pinch roller
- 8 - Downloop table
- 9 - Bar conditioner
- 10 - Guide roller

- 11 - Roughing mill (4 stand)
- 12 - Pinch roller
- 13 - Downloop table
- 14 - Finishing mill (8 stand)
- 15 - Mill drivers
- 16 - Coiler
- 17 - Coiler
- 18 - Coiler rod transfer unit
- 19 - Casting machine and ASARCO control
- 20 - Overhead crane

Other facilities: raw material and finished goods storage, scrap handling press, laboratory area, transformer and switchgear, workshop and miscellaneous storage

XIII. CASH FLOW TABLE (000 US \$)

Terminal value of assets

	Year										
	1	2	3	4	5	6	7	8	9	10	
<b>A. Source of cash</b>	1,472	2,286	13,673	41,930	42,752	42,752	42,752	42,752	42,752	42,752	
1 Financial resources total	1,472	2,286	3,600	-	-	-	-	-	-	-	
1.1 Loan <sup>1</sup>	330	600 <sup>a/</sup>	3,600 <sup>a/</sup>	-	-	-	-	-	-	-	
1.2 Equity	42	-	-	-	-	-	-	-	-	-	
1.3 Suppliers credits	1,100	1,686	-	-	-	-	-	-	-	-	
1.4 Subsidies	-	-	-	-	-	-	-	-	-	-	
2 Sales revenue	-	-	15,073	41,930	42,752	42,752	42,752	42,752	42,752	42,752	
<b>B. Uses of cash</b>	1,250	2,121	18,635	41,617	42,912	42,758	42,539	42,619	41,247	41,219	
1 Fixed capital expenditure total	1,150	1,519	-	-	-	-	-	-	-	-	
1.1 Land, site improvements, & buildings	150	179	-	-	-	-	-	-	-	-	( 100 )
1.2 Machinery & equipment (new installation)	1,000	1,341	-	-	-	-	-	-	-	-	( 460 )
1.3 Machinery & equipment (replacement)	-	-	-	-	-	-	-	-	-	-	( )
2 Net working capital total	-	600	1,000	-	-	-	-	-	-	-	
2.1 Stocks of materials	-	600	-	-	-	-	-	-	-	-	( 500 )
2.2 Work-in-process <sup>1</sup>	-	-	-	-	-	-	-	-	-	-	( )
2.3 Stocks of finished products	-	-	1,000	-	-	-	-	-	-	-	( 1,000 )
3 Pre-investment & start-up expenses: <sup>4/</sup>	100	276	-	-	-	-	-	-	-	-	( )
4 Production expenditure total	-	-	17,286	40,471	40,800	40,800	40,800	40,800	40,800	40,800	
4.1 Personnel expenditure	-	-	140	153	153	153	153	153	153	153	
4.2 Materials <sup>5</sup>	-	-	16,877	39,620	39,888	39,888	39,888	39,888	39,888	39,888	
4.3 Administrative expenditures	-	-	170	599	660	660	660	660	660	660	
4.4 Indirect taxes & royalties	-	-	99	99	99	99	99	99	99	99	
4.5 Other expenditure (rents, contingencies, etc.)	-	-	-	-	-	-	-	-	-	-	
5 Debt service total	-	96	349	1,146	2,112	1,958	1,739	1,819	447	419	
5.1 Interest on loans	-	30	283	682	648	494	341	221	49	21	
5.2 Repayment of loans & credits	-	66	66	464	1,464	1,464	1,398	1,598	398	398	
6 Dividends & profit taxes paid:	-	-	-	-	-	-	-	-	-	-	
<b>C. Surplus/Deficit (A - B)</b>	222	- 205	38	313	- 160	- 6	213	133	1,505	1,533	
<b>SURPLUS/DEFICIT ACCUMULATED</b>	222	17	55	368	208	202	415	548	2,053	3,586	

<sup>1</sup> Loans of different terms should be shown separately.  
<sup>2</sup> Annual value of production of finished goods minus annual accumulation of finished goods inventory.  
<sup>3</sup> Total production costs minus production costs of finished goods.  
<sup>4</sup> Not including interest during construction.  
<sup>5</sup> Annual purchase minus annual accumulation of materials inventory.  
<sup>6</sup> This item stands for the part of profit which is to be paid out, namely profit tax, dividends, fees of the members of the executive board, managerial staff's share in profits, etc. Actually this sum will be established after allowances have been made for depreciation which are not included under item 4. (production expenditure). The cash flow balance should be programmed, therefore, in such a way that all necessary replacement (B.1.3.) can be covered in any year by the accumulated surplus.

Comments:  
<sup>a/</sup> short-term loans (overdraft)

PROJECT: ENAMEL HOUSEHOLD WARE

(Planning year: 1971 )

**I. ORIGIN OF THE STUDY**

1. This study was prepared by an independent consultant for an international organization.
2. The study was intended to assess the feasibility of producing enamel household ware in a developing country.
3. Size of the economy considered:
  - Population (approx.): (1966) 5 million
  - Per capita GDP (approx.): (1966) 50 US \$
  - Other information:

**II. GENERAL DESCRIPTION**

1. Products: Enamel household ware, e.g., wash basins, bowls, soup plates, mugs, dishes, etc., white or coloured, partly decorated.
2. Major input materials: Stamped sheet iron, frits, paints, colouring oxides, quartz, etc. (all to be imported).
3. Alternative technologies available and technology adopted for the study:
 

Scouring of metal: Elimination of all fat and rusty materials by means of sulphuric acid and various degreasing chemicals, cold and hot rinsing, neutralising and drying. Enamel grinding: grinding of enamel mixture can be done either with porcelain or alumina balls. Advantage of alumina balls: a) shorter grinding time; b) less loss of weight of balls; c) better protection of grinders. Enamel application: products immersed manually into frits and put on a shelf afterwards. Decoration is done with stencils. Burning: two burning furnaces in operation six days a week and 16 hours per day at the beginning of production and after that seven days a week and 24 hours a day. Furnaces are fired with coal.
4. Locational factors:
  - Indication of particularly important factors:
 

Vicinity of a trading centre; due to the production programme, plant has to be located in a place free of air pollution.
  - Actually proposed locality:
 

The plant will be located in the vicinity of the capital where a new industrial centre is being developed.

**III. MARKET**

1. Tabulation of estimated demand on domestic and export markets:

Product	Unit	Current annual consumption (1970)	Of which imported (%)	Projected demand in 1980	Increase per year (%)
Domestic market	\$ 000	396	100	490	2.2

2. Notes on methodology:

Figures for 1980 were derived by extrapolation of sales figures based on import statistics 1964 - 70.

3. Selection of product-mix:

Only standard quality was considered since there is nearly no demand for luxury quality. Since high cost installations are required for the manufacture of stamped sheet iron, only enamelling of imported stamped sheet iron is recommended to be done in the plant.



**IV. CAPACITY OF PROPOSED PLANT**

1. Nominal maximum capacity according to major process: not specified

2. Maximum feasible capacity of the plant:  
 End of 1973: 423 t/year on two shifts/day  
 End of 1974: 635 t/year on three shifts/day

3. Expected maximum output of the plant: 90%

**V. INVESTMENT (000 US \$)**

	Total	Foreign currency component		Total	Foreign currency component
<b>TOTAL INVESTMENT</b>	269.1				
1. Fixed assets	156.0		2. Working capital	100.0	
1.1. Land, site development	2.5		2.1. Inventories	77.4	
1.2. Buildings	94.6		Production materials, fuels & auxiliary materials	40.2	
Factory, incl. storage, water and electricity facilities	75.2		Parts & supplies for repair & maintenance	-	
Office	6.8		Work in-process	13.5	
Storage			Finished goods	23.5	
Others (infrastructural works)	12.6		2.2. Accounts receivable	-	
1.3. Machinery & equipment (details see below) (incl. installation)	58.2		2.3. Other liquid assets	22.6	
			3. Other investments	14.1	
			3.1. Pre-investment costs	-	
			Preliminary expenditure		
			Planning costs		
			Engineering costs		
			Interest during construction		
			Training costs		
			Others		
			3.2. Start-up expenses	13.1	
			Consultant fees	-	
			Costs for test run (salaries for technicians)	13.1	
			Others		

Major machinery & equipment	C. I. P. supplier country's part	Transport cost inside the country	Import duty	Landing, local installation cost	Total	Foreign currency component
Welding machine (1)	461	47				
Surface scouring equipment	6,984	156				
Grinders (4)	5,220	540				
Accessories for grinders	164	16				
Boiler (1)	2,448	252				
Painting equipment	1,080	108				
Pulverisation equipment and stencils	1,312	126				
Burning furnaces including accessories (2)	21,600	2,160		1,080	58,882	n. a.
Maintenance equipment	1,080	108				
Spare parts and various accessories	1,080	108				
Series of metal network (nickel-chrome) (6)	900	90				
Electrical equipment	324	36				
Office equipment	1,638	162				
Transportation equipment	9,000	incl.				

**VI. MANNING TABLE**

Shops	Total number of persons: 53			Shops	1st shift	2nd shift	3rd shift
	1st shift	2nd shift	3rd shift				
1. Primary operative shops (including supervisory staff)				2. Auxiliary operative shops	6		
				Repair & maintenance	-		
				Utilities control	2		
				Product & material storage	2		
				Off-site transport	2		
				Guards, cleaners, etc.	-		
Total staff		40		3. Administration	7		
				Production management	2		
				Research & development	-		
				Sales & purchase	2		
				General administration	3		

## VII. ANNUAL PRODUCTION

## 1. Total annual expected maximum output:

Product	Unit	Domestic sales			Foreign sales		
		Quantity	Average unit price ex factory (US \$)	Annual turnover (000 US \$)	Quantity	Unit price ex factory (US \$)	Annual turnover (000 US \$)
Wash basins (white and plain colours)	dozens	54,786	2.17	119.0	Small quantities will be exported from 1975/76 on.		
Wash basins (white and plain colours with gold)	"	350	2.76	1.0			
Wash basins (decorated or marble on white or plain colours)	"	24,140	2.85	68.8			
Wash basins (deep, white)	"	1,620	3.21	5.2			
Finger bowls (without cover, white and plain colours)	"	12,050	1.48	17.8			
Finger bowls (without cover, decorated on white)	"	7,700	3.44	26.5			
Finger bowls (with bakelite knob, cover, decorated on white)	"	2,020	7.30	14.7			
Footed bowls (without cover, decorated on white)	"	3,100	2.55	7.9			
Footed bowls (with bakelite knob, cover, decorated on white)	"	8,850	4.84	42.8			
Footed bowls (with integral knob, cover, decorated on white)	"	420	5.93	2.5			
Soup plates (decorated on white)	"	4,000	1.78	7.1			
Seamless mugs (white or plain colours)	"	250	2.49	0.6			
Curry dishes (with knob, cover, decorated on white)	"	540	6.70	3.6			
Chamber pots (with knob, cover, white)	"	490	8.17	3.9			
Lunch carriers (with handle, white)	"	55	10.96	0.6			
Round trays (decorated on white)	"	250	9.46	2.5			
<b>Total</b>		<b>120,605</b>		<b>324.5<sup>1/</sup></b>			

<sup>1/</sup> A discount of 13% on the sales price will be granted to wholesalers. Thus actual turnover will amount to US\$282,362.

## 2. Expected sales and inventory build-up:

No data given.

## 3. Pricing policy:

The sales price is set at a level 5-10% below the present sales price.

## 4. Planned sales organization:

The sales officer will sell products to wholesalers. Distribution centres will be established in all regions of the country and sales officer will visit these centres periodically.

