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Pulp and Paper in the ASEAN Region

An Analysis of Development Potential up to the Year 2000

Massa och papper i ASEAN-området

En analys av utvecklingspotential till år 2000

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Abstract

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The development potential of the pulp and paper industries sector of the Association of Southeast Asian Nations (ASEAN) was analysed by the Pulp and Paper Industries Development Programme of FAO in two stages: an indicative investigation in 1977 and a more intensive analysis in 1978—79. The 1978—79 analysis resulted in a decision by the economic ministers of ASEAN to implement the next investigative phase: that of feasibility studies.

The approach to the analysis and subsequent strategy development was technical/political. This required that political aspirations and priorities by ASEAN member countries and the Association as a whole were considered in the selection of scenarios to be considered for evaluation and that the final choice of strategy was politically based.

The analysis was made with the help of a linear/integer programming model designed to derive optimal allocation of paper manufacturing activities, geographically as well as over time. This allocation involved resource utilization, industry location, industry type and size, choice among optional manufacturing processes and product qualities, trade with non-ASEAN countries and intra-ASEAN product distribution.

The results of the analysis indicate that ASEAN has a cost competitive advantage which allows the Association to manufacture and supply up to 90 percent of the projected internal requirement of the major grades of industrial and cultural papers in competition with the world market, without fiscal protection of the industry. All member countries of the Association, except Singapore, who has limited raw material resources, have a role to play in this intra-ASEAN supply of paper.

An attempt to critically evaluate the approach and assess the implementability of the development strategy was made.