## VIII. ANNUAL OPERATING COSTS AND PROFITS

Cost Item	Unit	Unit price (US \$)	Quantity	Annual costs (000 US \$)	Foreign currency component (000 US \$)	Cost Item	Annual costs (000 US \$)	Foreign currency component (000 US \$)																																																																																		
<b>Total costs</b>				<b>226.2</b>		<b>2. Personnel costs (*)</b>	<b>32.0</b>																																																																																			
<b>1. Material costs</b>				<b>181.7</b>	<b>n.a.</b>	2.1. Wages & salaries	30.8																																																																																			
<b>Raw materials:</b>						2.2. Contributions to social securities																																																																																				
Stamped sheet iron	n.a.	n.a.	n.a.	97.4	97.4	2.3. Fringe benefits	1.2																																																																																			
Basic coating material	t	297.0	48	14.2	14.2	3. Interests	-																																																																																			
White and transparent frits	t	446.4	80	35.6	35.6	4. Rents	-																																																																																			
Colouring oxides	t	7,632.0	0.5	3.8	3.8	5. Indirect taxes at company level	-																																																																																			
Urea	t	255.6	1.3	0.3	0.3	6. Depreciation	9.6																																																																																			
Potassium chloride	t	511.2	0.13	0.07	0.07	6.1. Buildings	2.4																																																																																			
Soda aluminate	t	763.2	0.13	0.1	0.1	6.2. Machinery & equipment	7.2																																																																																			
Sodium nitrite	t	511.2	0.2	0.1	0.1	6.3. Office equipment	-																																																																																			
Clay	t	87.4	11.5	1.0	1.0	6.4. Other fixed assets	-																																																																																			
Quartz	t	43.7	11.5	0.5	0.5	7. Administrative expenses & sales costs	-																																																																																			
Others	t	4,284.0	2	8.6	8.6	8. Other costs (contingencies)	2.9																																																																																			
<b>Other materials:</b>						9. Profit before tax of which - profit tax - subsidies	56.2																																																																																			
Electricity				6.2	-																																																																																					
Fuel oil				12.7	n.a.																																																																																					
Others (lubricants, water, etc.)				1.1	n.a.																																																																																					
The costs of the imported materials were calculated as C.I.F. + 28% (customs duty, transport, etc.).						<table border="1"> <thead> <tr> <th rowspan="2">(*) Categories of persons employed</th> <th colspan="2">Domestic</th> <th colspan="2">Foreign</th> <th rowspan="2">Foreign currency component (000 US \$)</th> </tr> <tr> <th>No. of persons</th> <th>Annual wages &amp; salaries &amp; fringe benefits (US \$)</th> <th>No. of persons</th> <th>Annual wages &amp; salaries &amp; fringe benefits (000 US \$)</th> </tr> </thead> <tbody> <tr> <td>Top managers</td> <td>3</td> <td>5,454</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Engineers</td> <td>-</td> <td>-</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Technicians</td> <td>-</td> <td>-</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Commercial staff</td> <td>3</td> <td>2,657</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Clerks and typists</td> <td>1</td> <td>569</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Others</td> <td>3</td> <td>1,854</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Foremen</td> <td>2</td> <td>1,710</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Skilled operatives</td> <td>7</td> <td>4,831</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Semi-skilled operatives</td> <td>14</td> <td>6,826</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Unskilled operatives</td> <td>20</td> <td>6,847</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Part-time operatives</td> <td>-</td> <td>-</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Other special categories</td> <td>2</td> <td>1,235</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>			(*) Categories of persons employed	Domestic		Foreign		Foreign currency component (000 US \$)	No. of persons	Annual wages & salaries & fringe benefits (US \$)	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)	Top managers	3	5,454				Engineers	-	-				Technicians	-	-				Commercial staff	3	2,657				Clerks and typists	1	569				Others	3	1,854				Foremen	2	1,710				Skilled operatives	7	4,831				Semi-skilled operatives	14	6,826				Unskilled operatives	20	6,847				Part-time operatives	-	-				Other special categories	2	1,235			
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**IX. FINANCING PROPOSAL (in US \$)****4 Suppliers' credits**

1 Equity capital (total)

2 Long term loans (total)

Rate of interest  
Repayment**5. Remarks on the financing policy**

3 Other loans

**X. IMPLEMENTATION PLAN**

1. Technical collaboration service

The foreign investor has to secure technical assistance as regards the installation of the plant and the training of personnel.

2. Project management

One engineer and one assistant engineer will be in charge of the installation of the equipment.

3. Recruitment and training of personnel

Commercial staff will be recruited at the beginning of construction but operatives only when machines are ready for trial run.

4. Other items:

5. Time schedule:

A total period of 12 months is considered necessary to carry out the following work: technical planning, construction of buildings, ordering of machines and their delivery, installation of machinery, ordering of raw materials and their delivery, training of personnel and trial run.

It is assumed that full capacity utilisation will be reached by the end of 1978; production volume by the end of 1973 will amount to about 421 t.

**XI. DATA FOR EVALUATION**

1. Profitability evaluation:

Check

- ( ) Break-even point analysis  
(x) Return to total capital  
(x) Pay back  
( ) Rentability return to equity capital

2. Further profitability analysis for given project life (Bankability test):

Check

- ( ) Internal rate of return  
( ) Net present value  
( ) Any other method used

3. National economic benefit cost analysis (National priority test)

Check

- ( ) Direct value added and employment effects  
( ) Balance of payment effect  
( ) Social marginal productivity of capital  
( ) Backward and forward effects  
( ) Synthetic benefit cost analysis  
( ) Any other method used

Give a short outline of the methods used and major findings

Return to total capital: 20.7%

Payback: Total capital: 4.5 years  
Fixed capital: 2.5 years

XII. SUPPLEMENT

XIII. CASH FLOW TABLE (000 US \$)

INFORMATION NOT AVAILABLE

Terminal value of assets

	Year	
<b>A. Sources of cash</b>		
-----		
-----		
<b>1. Financial resources:</b>		
cash/		
1.1. Loan <sup>1</sup>	-----	-----
1.2. Equity	-----	-----
1.3. Suppliers' credits	-----	-----
1.4. Subsidies	-----	-----
<b>2. Sales revenue<sup>2</sup></b>		
-----		
<b>B. Uses of cash</b>		
-----		
<b>1. Fixed capital expenditure:</b>		
cash/		
1.1. Land, site improvements, & buildings	-----	( )
1.2. Machinery & equipment (new installation)	-----	( )
1.3. Machinery & equipment (replacement)	-----	( )
<b>2. Net working capital:</b>		
cash/		
2.1. Stocks of materials	-----	( )
2.2. Work-in-process <sup>3</sup>	-----	( )
2.3. Stocks of finished products	-----	( )
<b>3. Pre-investment &amp; start-up expenses<sup>4</sup></b>		
-----		
<b>4. Production expenditure:</b>		
cash/		
4.1. Personnel expenditure	-----	-----
4.2. Materials <sup>5</sup>	-----	-----
4.3. Administrative expenditure	-----	-----
4.4. Indirect taxes & royalties	-----	-----
4.5. Other expenditure (rents, contingencies, etc.)	-----	-----
<b>5. Debt service:</b>		
cash/		
5.1. Interest on loans	-----	-----
5.2. Repayment of loans & credits	-----	-----
<b>6. Dividends &amp; profit taxes paid<sup>6</sup></b>		
-----		
<b>C. Surplus/Deficit (A - B)</b>		
-----		
<b>SURPLUS/DEFICIT ACCUMULATED</b>		
-----		

<sup>1</sup> Loans of different terms should be shown separately  
<sup>2</sup> Annual value of production of finished goods minus annual accumulation of finished goods inventory  
<sup>3</sup> Total production costs minus production costs of finished goods  
<sup>4</sup> Not including interest during construction  
<sup>5</sup> Annual purchase minus annual accumulation of materials inventory  
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Comments

(The cash flow table, prepared in the original study, was in a considerably different form, specifically geared to the calculation of return on investment capital. It is reproduced in Supplement.)

## PROJECT: RUBBER AND PLASTIC EQUIPMENT

(Planning year: 1972 )

**I. ORIGIN OF THE STUDY**

1. This study was prepared by an independent consulting firm for an international organization.

2. The study was intended to examine the feasibility and viability of producing selected items for plastic and rubber processing.

## 3. Size of the economy considered:

Population (approx.) 28 million  
Per capita GDP (approx.) 365 US \$  
Other information:

**II. GENERAL DESCRIPTION**

1. Products: Plastic extruders: 30-65 mm screw diameter; overall dimensions: 2,760 x 1,220 x 650; weight: 2.4 tone; maximum output: 13.6 kg/hr.  
Pipe extruders: 750-1,000 mm; weight: 4 tone; output: 5-28 kg per hour  
Blow holding machines: 1,000-5,000 cc; net weight: 2 tone; capacity: 2-5 shots per minute  
Extruder calendars: 1,000-2,000 mm width; weight: 4.0 tons  
Thermosetting plastic presses: 50-1,000 tons; overall dimensions: 2,000 x 1,500 x 3,450; weight: 6 tons  
Tyre curing presses: up to 1,650 mm tyre diameter; maximum internal pressure: 28 kg/cm<sup>2</sup>; weight: 9 tons  
Tyre building machine: up to 1,650 mm tyre diameter; maximum diameter of tyre 6,500 mm; weight: 3.0 tons

## 2. Major input materials:

M. S. plates, bars and sections, alloy steels, steel pipe and various intermediates

## 3. Alternative technologies available and technology adopted for the study:

The envisaged manufacturing process involves: material preparation - machining - fabrication and assembly - finishing - reassembly, packing and dispatch.

## 4. Locational factors: No information available

Indication of particularly important factors:

- Actually proposed locality:

**III. MARKET**

## 1. Tabulation of estimated demand on domestic and export markets.

Product	Unit	Current annual consumption	Of which imported (%)	Projected demand in 1972-82	Increase per year (%)
Rubber and plastic machinery	pieces	n.a.	n.a.	2,149	n.a.

## 2. Notes on methodology:

The demand during the period 1972-1977 is expected to amount to 726 pieces and between 1978-1982 to 1,423 pieces.

## 3. Selection of product-mix:

Existing capabilities and expansion possibilities were taken into consideration.

**IV. CAPACITY OF PROPOSED PLANT**

1. Nominal maximum capacity according to major process: No data available

2. Maximum feasible capacity of the plant: No data available

3. Expected maximum output of the plant: Stage I: 255 machines per year (two shifts, 300 working days)  
Stage II: 350 machines per year (two shifts, 300 working days)

**V. INVESTMENT (000 US \$)**

	Total		Foreign currency component			Total		Foreign currency component	
	Stage I	Stage II	Stage I	Stage II		Stage I	Stage II	Stage I	Stage II
<b>TOTAL INVESTMENT</b>	4,090	4,955	1,730	2,140					
<b>1. Fixed assets</b>	2,425	2,840	1,060	1,220					
1.1. Land, site development (I-II: 20,000 m <sup>2</sup> )	100	100	-	-	2. Working capital	755	900	80	110
1.2. Buildings (I: 4,924 m <sup>2</sup> ; II: 5,416 m <sup>2</sup> )	490	540	-	-	2.1. Inventories	495	651	-	-
- Factory (I: 2,592 m <sup>2</sup> ; II: 3,034 m <sup>2</sup> )	250	292	-	-	- Production materials, fuels & auxiliary materials (4 months)	320	429	-	-
- Office					- Parts & supplies for repair & maintenance (3 months)	13	16	80	110
- Storage (I: 2,332 m <sup>2</sup> ; II: 2,382 m <sup>2</sup> )	187	189			- Work-in-process (1 month)	162	206		
- Others					- Finished goods	172	220		
- Contingencies	53	59			2.2. Accounts receivable	88	109		
					2.3. Other liquid assets				
<b>1.3. Machinery &amp; equipment (details see below)</b>	1,835	2,200	1,060	1,220	3. Other investments	910	1,135	520	810
					3.1. Pre-investment costs	805	1,040	520	810
					- Preliminary expenditure	25	30	-	-
					- Planning costs	250	275	100	150
					- Engineering costs	-	-	-	-
					- Interest during construction	-	-	-	-
					- Training costs	50	775	490	660
					- Others (technical know-how, etc.)	45	55	-	-
					3.2. Start up expenses				
					- Consultant fees	45	55	-	-
					- Costs for test run				
					- Others				

Major machinery & equipment (000 US \$)	f.o.b. supplier country's		Transport cost (insurance freight)		Import duty	Landing, local installation cost		Total		Foreign currency component	
	Stage I	Stage II	Stage I	Stage II		Stage I	Stage II	Stage I	Stage II	Stage I	Stage II
<b>Production machinery</b>											
Material preparation section	10	10									
Machine shop	555	650									
Heat treatment shop	13	25									
Fabrication and assembly shop	25	35									
Paint shop	13	15									
Reassembly, packing and dispatch section	4	5									
<b>Auxiliary equipment</b>											
Tool room	11	11	203	243	-	113	135	1,835	2,200	1,060	1,220
Maintenance shop	12	12									
Material handling equipment	128	155									
<b>Utilities and services equipment</b>	213	261									
(electric power distribution system, compressed air system, water supply, transport equipment, heating, etc.)											
<b>Other machine accessories, fixtures, spare parts, etc.</b>	36	443									
Contingencies	147	200									

**VI. MANNING TABLE**

Total number of persons: Stage I: 254; Stage II: 315

Shop	Stage I			Stage II		
	1st shift	2nd shift	3rd shift	1st shift	2nd shift	3rd shift
<b>1. Primary operative shops (including supervisory staff)</b>	212	262	-			
Technical supervisors	24	29				
Non-technical supervisors	6	10				
Skilled workers	80	106				
Semi-skilled workers	60	70				
Unskilled workers	40	50				
<b>2. Auxiliary operative shops</b>						
- Repair & maintenance						
- Utilities control						
- Product & material storage						
- Off-site transport						
- Guards, cleaners, etc.						
<b>3. Administration</b>						
- Production management				42	46	
- Research & development				14	14	
- Sales & purchase				-	-	
- General administration				28	32	

**VII. ANNUAL PRODUCTION**

1. Total annual expected maximum output: Stage I: US\$ 4,430,000  
Stage II: US\$ 6,000,000

Product	Domestic sales						Foreign sales		
	Unit	Quantity		Unit price ex factory (US \$)	Annual turnover (1000 US \$)		Quantity	Unit price ex factory (US \$)	Annual turnover (1000 US \$)
		Stage I	Stage II		Stage I	Stage II			
Extrudere	piece	50	70	7,000	350	490			
Film extrudere	piece	15	25	12,000	180	300			
Blow moulding machines	piece	25	35	26,000	650	910			
Profile calendere	pieces	75	100	16,000	1,200	1,600			
Thermo-setting plastic presses	piece	50	70	21,000	1,050	1,470			
Tyres presses	piece	25	30	31,000	775	930			
Tyres building machines	pieces	15	20	15,000	225	300			
<b>Total</b>		<b>255</b>	<b>350</b>		<b>4,430</b>	<b>6,000</b>			

**2. Expected sales and inventory build-up:**

It is assumed that full production (Stage II) will be reached in the seventh year of operation. At this output level the demand will be met.

**3. Pricing policy:**

The sales prices are calculated on the basis of the CIF prices for comparable imported products. These prices are normalized fair prices after making allowance for some variation.

**4. Planned sales organization:**

Sales will be realized through dealers on a commission basis.

**VIII. ANNUAL OPERATING COSTS AND PROFITS**

Cost item	Unit	Quantity		Annual costs		Foreign currency component (1000 US \$)
		I (1000)	II	I (1000 US \$)	II	
<b>Total costs</b>				<b>3,125</b>	<b>4,025</b>	<b>375 510</b>
<b>1. Material costs</b>				<b>980</b>	<b>1,304</b>	<b>n.a.</b>
<b>Raw materials</b>						
M.S. plates	t	230	295 395	68	91	
M.S. bars and sections	t	200	130 175	26	35	
Alloy steels	t	700	10 15	7	11	
Steel pipes	t	335	10 15	4	6	
<b>Intermediates</b>						
G. I. castings	t	330	440 595	146	197	
Alloy iron castings	t	360	45 60	17	22	
Steel castings	t	600	155 210	93	126	
Non-ferrous castings	t	1,700	15 20	26	34	
Steel forging	t	670	30 40	21	27	
Electric motors	pieces	120	375 525	45	63	
Heating elements	..	..	.. ..	17	24	
Controls	..	..	.. ..	75	100	
Hydraulics and pneumatic elements	..	..	.. ..	160	225	
Ball and roller bearings	pieces	3 2,800	3,800	9	12	
Fasteners and fittings	t	1,100	7 9	8	10	
<b>Other inputs</b>						
Auxiliary materials and consumables				200	255	
Energy and utilities				58	66	

- 1/ Straight line method at the following rate: civil works - 3%, plant and equipment - 10%, amortization of projecting costs - 10%;
- 2/ Including royalties (5% of sales value) and sales expenses (15% of sales value);
- 3/ No data available

Cost item	Annual costs (1000 US \$)		Foreign currency component (1000 US \$)
	I	II	
<b>2. Personnel costs (*)</b>	<b>760</b>	<b>909</b>	<b>-</b>
2.1. Wages & salaries	543	649	
2.2. Contributions to social securities	217	260	
2.3. Fringe benefits	-	-	
3. Interests	-	-	
4. Rents	-	-	
5. Indirect taxes at company level	-	-	
6. Depreciation 1/	293	354	n.a.
6.1. Buildings			
6.2. Machinery & equipment	281	342	
6.3. Office equipment			
6.4. Other fixed assets	12	12	
7. Administrative expenses & sales costs 2/	957	1,290	n.a.
8. Other costs (maintenance and contingency allowances)	135	168	n.a.
9. Profit before tax of which - profit tax 3/ - subsidies	1,305	1,975	-

(*) Categories of persons employed	Domestic		Foreign	
	No. of persons	Annual wages & salaries & fringe benefits (1000 US \$)	No. of persons	Annual wages & salaries & fringe benefits (1000 US \$)
Top managers	1	24		
Engineers	13	160		
Technicians				
Commercial staff	28	70		
Clerks and typists				
Foremen	32	150		
Skilled operatives	80	200		
Semi-skilled operatives	60	111		
Unskilled operatives	40	45		
Part-time operatives	-	-		
Other special categories	-	-		



**IX. FINANCING PROPOSAL (in US \$)**

**4. Suppliers' credits: -**

1. Equity capital (total): Stage I: 4,090,000  
Stage II: 4,955,000

2. Long-term loans (total): -  
- Rate of interest:  
- Repayment

3. Other loans: -

**5. Remarks on the financing policy:**

For reasons of simplicity, it is assumed that total investment will be financed through equity capital.

**X. IMPLEMENTATION PLAN**

1. Technical collaboration service: No information given

2. Project management: No information given

3. Recruitment and training of personnel: No information given

**4. Other items:**

Stages I and II indicate the earlier stage of plant build-up and the later expanded stage of operations of full production capacity.

**5. Time schedule:**

For the realization of the project more than three years are planned. In the fourth year production will start up at a production level of 44% of total capacity, which will be reached in the tenth year.

**XI. DATA FOR EVALUATION**

**1. Profitability evaluation:**

- Check:
- Break-even point analysis
  - Return to total capital
  - Pay back
  - Rentability: return to equity capital

**2. Further profitability analysis for given project life (Bankability test):**

- Check:
- Internal rate of return
  - Net present value
  - Any other method used

**3. National economic benefit-cost analysis (National priority test):**

- Check:
- Direct value added and employment effects
  - Balance of payment effect
  - Social marginal productivity of capital
  - Backward and forward effects
  - Synthetic benefit cost analysis
  - Any other method used

Give a short outline of the methods used and major findings:

Return to total capital: Stage I: 31.9%; Stage II: 39.8%

Pay back period: Stage I: 3.7 years; Stage II: 3.2 years

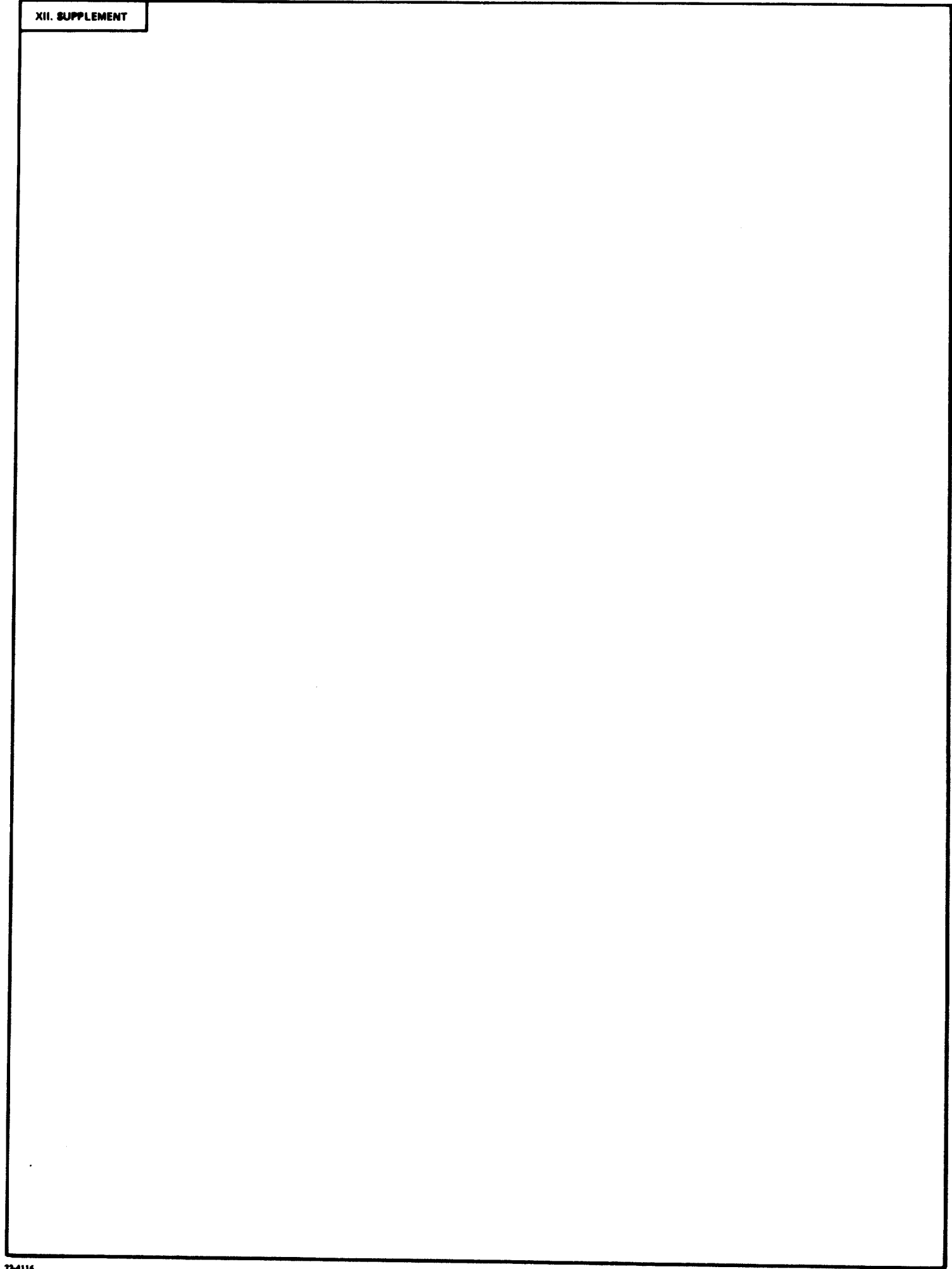
Return to equity capital: equal return to total capital

Internal rate of return: Stage I: 21.4%; Stage II: 24.9%

Direct value added and employment effects: Stage I: Value added per year amounts to approximately US\$ 3.4 million; in Stage II to US\$ 4.6 million

Balance of payment effect: Stage I: Foreign exchange savings per annum amount to US\$ 4,055,000; in Stage II to US\$ 5,490,000.

XII. SUPPLEMENT



XIII. CASH FLOW TABLE (000 US \$)												Terminal value of assets
Year	Stage I					Stage II						
	1	2	3	4	5	6	7	8	9	10		
<b>A. Source of cash</b>	2,500	1,590	-	2,700	4,040	4,800	4,430	5,220	5,640	6,000	6,000	
<b>1. Financial resources:</b>												
<i>total</i>	2,500	1,590	-	-	500	370	-	-	-	-	-	
1.1. Loan <sup>1</sup>	-	-	-	-	-	-	-	-	-	-	-	
1.2. Equity	2,500	1,590	-	-	500	370	-	-	-	-	-	
1.3. Suppliers' credits	-	-	-	-	-	-	-	-	-	-	-	
1.4. Subsidies	-	-	-	-	-	-	-	-	-	-	-	
<b>2. Sales revenue:</b>	-	-	-	2,700	3,540	4,430	4,430	5,220	5,640	6,000	6,000	
<b>B. Uses of cash</b>	700	1,500	1,340	2,128	2,646	3,092	3,032	3,293	3,531	3,671	3,671	
<b>1. Fixed capital expenditure:</b>												
<i>total</i>	300	1,435	690	-	200	170	45	-	-	-	-	
1.1. Land, site improvements, & buildings	300	200	90	-	50	-	-	-	-	-	-	( )
1.2. Machinery & equipment (new installation)	-	1,235	600	-	150	170	45	-	-	-	-	( )
1.3. Machinery & equipment (replacement)	-	-	-	-	-	-	-	-	-	-	-	( )
<b>2. Net working capital:</b>												
<i>total</i> <sup>2)</sup>	-	-	205	400	150	50	-	100	80	-	-	
2.1. Stocks of materials	-	-	205	128	-	50	-	62	-	-	-	( )
2.2. Work-in-process <sup>3)</sup>	-	-	-	102	60	-	-	-	44	-	-	( )
2.3. Stocks of finished products	-	-	-	-	-	-	-	-	-	-	-	( )
2.4. Accounts receivable and other liquid assets	-	-	-	170	90	-	-	38	36	-	-	( )
<b>3. Pre-investment &amp; start-up expenses:</b>	400	65	445	-	30	40	155	-	-	-	-	( )
<b>4. Production expenditure:</b>												
<i>total</i>	-	-	-	1,728	2,266	2,832	2,832	3,193	3,451	3,671	3,671	
4.1. Personnel expenditure	-	-	-	464	608	760	760	791	854	909	909	
4.2. Materials <sup>4)</sup>	-	-	-	538	794	980	980	1,134	1,206	1,308	1,304	
4.3. Administrative expenditure	-	-	-	584	766	957	957	1,122	1,213	1,290	1,290	
4.4. Indirect taxes & royalties	-	-	-	-	-	-	-	-	-	-	-	
4.5. Other expenditure (trans. contingencies, etc.)	-	-	-	82	108	135	135	146	158	168	168	
<b>5. Debt service:</b>												
<i>total</i>	-	-	-	-	-	-	-	-	-	-	-	
5.1. Interest on loans	-	-	-	-	-	-	-	-	-	-	-	
5.2. Repayment of loans & credits	-	-	-	-	-	-	-	-	-	-	-	
<b>6. Dividends &amp; profit taxes paid:</b>	-	-	-	-	-	-	-	-	-	-	-	
<b>C. Surplus/Deficit (A - B)</b>	1,800	90	-1,340	572	894	1,338	1,398	1,927	2,109	2,329	2,329	
<b>SURPLUS/DEFICIT ACCUMULATED:</b>	1,800	1,890	550	1,122	2,016	3,354	4,752	6,679	8,788	11,117	13,446	

<sup>1</sup> Loans of different terms should be shown separately  
<sup>2</sup> Annual value of production of finished goods minus annual accumulation of finished goods inventory.  
<sup>3</sup> Total production costs minus production costs of finished goods.  
<sup>4</sup> Not including interest during construction.  
<sup>5</sup> Annual purchase minus annual accumulation of materials inventory.  
<sup>6</sup> This item stands for the part of profit which is to be paid out, namely profit tax, dividends, fees of the members of the executive board, managerial staff's share in profits, etc. Actually this sum will be established after allowances have been made for depreciation which are not included under item 4. (production expenditure). The cash flow balance should be programmed, therefore, in such a way that all necessary replacement (B.1.3.) can be covered in any year by the accumulated surplus.