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Terms and Abbreviations

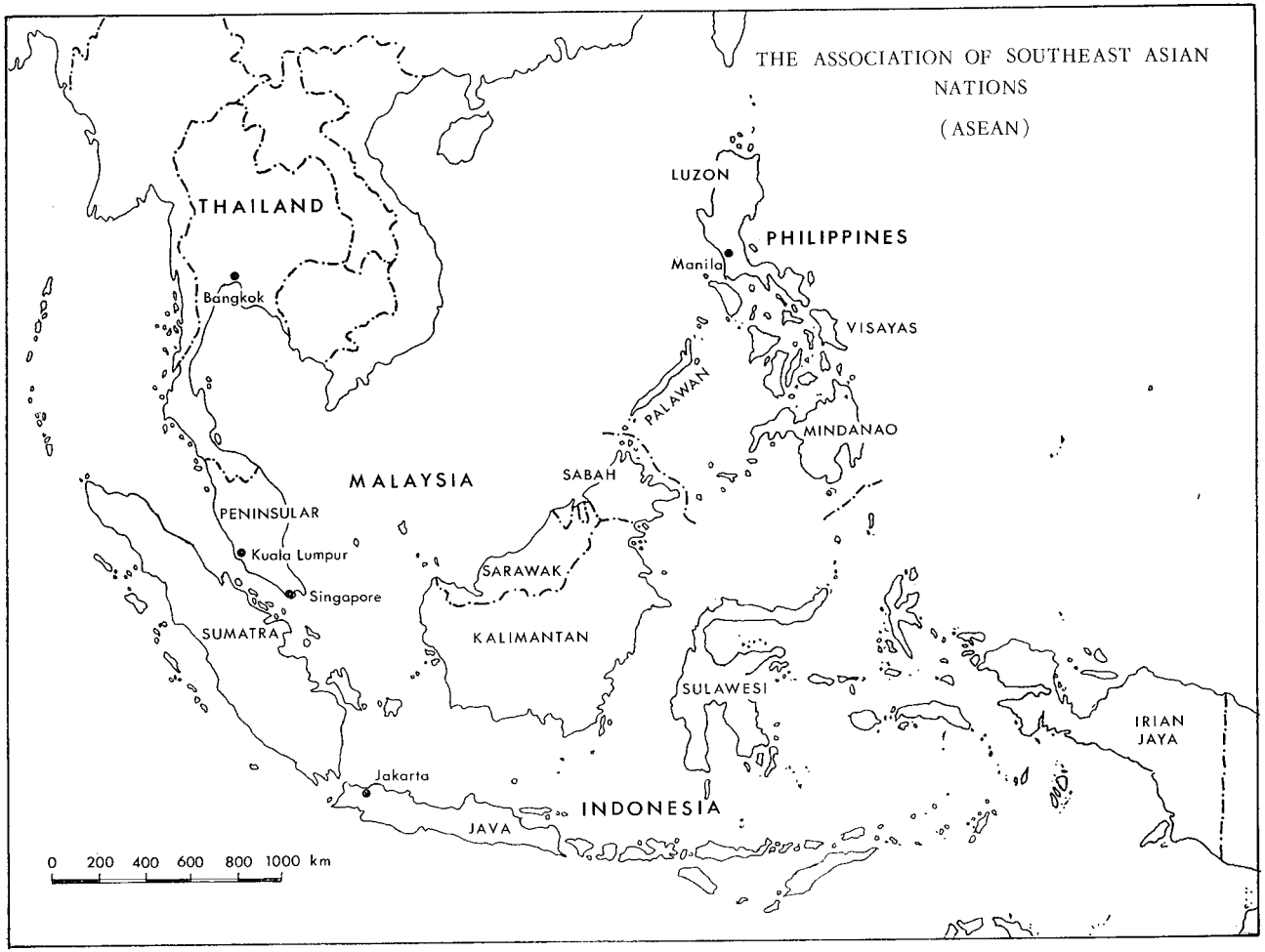
Terms

The following terms are used interchangeably in the text:

Kraft Pulp = Sulphate Pulp
Refiner Groundwood = Mechanical Pulp
NSSC Pulp = Neutral Sulphite Semichemical Pulp
Fine Papers = Printing and Writing Papers
Fluting = Corrugating Medium

Abbreviations

ASEAN	= Association of Southeast Asian Nations
c.i.f.	= Cost, Insurance, Freight (included in price)
FAO	= Food and Agriculture Organization of the United Nations
FOB	= Free on Board (all cost including loading on board ship included in price)
IBRD	= International Bank for Reconstruction and Development (World Bank)
IRR	= Internal Rate of Return
MWH	= Mega Watt Hour
OECD	= Organization for Economic Cooperation and Development
PPB	= Planning, Programming and Budgeting System
PPIDP	= Pulp and Paper Industries Development Programme
TPA	= Tonnes Per Annum
UNDP	= United Nations Development Programme
UNESCO	= United Nations Educational, Scientific and Cultural Organization
UNIDO	= United Nations Industrial Development Organization
US = USA	= United States of America
$	= US$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Preface

The origin of this thesis dates back to the early 70's. Forest sector planning was then, since some years, carried out by several agencies and institutions, one of them FAO in close liason with UNDP. It was felt that such studies should merit by being more fully documented with regard to methodology and analytic approaches than what is usually the case in the agency reports and that it would be an advantage to make an example of such works available to the forest research community.

Few are better equipped to provide the basic text for such an exercise than Nils Svanqvist. By training a forester, graduated in 1957 from the Royal College of Forestry in Sweden, he completed his training with a MS at Michigan State University majoring in economics. Since 1966, he has more or less continuously worked with FAO or UNDP mainly as a forest economist in sector planning or related subjects.

A scholarship for post graduate studies was granted to him by the Royal College of Forestry for the period 1975—1976 during which time the outline of this study was prepared.

This document is largely based on work carried out and material processed by PPIDP, FAO, UNDP and the World Bank. Nils Svanqvist has been a key person in these activities. In order to clarify his role we have asked the head of PPIDP, Mr K. Sargent to state in more detail Mr Svanqvist's contributions in this respect:

The sector analysis of the potential for the development of pulp and paper industries within the ASEAN Community, as undertaken by the UNDP/FAO Pulp and Paper Industries Development Programme (PPIDP), and which forms the basis for this thesis, owes much to the outstanding initiative, innovation and dedication shown by Mr Svanqvist during the period 1976 to 1979.