**Comments:**

\* ) Including total working capital as per 7. Investment

PROJECT: CEMENT, SUGAR AND ALLIED MACHINERY

(Planning year: 1972 )

**I. ORIGIN OF THE STUDY**

1. This study was prepared by an independent consulting firm  
for an international organisation.

2. The study was intended to examine the feasibility and viability of producing a variety of equipment for cement, sugar, vegetable oil and allied industries.

## 3. Size of the economy considered:

- Population (approx.): 28 million  
- Per capita GDP (approx.): 365 US \$  
- Other information: -

**II. GENERAL DESCRIPTION**

## 1. Products:

Fabricated vessels, storage tanks, bins, heat exchangers, furnaces and kilns, conveyors, ball mills, crushers, filters, screens, mechanical equipment and technological structures.

## 2. Major input materials:

M.S. plates, sheets, bars and sections, steel pipes, alloy steels and various intermediates.

## 3. Alternative technologies available and technology adopted for the study:

The envisaged manufacturing process involves: material preparation - structural fabrication - machining - assembly.

## 4. Locational factors:

- Indication of particularly important factors:

No information available

- Actually proposed locality:

**III. MARKET**

## 1. Tabulation of estimated demand on domestic and export markets:

Product	Unit	Current annual consumption	Of which imported (%)	Projected demand in 1972-82	Increase per year (%)
Cement, sugar and allied machinery	t	n.a.	n.a.	93,130	n.a.

## 2. Notes on methodology:

The demand during the period 1972-77 will amount to 16,500 t and between 1978-82 to 76,630 t.

## 3. Selection of product-mix:

The plant has a large measure of built-in flexibility to produce equipment for cement, sugar and vegetable oil industries and additionally equipment for brick making, refractories, glass and tannery industries.

**IV. CAPACITY OF PROPOSED PLANT**

1. Nominal maximum capacity according to major process: No information available

2. Maximum feasible capacity of the plant: No information available

3. Expected maximum output of the plant: Stage I: 10,000 tons per year (two shifts, 300 working days)  
Stage II: 14,500 tons per year (two shifts, 300 working days)

**V. INVESTMENT (000 US \$)**

	Total		Foreign currency component			Total		Foreign currency component	
	Stage I	Stage II	Stage I	Stage II		Stage I	Stage II	Stage I	Stage II
<b>TOTAL INVESTMENT</b>	24,660	29,200	12,425	14,575					
<b>1. Fixed assets</b>	16,040	18,250	9,175	10,105	<b>2. Working capital</b>	4,150	6,000	500	725
1.1. Land, site development (I-II: 100,000m <sup>2</sup> )	500	500	-	-	2.1. Inventories	3,198	4,931	-	-
1.2. Buildings (I-22, 892m <sup>2</sup> ; II-27, 816m <sup>2</sup> )	2,220	2,290	-	-	- Production materials, fuel & auxiliary materials (4 months)	2,392	3,521	-	-
- Factory (I-12, 672m <sup>2</sup> ; II-15, 552m <sup>2</sup> )	1,348	1,648	-	-	- Parts & supplies for repair & maintenance (1 months)	186	241	500	725
- Office (I-10, 200m <sup>2</sup> ; II-12, 344m <sup>2</sup> )	625	746	-	-	- Work-in-process (1 month)	820	1,118	-	-
- Others	-	-	-	-	- Finished goods	-	-	-	-
- Contingencies	247	286	-	-	2.2. Accounts receivable	590	848	-	-
					2.3. Other liquid assets	162	221	-	-
<b>1.3. Machinery &amp; equipment (details see below)</b>	13,320	15,070	9,175	10,105	<b>3. Other investments</b>	4,470	5,650	2,750	3,745
					3.1. Pre-investment costs	4,250	5,375	2,750	3,745
					- Preliminary expenditure	16.0	180	-	-
					- Planning costs	1,400	1,440	700	120
					- Engineering costs	-	-	-	-
					- Interest during construction	-	-	-	-
					- Training costs	-	-	-	-
					- Others (technical know-how, etc.)	2,690	3,755	2,050	3,025
					3.2. Start-up expenses	220	275	-	-
					- Consultant fees	-	-	-	-
					- Costs for test run	220	275	-	-
					- Others	-	-	-	-

Major machinery & equipment	f.o.b. supplier country's price		Transport cost (insurance included)		Import duty	Landing, local installation cost		Total		Foreign currency component	
	Stage I	Stage II	Stage I	Stage II		Stage I	Stage II	I	II	I	II
<b>Production machinery:</b>											
Material preparation shop		220		235							
Plate fabrication shop		3,445		3,515							
Structural fabrication shop		225		235							
Machins shop		620		300							
Assembly and teeting hop		40		40							
Painting and re-assembly shop		65		75							
<b>Auxiliary equipment:</b>											
Tool room		70		70							
Maintenance shop		200		200	1,470	1,660	821	977	13,320	15,070	9,175 10,105
Material handling equipment		555		590							
<b>Utilities</b> (electric power distribution system, compressed air system, water supply system, transport equipment, etc.)		1,700		2,135							
<b>Other machins accessories</b> (jigs and fixtures, tools, furniture and fittings, spare parts)		2,679		3,018							
<b>Contingencies</b>		1,211		1,370							

**VI. MANNING TABLE**

Shop	Total number of persons			Shop	Total number of persons		
	Stage I 1st shift	Stage II 2nd shift	3rd shift		Stage I 1st shift	Stage II 2nd shift	3rd shift
<b>1. Primary operative shops (including supervisory staff)</b>	705	1,005	-	<b>2. Auxiliary operative shops</b>			
Technical supervisors	25	105		- Repair & maintenance			
Non-technical supervisors	20	5		- Utilities control			Included in 1
Skilled workers	275	475		- Product & material storage			
Semi-skilled workers	200	300		- Off-site transport			
Unskilled workers	125	200		- Guards, cleaners, etc.			
				<b>3. Administration</b>	25	115	
				- Production management	15	40	
				- Research & development	-	-	
				- Sales & purchase	60	75	
				- General administration			



**IX. FINANCING PROPOSAL (in US \$)**

4. Suppliers' credits: -

1. Equity capital (total): Stage I: \$24,650,000  
Stage II: \$29,900,0002. Long-term loans (total): -  
Rate of interest  
Repayment

5. Remarks on the financing policy: For simplicity reasons it is assumed that total investment will be financed through equity capital.

3. Other loans: -

**X. IMPLEMENTATION PLAN**

1. Technical collaboration service: No information given

2. Project management: No information given

3. Recruitment and training of personnel: No information given

4. Other items:

Stages I and II indicate the earlier stage of plant build-up and the later expanded stage of operation of full production capacity.

5. Time schedule:

For the realisation of the project more than three years are planned. In the fourth year production will start up at a production level of 45% of total capacity which will be reached in the eighth year.

**XI. DATA FOR EVALUATION**

1. Profitability evaluation:

Check

- Break-even point analysis  
 Return to total capital  
 Pay back  
 Restability return to equity capital

2. Further profitability analysis for given project life (Bankability test):

Check

- Internal rate of return  
 Net present value  
 Any other method used

3. National economic benefit cost analysis (National priority test):

Check

- Direct value added and employment effects  
 Balance of payment effect  
 Social marginal productivity of capital  
 Backward and forward effects  
 Synthetic benefit cost analysis  
 Any other method used

*Give a short outline of the methods used and major findings*Return to total capital: Stage I: 14.5%; Stage II: 21.0%Pay-back period: Stage I: 5.5 years; Stage II: 4.5 yearsReturn to equity capital: equals return to total capitalInternal rate of return: Stage I: 11.8%; Stage II: 16.7%Direct value added and employment effects: Stage I: value added per year amounts to approximately US\$ 11.7 million; in Stage II, to US\$ 17.4 million.Balance of payment effect: Stage I: foreign exchange savings per annum amount to US\$ 17,150,000; in Stage II, to US\$ 23,160,000.

XII. SUPPLEMENT

Ad. III. ANNUAL OPERATING COSTS AND PROFITS

Stage II - Materials costs

	<u>Quantity</u>	<u>Annual costs (000 US\$)</u>	<u>Foreign currency component (000 US\$)</u>
<u>Total costs</u>		21,950	2,860
<u>1. Material costs</u>		10,323	n. s.
<u>Raw materials</u>			
W. S. plate	7,660	1,762	
W. S. sheets	850	211	
W. S. bars and sections	1,240	648	
Steel pipes	320	107	
Alloy steels	640	429	
<u>Intermediates</u>			
I. I. castings	915	302	
Steel castings	1,535	921	
Steel forgings	530	355	
Electric motors	765	3,060	
Control panels	..	350	
Bearings	29,000	87	
Fasteners and fittings	400	440	
Others	..	370	
<u>Other inputs</u>			
Auxiliary materials and consumables		1,000	
Energies and utilities		260	



XIII. CASH FLOW TABLE (000 US \$)												Terminal value of assets
Year	1	2	3	4	Stage I		Stage II				11	
	1	2	3	4	5	6	7	8	9	10	11	
<b>A. Sources of cash</b>	6,000	10,000	3,000	20,180	13,100	24,270	26,250	28,220	28,220	28,220	28,220	
1 Financial resources total	6,000	10,000	3,000	4,300	-	-	-	-	-	-	-	
1.1 Loan <sup>1</sup>	-	-	-	-	-	-	-	-	-	-	-	
1.2 Equity	6,000	10,000	3,000	4,300	-	-	-	-	-	-	-	
1.3 Suppliers' credits	-	-	-	-	-	-	-	-	-	-	-	
1.4 Subsidies	-	-	-	-	-	-	-	-	-	-	-	
2 Sales revenue	-	-	-	15,280	13,100	24,270	26,250	28,220	28,220	28,220	28,220	
<b>B. Uses of cash</b>	1,300	11,500	10,000	15,444	15,280	17,513	13,737	19,782	13,782	13,782	13,782	
1 Fixed capital expenditure total	620	10,100	5,320	2,210	-	-	-	-	-	-	-	
1.1 Land site improvements, & buildings	620	2,100	-	460	-	-	-	-	-	-	-	( )
1.2 Machinery & equipment (new installation)	-	3,100	5,120	1,750	-	-	-	-	-	-	-	( )
1.3 Machinery & equipment (replacements)	-	-	-	-	-	-	-	-	-	-	-	( )
2 Net working capital total <sup>2</sup>	-	-	1,320	2,175	1,322	193	250	-	-	-	-	
2.1 Stocks of materials	-	-	1,320	417	1,030	45	-	-	-	-	-	( )
2.2 Work-in-process <sup>3</sup>	-	-	-	186	45	-	-	-	-	-	-	( )
2.3 Stocks of finished products	-	-	-	820	-	108	250	-	-	-	-	( )
2.4 Accounts receivable and other liquid assets	-	-	-	750	317	-	-	-	-	-	-	( )
3 Pre-investment & start-up expenses	300	1,400	2,630	115	608	307	150	-	-	-	-	( )
4 Production expenditure total	-	-	-	10,344	13,680	17,013	18,197	13,782	13,782	13,782	13,782	
4.1 Personnel expenditure	-	-	-	1,126	1,657	1,947	2,106	2,264	2,264	2,264	2,264	
4.2 Materials <sup>4</sup>	-	-	-	5,620	1,025	3,978	3,600	10,323	10,323	10,323	10,323	
4.3 Administrative expenditure	-	-	-	3,364	4,205	5,295	5,206	6,157	6,157	6,157	6,157	
4.4 Indirect taxes & royalties	-	-	-	-	-	-	-	-	-	-	-	
4.5 Other expenditure (rents, contingencies, etc.)	-	-	-	634	793	933	365	1,038	1,038	1,038	1,038	
5 Debt service total	-	-	-	-	-	-	-	-	-	-	-	
5.1 Interest on loans	-	-	-	-	-	-	-	-	-	-	-	
5.2 Repayment of loans & credits	-	-	-	-	-	-	-	-	-	-	-	
6 Dividends & profit taxes paid	-	-	-	-	-	-	-	-	-	-	-	
<b>C. Surplus/Deficit (A - B)</b>	5,200	-1,500	-1,000	-164	3,420	6,757	7,453	9,438	9,438	9,438	9,438	
<b>SURPLUS/DEFICIT ACCUMULATED</b>	5,200	3,500	2,500	2,336	5,756	12,513	13,266	28,404	36,842	45,280	53,718	

<sup>1</sup> Loans of different terms should be shown separately  
<sup>2</sup> Annual value of production of finished goods minus annual accumulation of finished goods inventory  
<sup>3</sup> Total production costs minus production costs of finished goods.  
<sup>4</sup> Not including interest during construction  
<sup>5</sup> Annual purchase minus annual accumulation of materials inventory.  
<sup>6</sup> This item is for the part of profit which is to be paid out, namely profit tax, dividends, fees of the members of the executive board, managerial staff's share in profits, etc. Actually this sum will be established after allowances have been made for depreciation which are not included under item 4 (production expenditure). The cash flow balance should be programmed, therefore, in such a way that all necessary replacement (B.1.3) can be covered in any year by the accumulated surplus.

**Comments**

\* Including total working capital as per "C. Investment.

**PROJECT: CONSTRUCTION MACHINERY**

(Planning year: 1972 )

**I. ORIGIN OF THE STUDY**

1. This study was prepared by an independent consulting firm for an international organisation

2. The study was intended to examine the feasibility and viability of producing various items of construction equipment

**3. Size of the economy considered:**

Population (approx.) 24 million  
 Per capita GDP (approx.) 365 US \$  
 Other information -

**II. GENERAL DESCRIPTION**

1. **Products:** Bulldozers (105 FHHP to 270 FHHP); possible attachments: angle-, rake-, straight tilt-, straight dozers, hydraulic ripper, towing winch. Scrapers (10 M<sup>3</sup> to 29 M<sup>3</sup> heaped). Loaders (33 FHHP to 140 FHHP); possible attachments: shovel, front loader, towing winch, trench digger, back hoe, side crane, scarifier or ripper. Motor grader (90 FHHP to 150 FHHP); possible attachments: grader blade, scarifier.

**2. Major input materials:**

M.C. plates, bars and sections, steel pipes and intermediates.

**3. Alternative technologies available and technology adopted for the study:**

The envisaged manufacturing process involves: Plate work - fabrication - machining - assembly - finishing

**4. Locational factors:**

Indication of particularly important factors

No information available

Actually proposed locality

**III. MARKET**

**1. Tabulation of estimated demand on domestic and export markets:**

Product	Unit	Current annual consumption	Of which imported (%)	Projected demand in 1972-82	Increase per year (%)
Dozers )	pieces	n.a.	n.a.	10,731	n.a.
Graders )					
Scrapers )					
Shovel loaders )					

Additionally, there will be excellent export possibilities

**2. Notes on methodology:**

The demand during the period 1972 - 1977 will amount to 3,545 pieces and between 1978 - 1982 to 7,186 pieces

**3. Selection of product-mix:**

Existing capabilities and expansion possibilities were taken into consideration.



**VII. ANNUAL PRODUCTION**

1. Total annual expected maximum output: Stage I: US\$ 28 million  
 Stage II: US\$ 52.6 million

Product	Unit	Domestic sales		Unit price at factory (US \$)	Annual turnover (000 US \$)		Foreign sales		
		I	Quantity II		I	II	Quantity	Unit price at factory (US \$)	Annual turnover (000 US \$)
Dozers	pieces	200	400	36,000	7,200	14,400			
Traders	"	200	400	22,500	4,500	9,000			
Scrapers	"	20	25	65,000	1,300	1,625			
Shovel loaders	"	250	450	36,000	9,000	16,200			
Spares	tons	1,850	3,500	3,250	6,000	11,375			
					28,000	52,600			

2. Expected sales and inventory build-up: It is assumed that full production (Stage II) will be reached in the seventh year of operation. Demand will exceed production even at full output level.

3. Pricing policy: The sales prices are calculated on the basis of the c.i.f. prices for comparable imported products. The prices are normalised fair prices after making allowances for some variations.

4. Planned sales organization: Sales will be realized through dealers on a commission basis.

**VIII. ANNUAL OPERATING COSTS AND PROFITS**

Cost item	Unit	Unit price (US \$)	Quantity	Annual costs (000 US \$)	Foreign currency component (000 US \$)	Cost item	Annual costs (000 US \$)		Foreign currency component (000 US \$)						
							I	II							
Total costs						2. Personnel costs (*)	4,756	6,633	-						
1. Material costs						2.1. Wages & salaries	3,398	4,738	-						
Please see page 5						2.2. Contributions to social securities									
												2.3. Fringe benefits	1,358	1,895	
												3. Interests			
												4. Rents			
												5. Indirect taxes at company level			
												6. Depreciation 1/	2,118	2,872	n.a.
												6.1. Buildings			
												6.2. Machinery & equipment	2,093	2,842	
												6.3. Office equipment	25	30	
												6.4. Other fixed assets			
						7. Administrative expenses & sales costs 2/	3,915	7,178	n.a.						
						8. Other costs	1,215	1,922	n.a.						
						9. Profit before tax	4,520	12,540	-						
						of which - profit tax 3/									
						- subsidies									

- 1/ Straight line method at the following rates: civil works 3%, plant and equipment 10%, amortisation of projecting costs 10%;
- 2/ Including royalties (5% of sales value) and sales expenses (15% of sales value);
- 3/ No data available.

(*) Categories of persons employed	Domestic		Foreign		Foreign currency component (000 US \$)
	No. of persons I	II	Annual wages & salaries & fringe benefits (000 US \$)	II	
Top managers	1	1	24	24	
Engineers					
Technicians	59	74	734	915	
Commercial staff					
Clerks and typists	100	125	253	315	
Foremen	215	300	1,040	1,460	
Skilled operatives	600	875	1,515	2,207	
Semi-skilled operatives	450	650	850	1,230	
Unskilled operatives	300	425	340	482	
Part-time operatives	-	-	-	-	
Other special categories	-	-	-	-	

**IX. FINANCING PROPOSAL (in US \$)**

4. Suppliers' credits: -

1. Equity capital (total): Stage I: 31,150,000  
Stage II: 45,010,000

2. Long-term loans (total):  
- Rate of interest:  
- Repayment:

5. Remarks on the financing policy: For reasons of simplicity it is assumed that total investment will be financed through equity capital.

3. Other loans:

**X. IMPLEMENTATION PLAN**

1. Technical collaboration service: No information given

2. Project management: No information given

3. Recruitment and training of personnel: No information given

4. Other items: Stages I and II indicate the earlier stage of plant build-up and the later expanded stage of operations of full production capacity

5. Time schedule: For the realization of the project more than three years are planned. In the fourth year production will start up at a production level of 21% of total capacity, which will be reached in the 10th year.

**XI. DATA FOR EVALUATION**

1. Profitability evaluation:

Check:

- Break-even point analysis
- Return to total capital
- Pay back
- Rentability: return to equity capital

2. Further profitability analysis for given project life (Bankability test):

Check:

- Internal rate of return
- Net present value
- Any other method used

3. National economic benefit-cost analysis (National priority test):

Check:

- Direct value added and employment effects
- Balance of payment effect
- Social marginal productivity of capital
- Backward and forward effects
- Synthetic benefit cost analysis
- Any other method used

Give a short outline of the methods used and major findings:

Return to total capital: Stage I: 14.5%, Stage II: 27.9%

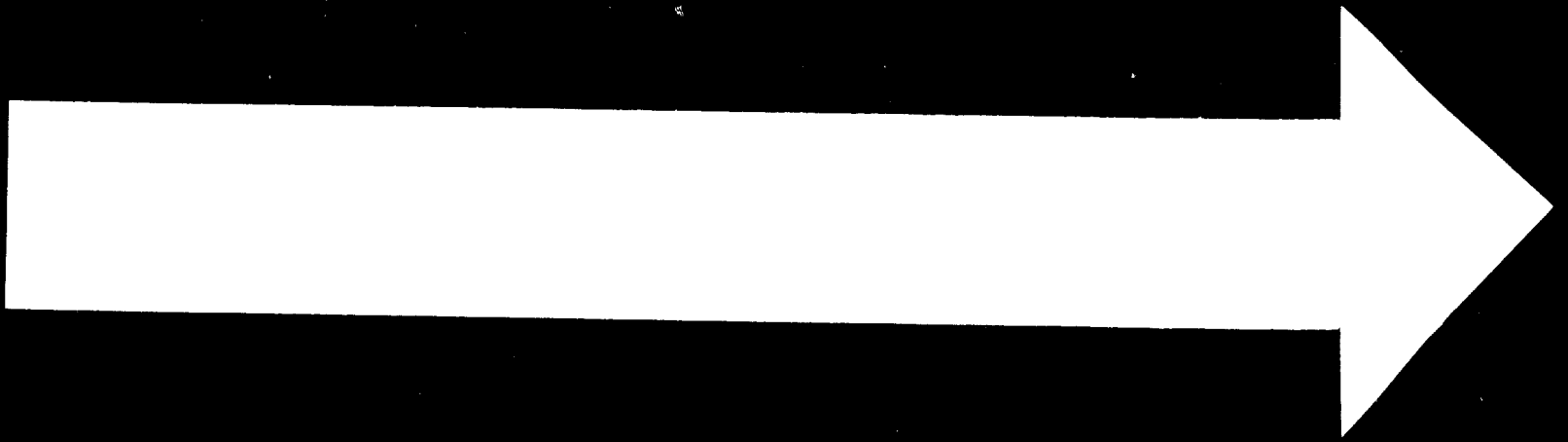
Pay back period: Stage I: 6.5 years, Stage II: 4.5 years

Return to equity capital: equals return to total capital

Internal rate of return: Stage I: 10.3%, Stage II: 18.6%

Direct value added and employment effects: Stage I: Value added per year amounts to approximately US\$ 15.9 million, in Stage II to US\$ 30.1 million

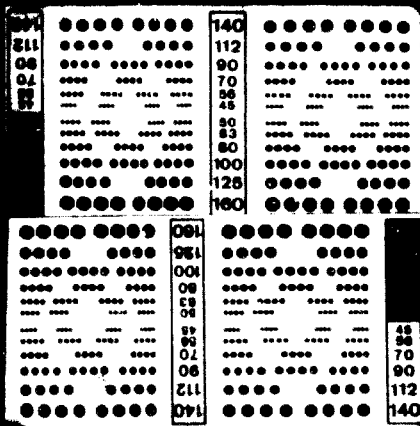
Balance of payment effects: Stage I: Foreign exchange savings per annum amount to US\$ 24,450,000, in Stage II to US\$ 46,770,000



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## XII. SUPPLEMENT

## VIII. ANNUAL OPERATING COSTS AND PROFITS

Cost item	Unit	Unit price (US \$)	Quantity		Annual costs (000 US \$)		Foreign currency component (000 US \$)			
			Stage I	Stage II	Stage I	Stage II	Stage I	Stage II		
<b>TOTAL COSTS</b>							<b>23,480</b>	<b>40,060</b>	<b>4,300</b>	<b>9,225</b>
<b>1. Material costs</b>							<b>11,476</b>	<b>21,455</b>	<b>n.a.</b>	
<u>Raw materials:</u>										
M.S. Plates	tons	230	5,475	10,425	1,259	2,398				
M.S. Bars and sections	tons	200	1,825	3,475	365	695				
Steel pipes	tons	335	15	30	5	10				
<u>Intermediates:</u>										
G.I. Castings	tons	330	730	1,400	241	462				
Steel castings	tons	600	2,450	4,650	1,470	2,780				
Steel forgings	tons	670	260	500	174	335				
Engines	pieces	2,500	804	1,530	2,010	3,825				
Gear boxes	pieces	1,000	430	820	430	820				
Power take-off units	pieces	1,200	265	510	318	612				
Wire ropes	metre	4	8,700	16,500	35	66				
Wheel rims	pieces	70	2,785	5,220	195	365				
Tyres and tubes	set	300	2,785	5,220	836	1,566				
Electricals	tons	4,000	335	640	1,340	2,560				
Hydraulics	tons	4,000	215	410	860	1,640				
Bearings	tons	3,000	40	77	120	291				
Fasteners and fittings	tons	1,100	80	150	88	165				
<u>Other inputs:</u>										
Auxiliary materials and consumables							1,455	2,465		
Energies and utilities							275	400		