Mr Svanqvist was, indeed, the prime motivator in the attempt by PPIDP to apply new technology to the integrated sub-regional planning of the development potential of wood-based industries. His technical stimulus and pragmatic guidance to the project team was an important factor in ensuring the success of what had hitherto been regarded as an excessively ambitious undertaking.

The planning technique described in this thesis provides the basis for a highly versatile and powerful aid to policy formulation. Planners and decision makers now have available to them a methodology of proven practical application which enables an objective evaluation of a wide range of potentially viable development options.

Mr Svanqvist, through his work with PPIDP and its subsequent refinement as presented in this thesis, has made an important and original contribution to the promotion of forest sector planning. He has established a means to facilitate the formulation of technically sound and politically acceptable forest development strategy and to update that strategy in the light of changing events. His work has important implications for both developing and developed countries.

It is our hope that this publication will promote forest sector planning, contribute to improvements of theories and tools, make the work of the above-mentioned international agencies more known and thus support concerted actions to developments in forestry.

College of Forestry, Garpenberg, March 1980.
Sten Nilsson Ulf Sundberg

Authors's Preface

A number of the chapters presented in this document have been included in documents by the FAO Pulp and Paper Industries Development Programme in slightly different editing to make them consistent with the context in which they were published. Chapters 2, 3 and 4 appear in Terminal Report of Phase II (68), Chapters 9 and 10 in Working Paper 20 (62) and Chapter 18 in Technical Report 1 (69). In addition, parts of Chapters 5 and 6 are contained in Terminal Report of Phase II.

Chapters 11 through 14, 16, 17, 19 and 20 are new and have been drafted specifically for this presentation.

All chapters except 2 were originally researched and drafted by this author. Chapter 2 was written by the Programme Coordinator, Mr K. Sargent. Chapter 15 is a condensed version of the result section of Technical Report 1. This section was originally drafted by Dr Y. S. Rao, Economist of the Programme.

It should be pointed out, in order to avoid that what is said above should give the impression that I produced most of the reports written by the Programme, that the contribution by me, in terms of first drafts, to the publications by the Programme, was rather modest in volume. However, the normal procedure was that all material to be published was scrutinized by an informal editing group made up of the Coordinator, Mr Sargent and the two economists, Dr Rao and myself. From time to time, also other members of the Programme staff took part in this work. This means, on one hand, that I have been involved in finalizing most of the material published by the Programme and, on the other, that the editing committee has greatly affected the style and mannerism used in the chapters which have been published earlier. As English is not my mother tongue it is very likely that the influence from the learning process, which the editing work certainly was for me, has affected also the new chapters in a positive manner.

During the period December 1975 to June 1977 I was almost continuously engaged as an economist with the Programme. From June 1977 I took up a post with the FAO Forestry and Forest Products Development Project in Indonesia, but continued to be associated with the Programme. Besides providing advice and drafting and editing assistance, this took the form of two periods of full time secondment: in June to October 1978 for three months to assist in installing the World Bank Model at FAO Computer Center and to train the new economist, Dr Rao, in the use of the Model; and in August to September 1979 to assist in finalizing the draft of Technical Report 1 and carry out some complimentary analysis.

1 Introduction

The UNDP/FAO Pulp and Paper Industries Development Programme was initiated in 1974 in response to forecasted increasing shortage of almost all paper grades on the world market, with accompanying escalating prices. Forecasts made in previous years indicated prolonged periods of shortage (28), which, it was believed, could adversely affect economic growth throughout the developing world. Investigations into fibre availability also indicated that the traditional paper producing countries, with few exceptions, may have reached the limit of their fibre resource potential and that, therefore, the large resources of unutilized fibre of the tropical hardwood forests would have to be employed as a basis for expanded paper production. It was feared that, in a situation of tight supply, the industrialized countries would tend to safeguard their own supply, pre-empting the free paper market which, so far, had supplied the requirements of the developing world. This fear focused attention on the fact that the developing countries should establish industries of their own so as not to be victims of severely erratic paper market conditions.