## XIII. CASH FLOW TABLE (000 US \$)

Terminal  
value of  
assets

	Year											
	1	2	3	4	5	6	7	8	9	10	11	
<b>A. Source of cash</b>	17,100	14,050	18,500	15,000	21,800	27,460	28,000	39,450	42,000	52,600	52,600	
1. Financial resources:												
total	15,100	9,050	7,000	3,800	5,000	5,060	-	-	-	-	-	
1.1. Loan <sup>1</sup>	-	-	-	-	-	-	-	-	-	-	-	
1.2. Equity	15,100	9,050	7,000	3,800	5,000	5,060	-	-	-	-	-	
1.3. Suppliers' credits	-	-	-	-	-	-	-	-	-	-	-	
1.4. Subsidies	-	-	-	-	-	-	-	-	-	-	-	
2. Sales revenue:	-	-	-	11,200	16,800	22,400	28,000	39,450	42,000	52,600	52,600	
<b>B. Uses of cash</b>	2,000	5,000	11,500	14,344	18,418	21,790	25,862	31,790	31,760	37,188	37,188	
1. Fixed capital expenditure:												
total	1,800	5,000	11,500	480	-	3,400	1,680	340	-	-	-	
1.1. Land, site improvements, & buildings	1,800	2,470	50	-	-	1,220	-	-	-	-	-	( )
1.2. Machinery & equipment (new installation)	-	2,530	11,450	480	-	2,180	1,680	340	-	-	-	( )
1.3. Machinery & equipment (replacement)	-	-	-	-	-	-	-	-	-	-	-	( )
2. Net working capital:												
total *)	-	-	-	1,600	4,100	1,250	2,820	2,060	1,110	-	-	
2.1. Stocks of materials	-	-	-	1,550	2,528	-	1,700	1,201	60	-	-	( )
2.2. Work-in-process <sup>2</sup>	-	-	-	50	1,455	-	590	96	390	-	-	( )
2.3. Stocks of finished products	-	-	-	-	-	-	-	-	-	-	-	( )
2.4. Accounts receivable and other liquid assets	-	-	-	-	117	1,250	-	63	660	-	-	( )
3. Pre-investment & start-up expenses:	200	-	-	3,720	1,500	50	530	1,500	300	-	-	( )
4. Production expenditure:												
total	-	-	-	8,544	12,818	17,090	21,362	27,890	29,750	17,188	37,188	
4.1. Personnel expenditure	-	-	-	1,902	2,854	3,805	4,756	4,375	5,306	6,633	6,633	
4.2. Materials <sup>3</sup>	-	-	-	4,590	6,886	9,181	11,476	16,091	17,114	21,455	21,455	
4.3. Administrative expenditure	-	-	-	1,566	2,349	3,132	3,915	5,383	5,742	7,178	7,178	
4.4. Indirect taxes & royalties	-	-	-	-	-	-	-	-	-	-	-	
4.5. Other expenditure (rents, contingencies, etc.)	-	-	-	486	729	972	1,215	1,441	1,538	1,922	1,922	
5. Debt service:												
total	-	-	-	-	-	-	-	-	-	-	-	
5.1. Interest on loans	-	-	-	-	-	-	-	-	-	-	-	
5.2. Repayment of loans & credits	-	-	-	-	-	-	-	-	-	-	-	
6. Dividends & profit taxes paid:	-	-	-	-	-	-	-	-	-	-	-	
<b>C. Surplus/Deficit (A - B)</b>	15,100	9,050	7,000	656	3,382	5,670	2,138	7,660	10,240	15,412	15,412	
<b>SURPLUS/DEFICIT ACCUMULATED:</b>	15,100	24,150	31,150	31,806	35,188	40,858	42,996	50,656	60,896	76,308	91,720	

<sup>1</sup> Loans of different terms should be shown separately.<sup>2</sup> Annual value of production of finished goods minus annual accumulation of finished goods inventory.<sup>3</sup> Total production costs minus production costs of finished goods.<sup>4</sup> Not including interest during construction.<sup>5</sup> Annual purchase minus annual accumulation of materials inventory.<sup>6</sup> This item stands for the part of profit which is to be paid out, namely profit tax, dividends, fees of the members of the executive board, managerial staff's share in profits, etc. Actually this sum will be established after allowances have been made for depreciation which are not included under item 4. (production expenditure). The cash flow balance should be programmed, therefore, in such a way that all necessary replacement (B.1.3.) can be covered in any year by the accumulated surplus.

## Comments:

\*) Including total working capital as per V. Investment.

## PROJECT: ELECTRIC ACCUMULATORS

(Planning year: 1971 )

## I. ORIGIN OF THE STUDY

1. This study was prepared by a governmental advisory body for the Ministry of Planning and Economy of a developing country.

2. The study was intended to assess the feasibility of producing electric accumulators in the country. The study analysed the market and concentrated on calculating the cost of production. It is not a complete feasibility study; it does not deal with location, financing and project implementation. Working capital was also not specified.

## 3. Size of the economy considered:

- Population (approx.): 5 million
- Per capita GDP (approx.): 200 US\$
- Other information:

## II. GENERAL DESCRIPTION

1. Products: Electric accumulators

2. Major input materials: Lead, lead oxide, tar, sulphuric acid, distilled water (locally supplied); antimony, trays, separators (to be imported).

## 3. Alternative technologies available and technology adopted for the study:

The assembling of electric accumulators is relatively simple. Isolated thin plates are casted and then assembled. The number of plates depends on the voltage that is desired. Lead oxide is used to produce positive and negative plates. The separators are made of cardboard, wood or plastic.

## 4. Locational factors:

- Indication of particularly important factors: -

- Actually proposed locality: -

## III. MARKET

## 1. Tabulation of estimated demand on domestic and export markets:

Product	Unit	Current annual consumption (1970)	Of which imported (%)	Projected demand in 1980	Increase per year (%)
<b>Domestic market:</b>					
a) Newly manufactured accumulators	000 pcs.	45	-	95	7.5
b) Renovated accumulators	000 pcs.	15	-	25	5.0
c) Special type accumulators	000 pcs.	10	100	15	5.0

## 2. Notes on methodology:

Present demand for a) and b) is sufficiently covered by the two existing plants in the country. All special type accumulators (c) are imported. Figures for 1980 were derived by estimating the development of demand for vehicles.

3. Selection of product-mix: -





**IX. FINANCING PROPOSAL (in US \$)**

1. Equity capital (total): -

2. Long-term loans (total): -  
- Rate of interest:  
- Repayment:

3. Other loans: -

4. Suppliers' credits: -

5. Remarks on the financing policy: -

**X. IMPLEMENTATION PLAN**

1. Technical collaboration service: -

2. Project management: -

3. Recruitment and training of personnel: -

4. Other items: -

5. Time schedule: -

**XI. DATA FOR EVALUATION**

1. Profitability evaluation:

- Cheat:
- Break-even point analysis
  - Return to total capital
  - Pay back
  - Rentability: return to equity capital

2. Further profitability analysis for given project life (Bankability test):

- Cheat:
- Internal rate of return
  - Net present value
  - Any other method used

3. National economic benefit-cost analysis (National priority test):

- Cheat:
- Direct value added and employment effects
  - Balance of payment effect
  - Social marginal productivity of capital
  - Backward and forward effects
  - Synthetic benefit cost analysis
  - Any other method used

Give a short outline of the methods used and major findings:

Return to total capital: 13%

## XII. SUPPLEMENT

Ad V. INVESTMENT

<u>Major machinery and equipment</u>	<u>Total</u>
<u>Foundry:</u>	
Rotating furnace (1)	38,000
<u>Lead oxide manufacturing</u>	
Holl casting machine (1)	3,800
Mill (1)	38,000
Accessories	5,700
<u>Plates manufacturing</u>	
Melting furnaces	9,500
Grill casting machines	19,000
Mixer (1)	19,000
Coating equipment	28,500
Installation for plates adjustment	28,500
Charging equipment	28,500
Various moulds	19,000
<u>Accessories manufacturing</u>	
Melting furnaces	5,700
Casting machines	3,500
Various moulds	3,800
<u>Trays manufacturing</u>	
Injection machine (1)	47,500
Moulds for different models	19,000
Accessories	9,500
<u>Assembling and preparation</u>	
Assembling unit	9,500
Welding equipment	9,500
Electrical equipment	47,500
<u>Miscellaneous (laboratory, handling and measuring equipment)</u>	<u>57,000</u>
Total	456,000

XIII. CASH FLOW TABLE (000 US \$)

INFORMATION NOT AVAILABLE

Terminal value of assets

	Year	
<b>A. Source of cash</b>	-----	
1. Financial resources:	-----	
total	-----	
1.1. Loan <sup>1</sup>	-----	
1.2. Equity	-----	
1.3. Suppliers' credits	-----	
1.4. Subsidies	-----	
2. Sales revenue <sup>2</sup>	-----	
<b>B. Uses of cash</b>	-----	
1. Fixed capital expenditure:	-----	
total	-----	
1.1. Land, site improvements, & building	-----	( )
1.2. Machinery & equipment (new installation)	-----	( )
1.3. Machinery & equipment (replacement)	-----	( )
2. Net working capital:	-----	
total	-----	
2.1. Stocks of materials	-----	( )
2.2. Work-in-process <sup>3</sup>	-----	( )
2.3. Stocks of finished products	-----	( )
3. Pre-investment & start-up expenses <sup>4</sup>	-----	( )
4. Production expenditure:	-----	
total	-----	
4.1. Personnel expenditure	-----	
4.2. Materials <sup>5</sup>	-----	
4.3. Administrative expenditure	-----	
4.4. Indirect taxes & royalties	-----	
4.5. Other expenditure (rents, contingencies, etc.)	-----	
5. Debt service:	-----	
total	-----	
5.1. Interest on loans	-----	
5.2. Repayment of loans & credits	-----	
6. Dividends & profit taxes paid <sup>6</sup>	-----	
<b>C. Surplus/Deficit (A - B)</b>	-----	
<b>SURPLUS/DEFICIT ACCUMULATED:</b>	-----	

<sup>1</sup> Loans of different terms should be shown separately.  
<sup>2</sup> Annual value of production of finished goods minus annual accumulation of finished goods inventory.  
<sup>3</sup> Total production costs minus production costs of finished goods.  
<sup>4</sup> Not including interest during construction.  
<sup>5</sup> Annual purchase minus annual accumulation of materials inventory.  
<sup>6</sup> This item stands for the part of profit which is to be paid out, namely profit tax, dividends, fees of the members of the executive board, managerial staff's share in profits, etc. Actually this sum will be established after allowances have been made for depreciation which are not included under item 4. (production expenditures). The cash flow balance should be programmed, therefore, in such a way that all necessary replacement (B.1.3.) can be covered in any year by the accumulated surplus.

Comments:

The original study included no cash flow table.

## PROJECT

## MANUFACTURE OF STATIONERY GOODS

(Planning year: 1967 )

## I. ORIGIN OF THE STUDY

1. This study was prepared by an independent consulting firm, for an investment bank in an African country.

2. The study was intended to provide an investment plan for manufacturing a range of stationery goods by way of (nearly) completing the import substitution programme in this field. Other stationery items, such as exercise and class books, forms, envelopes, accountants' specialties, etc. are either already produced in a separate complex, or being considered under a separate study.

## 3. Size of the economy considered:

- Population (approx.) 8 million  
 - Per capita GDP (approx.) 220 US \$  
 - Other information -

## II. GENERAL DESCRIPTION

1. Products: Manufacturing of stationery items, such as ordinary, coloured and blue pencils, wooden penholders, wooden rulers, ink, carbon paper, typewriter ribbons, glue, erasers, stamp pads, chalk, pencil-sharpeners, colour-boxes.

2. Major input materials: Most of the chemical materials will have to be imported. The wood to be obtained from a local source should be branchless, light and straight grained. Generally cedar and alder wood are used. Experiments with tropical soft wood (Wawa) were encouraging. For fuel, wood waste from the wood processing department will be used exclusively. Existing local enterprises are able to supply varnishes, brushes for colour boxes, gypsum for the aggregate for chalk production, and packaging material, such as cardboard, folding boxes and ink pots.

3. Alternative technologies available and technology adopted for the study: All main items of the production programme are manufactured by using conventional processes. The production process for typewriter ribbons consists of spooling of dyed cotton ribbon on reels; for erasers, cutting and packaging of vulcanised rubber; for pencil sharpeners, die-casting of plastic casings and fixing of outters. Main parts of the machinery such as cut-to-length saw, shaping machine, form grinding machine, dip varnishing apparatus, semi-automatic foil stamping machine, triple roll grinder, multi-cornered flash trimmer drum, can be used in several production lines. In this sense, the production programme can be to a certain degree flexible.

## 4. Locational factors:

Indicator / particularly important factors: Because of the relatively high value/ton ratio of the products, transport costs are relatively unimportant. Relatively small electricity and water requirements and the use of own wood waste for steam production would further free the project from locational restrictions. On the other hand, the project can profit from so-called "contact advantages", i.e. good communication possibilities with authorities, public service utilities of all kinds, banks, commercial and industrial firms, universities and schools. The factory is not likely to cause any annoyances by smell, smoke, soot, dust, noise. A distance of about 100 m between the factory and the next residential quarters would be sufficient.

Actually proposed locality: In selecting the locality, priority has been given to the so-called "contact advantages". The proposed locality lies in the area of the main industrial, commercial and administrative centre of the country.

## III. MARKET

## 1. Tabulation of estimated demand on domestic and export markets.

Product	Unit	Current annual consumption	Of which imported (%)	Projected demand in 1970	Increase per year (%)
Pencils ordinary	000 pcs	10,000	100	13,615	
Coloured and blue	" "	4,000	100	5,756	
Penholders	" "	1,000		1,470	
Rulers "ordinary"	" "	680	100	944	
Rulers "learners measure"	" "	220	100	323	
Ink 1 oz bottles	" "	1,500	100	1,740	
2 oz bottles	" "	3,000	100	4,069	
Carbon paper folio cap	" boxes	84	100	97	
Double folio cap	" "	6	100	7	
Quarto	" "	30	100	35	
Typewriter ribbons	" pcs	100	100	116	
Glue 5 oz bottles	" "	30	100	35	
10 oz bottles	" "	70	100	81	
Erasers	" "	2,200	100	3,017	
Stamp pads	" "	15	100	17	
Chalk	" gross	480	90	662	
Pencil sharpeners	" pcs	..	..	1,000	
Colour boxes	" "	-	100	-	
Artist colours	" tin 1/2 lbs	250	100		
Ball-point pens	" pcs	2,500	100	2,900	

2. Notes on methodology: The market structure for stationery items required an assessment of the private and public (schools and authorities) demand separately. It was assumed that the demand from schools develops in proportion to the increase in the number of pupils (+47% in 5 years). For other types of demand the following factors were taken into consideration: growth of population and income, evolution of consumer buying habits, and decreasing share of illiterates in total population. The demand from other consumers than schools was on the whole projected to increase at the rate of 3% per annum. A field study was conducted including the major importers of stationery goods and the Ministry of Education.

3. Selection of product-mix: From the point of view of turnover, pencils, ink, carbon paper, chalk, and colour boxes are the important items. To complete the programme and for better utilisation of the capacity of the plastics department, penholders and wooden rulers (manufactured jointly with pencils) erasers, glue, pencil sharpeners with plastic case are also to be manufactured. Typewriter ribbons, stamp pads, and glue in plastic bottles complete the supply programme for office supplies. In the future powdered artist colours will be substituted by colour boxes for schools. The existing colour factory does not expect any profit from the production of colour powder. Therefore, this item was excluded and the production of colour boxes recommended. For the production of ball-point pens a separate plant is already under construction.



**IV. CAPACITY OF PROPOSED PLANT**

1. Nominal maximum capacity according to major process: The maximum capacity for the main products is:

pencil	21 million pcs/year; one shift
ink	6 million bottles/year; one shift
carbon paper	100 ft/min. 26" width
chalk	660,000 gross/year; one shift

2. Maximum feasible capacity of the plant: Major machines can be used in several production lines: e.g. wood working machines, varnishing machines, extrusion presses. Some machines in minor departments are only partially used. Their excess capacity can be utilized as a standby in the major departments. Thus the maximum feasible capacities of the main departments differ only negligibly from the nominal maximum capacities. The maximum feasible capacity of the carbon paper manufacturing department is 66 ft/min. The only potential bottleneck exists in the ink manufacturing department. At full production of this department the labelling machine must work an additional shift.

3. Expected maximum output of the plant: The output is determined by the expected market volume for 1970. The expected maximum feasible capacity outputs are: pencils 94%, ink 96%, carbon paper 70%, chalk 100%, respectively, relative to their maximum feasible capacity outputs.

**V. INVESTMENT (000 US \$)**

	Total	Foreign currency component	Total	Foreign currency component
<b>TOTAL INVESTMENT</b>	2,150	1,037		
<b>1. Fixed assets</b>	1,210	736		
1.1. Land, site development 2/ (1.5 ha)	25	-		
1.2. Buildings	518	105		
- Factory (3,193 m <sup>2</sup> ; US \$ 24.7/m <sup>2</sup> )	290	56		
- Office (1,013 m <sup>2</sup> ; US \$ 24.7/m <sup>2</sup> )	80	18		
- Storage (955 m <sup>2</sup> )	93	18		
- Others: Auxiliary departments (535 m <sup>2</sup> ; US \$ 24.7/m <sup>2</sup> )	55	11		
1.3. Machinery & equipment (details see below)	667	631		
<b>2. Working capital</b>	641	103		
2.1. Inventories	414	-		
- Production materials, fuels & auxiliary materials (3 months)	154	-		
- Parts & supplies for repair & maintenance	33	-		
- Work-in-process (incl. in prod. material inventories)	-	-		
- Finished goods (1.5 months)	227	-		
2.2. Accounts receivable (1.5 months)	227	-		
2.3. Other liquid assets	-	-		
<b>3. Other investments</b>	299	198		
3.1. Pre-investment costs	299	-		
- Preliminary expenditure	-	-		
- Planning costs	63	-		
- Engineering costs	101	-		
- Interest during construction	93	-		
- Training costs	42	-		
- Others	-	-		
3.2. Start-up expenses	-	-		
- Consultant fees	-	-		
- Costs for test run	-	-		
- Others	-	-		

1/ It is assumed that the project is granted exemption from import duty under an investment promotion decree.

2/ No costs for land; industrial sites can be rented.

3/ The plastic department is equipped with 2 die-casting machines and 1 bottle-blowing machine for the manufacture of screw caps for ink pots, bottles for glue, casings for stamp pads, pencil sharpeners and casings for colour boxes.

Major machinery & equipment	Capacity power kW	f.o.b. supplier country's part	Transport cost (insurance freight)	Import duty	Landing, local installation cost	Total	Foreign currency component
(Value in US \$ 000)							
Manufacture of ordinary, coloured and blue pencils	132						
- Pencil slet manufacture		45	3.5		7.5	56	53
- Pencil finishing		151	10		24	185	177
Manufacture of penholders	14	23	1.65		3.75	28.5	27
Manufacture of rulers	12	20.7	1.5		3.3	25.5	24
Manufacture of ink	6	16.3	1.1		2.6	20	19
Manufacture of carbon paper	40						
- Colour manufacture		13.7	1		2.1	16.8	16
- Carbon paper manufacture		40	3		6.5	49.5	47
Manufacture of typewriter ribbons	7	4.8	0.3	1/	0.5	5.6	5
Manufacture of glue	2	9.6	0.7		1.5	11.8	11
Manufacture of erasers	14	4.4	0.3		0.8	5.5	5
Manufacture of stamp pads	10	8.5	0.6		1.3	10.4	10
Manufacture of chalk	15	40.2	2.8		6.4	49.4	47
Manufacture of pencil sharpeners	-	4.1	0.3		0.6	5.0	5
Manufacture of colour boxes	22	16.2	1.2		2.6	20	19
Auxiliary and service departments							
- Plastic department 3/	25	17.3	1.2		2.8	21.3	20
- Power, steam and water supply	500 kVA	52	4		8.5	65	62
- Repair shop	10	21.4	1.5		3.4	26.3	25
- Factory and office equipment	35	..	..		..	36	28
- Vehicles	-	..	..		..	29	28

**VI. MANNING TABLE**

Total number of persons: 232

Shops	1st shift	2nd shift	3rd shift	Shops	1st shift	2nd shift	3rd shift
<b>1. Primary operative shops (including supervisory staff)</b>	189	-	-	<b>2. Auxiliary operative shops</b>	24	-	-
- Pencil production	8			- Repair & maintenance	14		
- Penholder production	9			- Utilities control	1		
- Ruler production	12			- Product & material storage	-		
- Ink production	17			- Off-site transport	4		
- Carbon paper production	18			- Guards, cleaners, etc.	5		
- Typewriter ribbons production	4						
- Glue production	3			<b>3. Administration</b>	19	-	-
- Eraser production	5			- Production management	5		
- Stamp pads production	3			- Research & development	-		
- Chalk production	11			- Sales & purchase	3		
- Pencil sharpener production	4			- General administration	11		
- Colour boxes production	12						
- Plastic department	-						

## VII. ANNUAL PRODUCTION

1. Total annual expected maximum output: US \$ 1,755,000.

Product	Domestic sales				Foreign sales		
	Unit	Quantity	Unit price on factory (US \$)	Annual turnover (000 US \$)	Quantity	Unit price on factory (US \$)	Annual turnover (000 US \$)
Pencils ordinary	000 pcs	18,700	14	262			
Pencils coloured	" "	5,400	25	135			
Pencils blue	" "	1,240	33.3	42			
Penholders	" "	1,520	32.9	50			
Rulers ordinary	" "	900	33.3	30			
Rulers learners measure	" "	1,050	37.1	39			
Ink 1 oz bottle	" "	1,700	56.5	96			
Ink 2 oz bottle	" "	4,100	81.7	335			
Carbon paper foolscap	00 boxes	970	179.4	174			No exports foreseen.
double foolscap	" "	70	314.3	22			
quarto	" "	350	162.8	57			
Typewriter ribbons	000 pcs	60	483.3	29			
Clus 5 oz bottle	" "	40	250	10			
Clus 10 oz bottle	" "	80	462.5	37			
Erasers	" "	1,625	32	52			
Stamp pads	" "	17	588.2	10			
Chalk	" "	95,000	2.2	208			
Pencil sharpeners	" "	1,000	41	41			
Colour boxes	" "	600	210	126			

2. Expected sales and inventory build-up: The average utilisation of capacity by all departments will be: 40% in the 1st year; 75% in the 2nd, and 100% in the 3rd and subsequent years of expected maximum output. No further details are given.

3. Pricing policy: Prices are fixed somewhat below the import substitution prices: that is, at CIF prices not including any import duty, for the products to be mainly sold to schools. For the products mainly sold to the public, CIF prices including a 50% import duty and a 20% importer margin were taken as a basis.

4. Planned sales organization: The proposed location of the complex in the vicinity of the main consumers and the limited need for relying on wholesalers enables the sales manager and his staff to keep in close contact with the market. Also, it is expected that approximately 60% of the annual turnover will be consumed by a single customer (Government).

## VIII. ANNUAL OPERATING COSTS AND PROFITS

(Footnotes are in XII. Supplement)

Cost item	Unit	Unit price (US \$)	Quantity	Annual cost (000 US \$)	Foreign currency component (000 US \$)
<b>Total costs 1/ (Items 1-8)</b>				<b>1,325</b>	<b>315</b>
<b>1. Material costs</b>				<b>678</b>	<b>289</b>
Planks of wood	m <sup>3</sup>	37.54	879	33	
Varnish	kg	1.13	18,500	21	21
Stamp foil	-	-	-	6	6
Graphite lead	000 pcs	2.98	14,400	43	43
Colour lead	000 pcs	4.37	6,050	26	26
Plastic granulate	t	421	42.6	18	18
Ink raw material	kg	8	5,000	40	40
Raw paper in rolls 2/	kg	1.01	18,000	18	18
Waxes, colours and various chemicals	..	..	..	24	24
Vulcanised rubber sheets	t	630	20	13	13
Wood softener	-	-	-	4	4
Gypsum	t	-	450	10	-
Chalk	t	23.8	125	3	3
Brushes	000 pcs	25.2	600	15	-
Cutters with screws	000 pcs	4.8	1,000	5	5
Dyed cotton ribbon	00 m	2.52	6,000	15	15
Resin	000 pcs	25.2	600	15	15
Caolin pigments					
binding agent	kg	6	2,000	12	12
Dextrine	kg	0.28	8,000	2	2
Rubber caps	000 pcs	17.6	120	2	2
Other material				3	-
Insurance, freight, landing costs				27	19
Cardboard cases and boxes	000 pcs	-	2,188	123	-
Paper cuffs for pencils	000 pcs	2.4	1,200	3	-
Ink bottles 1 oz	000 pcs	17.6	1,700	30	-
Ink bottles 2 oz	000 pcs	25.5	4,100	104	-
Labels	000 pcs	2.52	5,800	15	-
Water	000 l	0.11	50,000	6	-
Electric power	kWh	0.02	577,920	12	-
Steam 8 etc	t	-	1,440	12	-
Repair material				26	-

Cost item	Annual cost (000 US \$)	Foreign currency component (000 US \$)
<b>2. Personnel costs (*)</b>	<b>318</b>	<b>26</b>
2.1. Wages & salaries	205	26
2.2. Contributions to social securities	78	-
2.3. Fringe benefits	35	-
3. Interests (average)	41	-
4. Rents (for factory plot)	2	-
5. Indirect taxes at (50% import duty on imported company level 4/ material for non-government demand)	60	-
6. Depreciation (linear depreciation)	98	-
6.1. Buildings (3,33% p.a.)	18	-
6.2. Machinery & equipment (7%; 25% for transp. equipment)	50	-
6.3. Office equipment (25% p.a.)	9	-
6.4. Other fixed assets (7% p.a.)	21	-
7. Administrative expenses & sales costs	67	-
8. Other costs (contingencies 5%)	59	-
9. Profit before tax	430	-
of which - profit tax (50%) 5/	(215)	-
- subsidies	-	-

(*) Categories of persons employed	Domestic		Foreign		Foreign currency component (000 US \$)
	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)	No. of persons	Annual wages & salaries & fringe benefits (000 US \$)	
Top managers	2	19	2	42	18.5
Engineers			2	25	7.5
Technicians	3	8			
Commercial staff	3	10			
Clerks and typists	12	14			
Foremen	15	33			
Skilled operatives	19	27			
Semi-skilled operatives	40	39			
Unskilled operatives	31	23			
Part-time operatives	-	-			
Other special categories (women)	103	78			

**IX. FINANCING PROPOSAL (in US \$)**

1. Equity capital (total): US \$ 980,000

2. Long-term loans (total): US \$ 490,000

Rate of interest: 8% p.a.  
 Repayment: The duration of the loan need not exceed ten years. It is advisable that this loan be granted with a period of grace for 3-4 years so that priority could be given to the repayment of suppliers' credits.