In the light of the outlook broadly described above, the Programme was designed to assist developing countries to expand existing pulp and paper industries or establish new ones where these appeared to be feasible and viable. However, the role of developing countries in the world paper economy had to be reassessed in the light of some major changes which took place in the world economy in general and in paper consumption patterns specifically after 1974.

The high demand for paper which developed in 1973—74 with accompanying rise in prices coincided with a general economic recession. The combined effects of these economic phenomena appeared to have been the development of methods of economizing in the use of paper which, it was believed, could result in permanent reduction of the trend in paper consumption. This overall reduction in consumption in turn resulted in paper again becoming freely available on the international market. The receding of the tight market situation, however, was not accompanied by a corresponding reduction in prices.

The stagnation or recession of the economies throughout the world did not result in cost and price stabilization or reduction but was combined by an, in recent decades, unprecedented inflation and escalation in costs of capital to the extent that investment trends have been severely disrupted within the pulp and paper economy of the world.

Though the change in paper consumption pattern has still not stabilized and no firm new trend has yet emerged, it appears that the immediate threat of a severe shortage, if not removed, is softened and deferred. However, the reduction in capacity build-up and the continued tendency of the developed countries to guard their own self-sufficiency by consolidating markets and supplies among and from themselves, reinforces the need for the developing countries to secure supply among themselves, for themselves and for the world at large. Thus, though the urgency of avoiding a situation of severe shortfall in paper supply may have been removed by recent changes of consumption patterns, the need for on identification of development opportunities in developing countries remains urgent and the rapidly increasing escalation of capital requirement per unit of capacity has placed a higher demand on the refinement of identification criteria and for sharpness in the economic assessment used in these identifications.

Table 1. Actual Average Apparent Paper Consumption and Production Capacity in Developing Countries in 1973—75 Compared to Forecasted Requirements in 1990.[1] (In million tons per year.)

Region	Production Capacity 1973—75	Consumption 1973—75	1990
Latin America	4.86	6.57	14.48—24.53
Near East/North Africa	0.52	1.25	4.36— 7.26
Africa South of Sahara	0.96	1.44	3.20— 5.10
Far East	2.89	4.04	11.73—17.80
Total	9.23	13.30	33.77—54.69

[1] Based on FAO Forest Products Statistics, FAO cross sectional equations and FAO Capacity Survey (35, 28, 38, 32).

The magnitude of the requirement of expanded supply to developing countries is highlighted by the forecast summarized in Table 1.

The above forecasts were made in 1977 and account for changes in consumption patterns since 1974.

In the following is presented an analysis of the development potential of the pulp and paper sector of the Association of Southeast Asian Nations (ASEAN). The Association forms part of the Far East complex which, as can be seen from Table 1, may develop the relatively largest discrepancy between domestic production and consumption requirement of paper, among the major developing regions of the world.

The aim with the report is twofold: (i) to describe a technical/political approach to sector analysis and sector planning; and (ii) to present a preliminary pulp and paper sector development strategy for ASEAN which can provide a basis for further studies, ultimately leading to attraction of funds and actual implementation.

The all over-riding emphasis in the analysis and plan development has been to, besides producing a plan which is technically and economically feasible, provide a strategy which could receive political support from the individual member countries of ASEAN as well as from the technical working groups within the Association. In order to generate this political support the calculated effects of implementation of the chosen strategy had to meet competitive return expectation, satisfy foreign exchange expectations, aim at creating a healthy employment situation, etc. All these prerequisites and aspirations were entered as constraints in the analysis or considered in the selection of development alternatives. The implications of these restrictions and constraints are highlighted in the chapters dealing with results and in the evaluation sections which follow.

Chapters 2—4 of the report present the Pulp and Paper Industries Development Programme and give an over-all view of the various evaluations leading to selection of countries and regions for further studies.

The analytical technique used in the case of ASEAN and the results of the analysis and strategy development are given in Chapters 5—17. The three concluding chapters, 18—20, contain an attempt to evaluate the results and the approach.

The main body of the report is, for reason of readability, as far as possible, free from technical data. Most of these data are available in publications from the Programme but are, for ease of reference, briefly summarized in Chapters 9 and 13.

It should be stressed that the presentation contained in this report covers only a portion of the activities of the Pulp and

Paper Industries Development Programme. The Programme was world embracing, as is indicated in Chapter 2, and considerable efforts were applied to strategy development in other parts of Asia as well as in Africa and Latin America and to the collection and dissemination of technical information. A study of the PPIDP publications, contained in the list of references, provides an over-all view of the total activities of the Programme (42—69).

2 The Pulp and Paper Industries Development Programme

The Pulp and Paper Industries Development Programme has been executed in three phases. Phase I, which was completed in October 1974, comprised a short consultancy of five weeks. The findings of this phase were presented to UNDP in a report entitled "The Current and Projected Supply and Demand Situation for Pulp and Paper, Policy Strategy and Work Plan to Mitigate Effects of Projected Shortages in the Developing Countries" (11). The report concludes that immediate attention should be given to identification and promotion of viable pulp and paper projects in developing countries.

Phase II, which became operational in September 1975, was designed to implement the recommendation of Phase I and was made up of five components:

1. Inter-regional Core Component (INT)
2. Inter-country Project for Asia and Far East (RAS)
3. Inter-country Project for Africa (RAF)
4. Inter-country Project for Latin America (RLA)
5. Inter-country Project for Europe, Mediterranean and the Middle East (REM)

The allocation of manpower and funds were as follows:

Table 2. Allocation of Funds and Man-months for Phase II of the Pulp and Paper Industries Development Programme.

	US$	Man-months
INT	410,672	67.4
RAS	239,283	40.9
RAF	151,576	61.0
RLA	183,800	50.0
REM	55,000	12.0
Total	1,040,331	231.3

In addition to the above, the Regular Programme of Forestry Department, FAO, contributed 96 man-months of expert services and US$ 17,155 to cover costs of computer analysis and the Economic Commission for Latin America provided 12 man-months of services by a Pulp and Paper Economist.

The planning of activities under Phase II was guided by two Review Meetings, in January and July 1976, attended by representatives from UNDP, IBRD, UNIDO, UNESCO, OECD, the FAO Advisory Committee of Experts on Pulp and Paper, the FAO Investment Center, and the Industry Cooperative Programme.

Phase II, which was concluded on December 31, 1977, produced a number of Working Papers, which are listed in References. A summary of the results derived by Phase II was given in a report entitled "the Pulp and Paper Industries Development Programme, Inter-Regional, Project Findings and Recommendaitons" (68) presented at the Expert Consultation on World Paper Demand, Supply and Trade in Tunis on 20—22 September 1977.

The main activities under Phase II consisted of identification of potential investment opportunities and macro-techno-economic evaluation of such opportunities.

Based on recommendations by FAO, UNDP decided to continue the evaluation activities started under Phase II and allocated funds for a Phase III which came into operation in January 1978. The resource allocations in terms of funds and manpower are presented in Table 3 (p. 15).

The Programme was implemented as a UNDP field project with FAO as Executing Agency. The Coordinator of all Programme activities was Mr Kenneth Sargent who, together with the core component, operated

with Headquarters in Rome. The Inter-country Projects for Asia and Far East, Africa and Latin America were based at FAO Regional Offices in Bangkok, Addis Ababa, and Santiago de Chile respectively. The Inter-country Projects for Europe, Mediterranean and the Middle East employed short-term consultants only and were directly supervised by the Coordinator.

Table 3. Allocation of Funds and Man-months for Phase III of the Pulp and Paper Industries Development Programme.

	US$	Man-months
INT	217,430	40
RAS	255,979	38
RAF	—	—
RLA	—	—
REM	—	—
Total	473,409	78

3 Paper and the Paper Industry in Development

3.1 Paper

Paper has, in the developed world, become an ingredient in almost every activity and goods (92). The penetration of paper throughout the economy of the developing world is not as complete and a great number of substitutes are used by people in these countries. The question of the need to promote pulp and paper industries in the developing world can, therefore, not be justified by consumption patterns in North America or Europe but has to be judged from the contribution by paper to economic development. Furthermore, the industry unit itself can be justified only if it is regarded as an essential ingredient in the development process.