3. Other loans: /

4. Suppliers' credits: US \$ 360,000. Terms: rate of interest: 8.5% including financing cost; conditions of payment: 10% cash down when ordering; 10% upon delivery; 10% when machinery is ready for operation; 70% repayment within 3 years, at the most 4 years, by 6 or 8 half-yearly installments. It is recommended that the suppliers' credits be granted free of repayment for at least the first year of operation.

5. Remarks on the financing policy: This is only a crude financing proposal.

**X. IMPLEMENTATION PLAN**

1. Technical collaboration services: Special technical know-how is necessary for the manufacture of ink and carbon paper and also if the production of lead should be taken up.

2. Project management: No suggestion.

3. Recruitment and training of personnel: The 136 unskilled and 40 semi-skilled workers will be trained on the job during the first year of production. The three shift-supervisors and four foremen of the production departments will get a one and a half to two years' training abroad. The training programme in Europe will include both schooling and in-plant lessons.

4. Other items: -

5. Time schedule: Since some special machines require a longer delivery time, two parallel implementation phases are envisaged.

	Phase I (months)	Phase II (months)	
Planning and design	7	7	It takes a total of 21 months for the completion of phase I and 27 months for the realisation of phase II. In phase I the following departments are to be set up: ink, typewriter ribbons, glue, erasers, stamp pads, pencil sharpeners, colour boxes, service departments, in phase II the departments for: ordinary pencils, coloured pencils, blue pencils, wooden penholders, wooden rulers, carbon paper and chalk. No extension phase is planned, since the second production shift can be introduced when demand growth calls for it.
Supply of machinery	6	9	
Transport and delivery	2	2	
Site development and construction of buildings	8	8	
Assembly and trial run	6	9	

**XI. DATA FOR EVALUATION**

1. Profitability evaluation.  
 Check:  
 Break-even point analysis  
 Return to total capital  
 Pay back  
 Rentability: return to equity capital

2. Further profitability analysis for given project life (Bankability test):  
 Check:  
 Internal rate of return  
 Net present value  
 Any other method used

3. National economic benefit-cost analysis (National priority test):  
 Check:  
 Direct value added and employment effects  
 Balance of payment effect  
 Social marginal productivity of capital  
 Backward and forward effects  
 Synthetic benefit cost analysis  
 Any other method used

Give a short outline of the methods used and major findings:

**Profitability: return to equity capital:** Total costs and sales revenue of the first two years of production and of a "normal" operating year were taken as the basis of calculation. Total costs include depreciation and an average amount of interest payments for loans and credits. A tax holiday for the early years of production, was also assumed. There will be a loss in the first year of production. In the second year, the return on equity capital amounts to 16%. In the long run, the return on equity capital after a 50% income taxation is approximately 23%.

**Direct value added and employment effects:** Net value added at factor cost amounts to some US \$ 800,000: i.e. wages and salaries (318,000), interest and interest (on the average 430,000), and profit before taxes (430,000). The project provides work for 228 domestic employees, 136 of which can be unskilled. 7 members of the technical staff will be trained in Europe.

**Balance of payment effect:** The average annual foreign exchange expenditures amount to US \$ 315,000 for import of materials and transfer of salaries; US \$ 147,000 for debt service (only during 8 years); US \$ 44,000 for transfer of profit of a foreign partner holding 20% of equity capital; US \$ 50,000 for replacement of machinery. Thus average net savings amount to US \$ 1,100,000 annually, as compared with the non-recurring foreign exchange expenditure (investment) of US \$ 1,037,000.

**Backward and forward effects:** The project will give an impulse to the wood and packaging industries.

XII. SUPPLEMENT

1. Footnotes to VIII. ANNUAL OPERATING COSTS AND PROFITS:

Break down of total costs according to departments is shown in supplement.

- 1/ The wood should be branchless, light and straight grained. The wood generally used is cedar and alder wood. Experiments with tropical soft wood (Nans) were encouraging.
- 2/ For the manufacture of carbon paper.
- 3/ No fuel cost is included in this item, because wood waste from the pencil production is used.
- 4/ The sales tax of 11.5% is not included in ex factory prices, which form the basis for the calculation of the sales revenue. Therefore sales tax is omitted here also.
- 5/ According to an investment promotion decree, newly established industrial enterprises can be exempted from income tax up to ten years. The profit after dividend will be internally accumulated to finance replacement investment, working capital, and loan repayment.

2. Break down of operating costs by departments:

(in 000 US \$)

Operating costs of individual departments: (approx)

Manufacture of pencils	328
Manufacture of penholders	23
Manufacture of rulers	26
Manufacture of ink	285
Manufacture of carbon paper	150
Manufacture of typewriter ribbon	38
Manufacture of glue	25
Manufacture of erasers	35
Manufacture of stamp pads	8
Manufacture of chalk	87
Manufacture of pencil sharpeners	15
Manufacture of colour boxes	67
Commercial and technical administration	<u>236</u>
	1,323

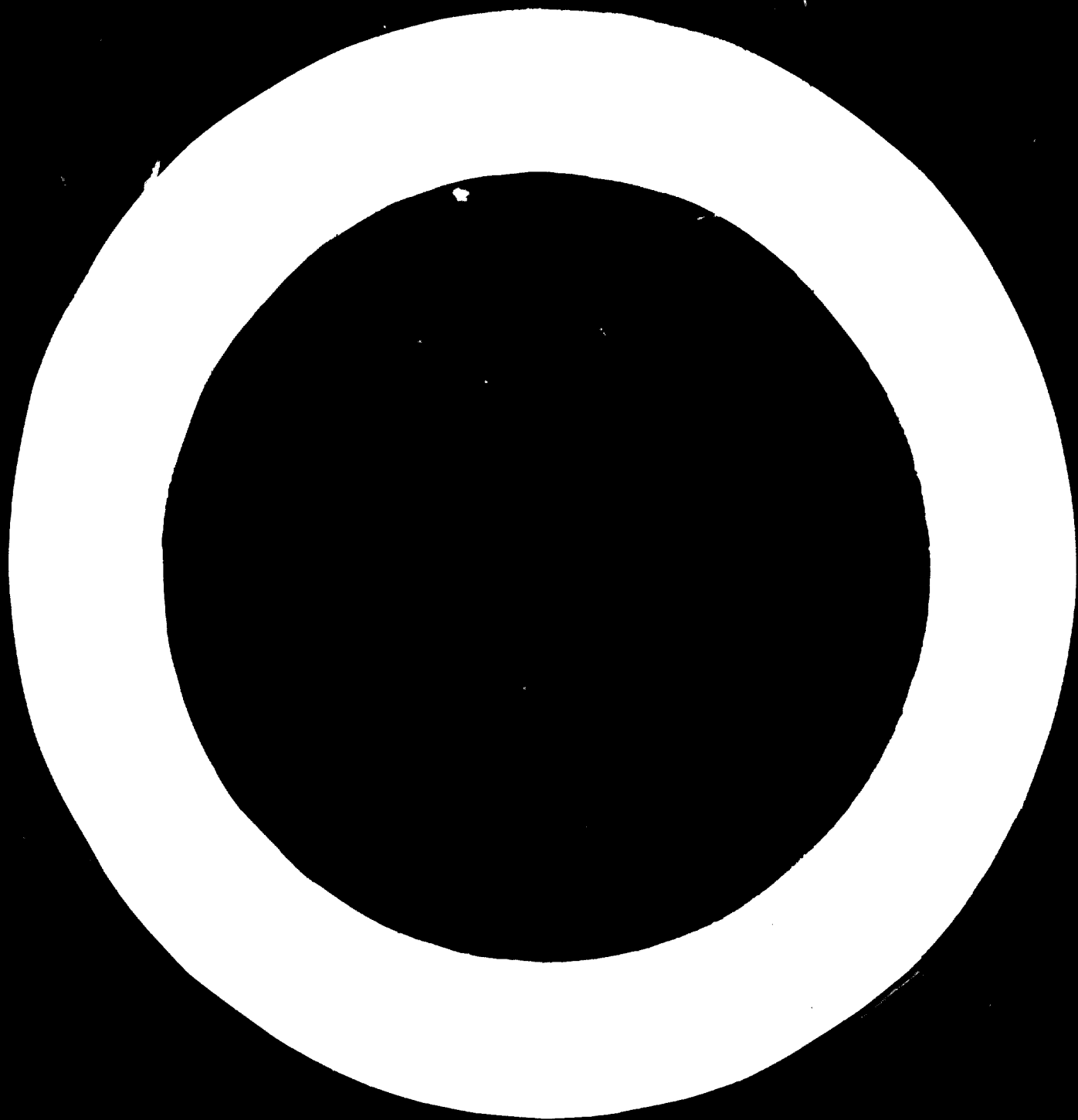
XIII. CASH FLOW TABLE (000 US \$)

	Year (construction)			Year (production)								Terminal value of assets
	1st	2nd	3rd	1st	2nd	3rd	4th	5th	6th	7th	8th	
<b>A. Source of cash</b>	980	490	360	725	1,280	1,755	1,755	1,755	1,755	1,755	1,755	
1. Financial resources: total	980	490	360	-	-	-	-	-	-	-	-	
1.1. Loan <sup>1</sup>		490										
1.2. Equity	980											
1.3. Suppliers' credits			360									
1.4. Subsidies												
2. Sales revenue <sup>2</sup>	-	-	-	725	1,280	1,755	1,755	1,755	1,755	1,755	1,755	
<b>B. Uses of cash</b>	434	628	496	793	1,247	1,639	1,744	1,664	1,751	1,751	1,686	
1. Fixed capital expenditure: total	328	489	393	-	-	-	65	-	-	-	65	
1.1. Land, site improvements, & buildings	276	267										( 399 )
1.2. Machinery & equipment (new installation)	52	222	393									( 265 )
1.3. Machinery & equipment (replacement)							65				65	( 49 )
2. Net working capital: total	-	42	53	20	75	125	50	50	-	-	-	
2.1. Stocks of materials		42	53		45	48						( 188 )
2.2. Work-in-process <sup>3</sup>												( )
2.3. Stocks of finished products				20	30	77	50	50				( 227 )
3. Pre-investment & start-up expenses <sup>4</sup>	106	77	22	-	-	-	-	-	-	-	-	( )
4. Production expenditure: total	-	-	-	712	988	1,171	1,171	1,171	1,171	1,171	1,171	
4.1. Personnel expenditure				280	310	317	317	317	317	317	317	
4.2. Materials <sup>5</sup>				252	470	666	666	666	666	666	666	
4.3. Administrative expenditure				67	67	67	67	67	67	67	67	
4.4. Indirect taxes & royalties				30	45	60	60	60	60	60	60	
4.5. Other expenditure (rents, contingencies, etc.)				83	96	61	61	61	61	61	61	
5. Debt service: total	-	20	18	61	124	118	233	218	140	140	-	
5.1. Interest on loans		20	18	61	61	55	50	35	20	10		
5.2. Repayment of loans & credits					63	63	183	183	120	130		
6. Dividends & profit taxes paid <sup>6</sup>	-	-	-	-	60	225	225	225	440	440	450	
<b>C. Surplus/Deficit (A - B)</b>	546	- 138	- 126	- 68	33	116	12	92	5	4	70	
<b>SURPLUS/DEFICIT ACCUMULATED:</b>	546	408	282	214	247	363	375	467	471	475	545	

<sup>1</sup> Loans of different terms should be shown separately.  
<sup>2</sup> Annual value of production of finished goods minus annual accumulation of finished goods inventory.  
<sup>3</sup> Total production costs minus production costs of finished goods.  
<sup>4</sup> Not including interest during construction.  
<sup>5</sup> Annual purchase minus annual accumulation of materials inventory.  
<sup>6</sup> This item stands for the part of profits which is to be paid out, namely profit tax, dividends, fees of the members of the executive board, managerial staff's share in profits, etc. Actually this sum will be established after allowances have been made for depreciation which are not included under item 4. (production expenditure). The cash flow balance should be programmed, therefore, in such a way that all necessary replacement (B.I.J.) can be covered in any year by the accumulated surplus.

Comments:

"Net working capital" under Uses of cash excludes accounts receivable and other liquid assets, the latter being absorbed in "Accumulated surplus", together with the depreciation fund.



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