The following statements highlight some of the arguments used in advocating the need for expanded use of paper:

— Substitutes for paper in industrial manufacturing and for packaging are readily available but most of them lack the versatility of paper and are in general less convenient to use. Paper can therefore not be regarded as an absolute necessity for industrial development, other than for administrative uses, but is a desired component.

— The development in electronic mass communication has not obviously reduced the consumption of paper. On the contrary, paper plays an essential supporting role in this new system and it is not envisaged that this role will diminish but rather increase as communication systems become more sophisticated.

— The developing countries, in cooperation with various bilateral and multi-lateral assistance agencies, are investing heavily in education and the effect of this effort could be severely jeopardized if the supply of textbooks and teaching materials became restricted due to shortage in paper. Education is the very foundation for economic progress and shortage of cultural paper could, therefore, become a serious obstacle to development. Further, a literacy programme could be rendered inefficient if follow-up material in the form of books and newspapers were unobtainable or in short supply.

The brief points made above indicate that paper, though it can be substituted in many uses, has an important role to play in the development process, especially as a medium for communication and dissemination of education.

3.2 The Paper Industry

When planning the establishment or expansion of an industry in a developing economy, or any economy for that matter, it is essential to consider the impact that industry will have on the total national economy. The industry should not only be capable of carrying its own momentum, but should also, in the national context, have a competitive ability which enables it to be ranked as having priority status in the context of national development.

The criteria used by national planners in the selection of priority investment opportunities are of socio-economic nature, usually with heavy weighting to self-sustained growth and foreign exchange effects. Emphasis is often placed upon (88):

— employment generation relative to investment
— earning capacity per employee
— multiplier and linkage effects
— geographic diversification of production and employment
— return on investment
— foreign exchange implications

— resource utilization

It is in the light of these criteria that the prospects of giving investment into pulp and paper industries a priority ranking in developing economies are discussed in the following.

3.2.1 *Employment-Investment Ratio*

In comparison with other industries, the pulp and paper industry has a low employment potential per unit value of investment. An examination of the manufacturing industry in the USA (85) has indicated that of the major industries, only petroleum, coal and chemicals had a lower payroll—investment ratio than pulp and paper. Mechanical forest industries, paper converting and printing industries, for instances, have more favourable ratios.

The employment-capital ratio is, to some extent, dependent on the flexibility of industry to combine different techniques and to choose different levels of production. Although the pulp and paper industry is regarded generally as being somewhat inflexible in its employment-capital ratio, there are sections of its production chain, especially in the collection and handling of its fibre supply, which permit flexibility for the substitution of capital (machinery) by manpower. This flexibility is limited in the primary pulp and paper mill, at least in presently used technology.

The pulp and paper industry appears to be rather flexible in its choice of scale of production. The economies of scale are more pronounced in this industry than in most food-processing industries, but are less than in such basic industries as fertilizers, cament manufacturing, sugar refining or vegetable oil processing (75, 87). Flexibility in the techniques and in the actual scale of operation must, however, be judged against economic and financial returns. The demand for a minimum rate of return severely restricts the use of small scale operations in the pulp and paper industry, as returns are relatively low and therefore the industry units generally have to be very large in order to yield competitive rates of return on investment.

3.2.2 *Earnings*

The earning capacity of employees within the paper industry, as expressed in terms of value added, varies from country to country and over time. Global comparisons between industrial sectors (96) concluded that paper manufacturing is an average industry. It has, for instance, a greater value added than the food-processing industry or the rubber products manufacturing industry or the textile industry, but has a lower value added per employee than either the mechanical wood processing industries or the processing of metals and minerals. Total value added within the pulp and paper sector will increase if the mills are integrated with other primary wood-based industries and utilize their residue products as raw material.

3.2.3 *Multiplier and Linkage Effects*

The multiplier effects of an industry relate to the additional income generated by the introduction of a new economic activity through increased demand for goods and services and through stimulations of new or expanded activities which provide inputs into the new industry and the further processing of its products. This latter is usually termed linkage effects.

The potential multiplier effects generated through additional income provided by a new pulp and paper industry, measured in terms of generated new employment and earnings, is average relative to other industries. The linkage effects, both forward and backward, are, however, relatively high compared with those of most other industries. In this respect, the primary production of pulp and paper compares well with iron and steel and with petroleum products and it has a marked advantage over food-processing and over the manufacture of forest products in general (97).

3.2.4 *Geographical Diversification*

The forest industry in general, by virtue of its reliance on a renewable natural resource, is characterised by a strong potential for

diversifying activities to rural areas. The logging activities have by necessity to take place distributed over the rural countryside and, although logs can be transported over long distances, considerable economies can be achieved by locating processing industries close to the resource. Transport costs are minimized by transporting only processed products to the consumption centres, eliminating unusable residues at an early stage in the transport chain.

In the pulp and paper industry this flexibility with regard to location of processing activities is limited, as pulp and paper mills are strongly dependent on availability of skilled staff and labour and on such facilities as water supply, power supply and good transport facilities. Therefore, feasible mill sites may be few and strongly oriented to already developed town sites. The above mentioned facilities, possibly with the exception of water supply, can be created but as capital and its costs largely determines the economic viability of a pulp and paper mill, the investor will search for sites having low development costs and, therefore, will be attracted to urban centers with well established infrastructure, industrially oriented institutions and services and social amenities.

3.2.5 *Return on Investment*

Techno-economic evaluations of primary pulp and paper manufacturing units of a size which will produce the domestic requirements of most developing countries, carried out by the Pulp and Paper Industries Development Programme, have confirmed the generally low rate of return on investment. In order to improve the return prospects, because of the relatively modest economy of scale of the pulp and paper industry, it will be necessary to envisage size of units which often produce well in excess of domestic market need of most developing countries and which have investment requirements which cannot be funded from internal financial sources.

A comparison of the return on investment in the pulp and paper industry with that of other industries, indicates a relatively poor performance by pulp and paper.

The above comments on return are valid when the pulp and paper industry is evaluated with regard to financial return to capital. The return outlook may, however, have a totally different magnitude, especially in the context of a developing economy, if the investment is evaluated in terms of benefits to the economy as a whole taking account of positive factors such as employment, boost to other industries and training effects as well as negative effects such as air and water pollution.

3.2.6 *Foreign Exchange*

Most developing countries which have foreign exchange difficulties also import the bulk of their paper and paper products. On an average, countries which, in 1973, manufacture less than 10 percent of their total consumption of paper, spent a little over 1.5 percent of their total import expenditures on paper and paper products (24, 35). This percentage may appear insignificant but could be significant in offsetting a trade deficit in a particular country.

The paper importing countries, if they are to establish an effective pulp and paper industry must, however, import equipment, machinery and other items; the impact of this outflow of foreign exchange will inevitably defer the positive import substitution effect depending on if international loans are involved or not, the breakeven point in import expeditures will not be achieved until eight to twelve years after the start of production. In the event of continuing import of energy, part of fibre furnish and chemicals, the foreign exchange advantages of domestic production fade further into a distant future.

Note should be taken of the fact that the smaller the production unit, the longer it takes to realize the foreign exchange advantage; conversely, the larger the domestic market, the earlier the import substitution effect will materialize.

3.2.7 *Resource Utilization*

The large scale commercial manufacture of paper was developed and established to utilize a resource which, to a large extent, was made up of residues from logging and mechanical wood industries. This resource was not claimed by any other economic activities and its disposal was sometimes connected with costs.

Several of the developing countries, especially those within the humid tropics, have extensive, under-utilized resources of mixed tropical hardwoods which have a potential as fibre resource base. In addition several countries also produce large amounts of agricultural residues which could be utilized for pulp and paper manufacturing. In other words, there are developing countries which have a resource base for pulp and paper manufacturing which hitherto has not been used or are put to a low economic use. The utilization of this resource in a high value added industry could give a substantial boost to development, earnings and employment. However, when evaluating the potential of such resources, competing claims to these resources must be taken into consideration, particularly where these uses are more essential than pulp and paper.

3.2.8 *Combined Criteria*

The characteristics of the pulp and paper industry emerging from the above discussion is that of an industry of low employment relative to investment, low return on investment, strong linkage and multiplier effects but with an otherwise average profile. Based upon these characteristics alone, it is not possible to classify the pulp and paper industry in terms of its potential to induce development. The dull profile of the industry makes it necessary to evaluate the development impact by the industry from case to case in the light of the economic, social and resource situation in which the industry is required to perform within a given country. In other words, although the development potential of this industry could be significant, it is difficult to make a strong case for priority, relative to alternative investment options, based strictly on quantifiable criteria.

Many of the factors which must be taken into consideration in the ranking of investment priorities are socio-economic in nature and cannot be quantified in precise terms. These relate to such aspects as the desire to promote and maintain a high standard of literacy and education, the extent to which paper should be used in the dissemination of information, and the strategic values which a particular government might place on security of supply and the control over production and price of products.

If an industry project has prospects of good financial returns it will probably be rapidly implemented by the private sector provided no government constraints prevent this. If, on the other hand, as is often the case with pulp and paper industries, the return prospects are less bright the implementation is doubtful without government support. In such cases the implementation becomes a question of political will rather than a result of economic forces.

From the above follows that the identification of opportunities has to be based, not only on economic and resource considerations, but has to include direct dialogue with political leaders of the countries involved.

4 Primary Identification of Opportunities

The Pulp and Paper Industries Development Programme, because of its limited manpower and financial resources, had to make a screening of development opportunities so as to be able to concentrate on those cases which had the necessary prerequisites and positive environment for industry development. In this primary identification several approaches were used, most of them considering availability of resources and market and the technological development. One screening technique developed by the Programme is described below.

Historically, the pulp and paper industry of countries around the world, with the possible exclusion of Canada, started out as supplier to a domestic market. Even after years of expansion, diversification and modernization, the industry has remained basically a domestic supplier. Only a limited number of cases deviate from this rule.

The basic domestic nature of the industry implies that the size of the domestic market and the economy of scale of production were the major criteria in determining when and where a pulp and/or paper mill was established. This historic fact has been taken as a valid assumption to be used for the screening of developing countries in order to identify those countries which appear to have potential to develop new pulp and paper industries, or to expand existing capacity.

With this basic concept in mind, and assuming that *per caput* income and population determine the size of the domestic market, the historic trend in pulp and paper industry development should, at a given point of time, group pulp and paper producers on one side of an income-population function and non-producers on the other. If all producing countries (35) are plotted on a graph, with population size (33) along one axis and *per caput* income along the other (31), a market floor for pulp and paper producers becomes clearly distinguishable. A line or curve can be drawn below these points to represent the producers' or market floor. If non-producing countries are then added to the graph, the majority fall below the floor line for producing countries. The few non-producers which fall above the producers' floor should, according to the assumption, have the basic pre-requisite of a sufficiently large market to warrant further development of the industry.

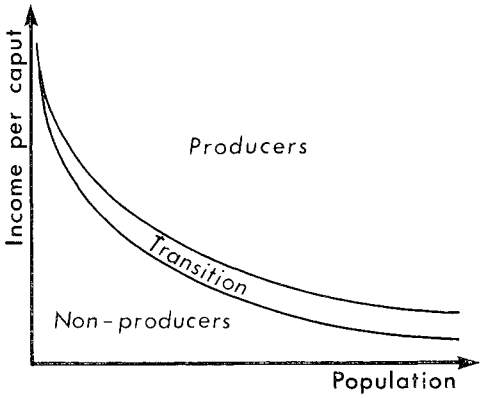


Figure 1. Stratification of Countries in Producers and Non-producers.

Since the market floor cannot be precisely defined, an area exists on either side, which contains borderline cases and which can be more accurately described as a transition space between producing and non-producing countries; this concept is illustrated in Figure 1.

It is clear that the market alone cannot determine whether or not a pulp and paper mill is justified; raw material must obviously be available in sufficient quantity. For in-

stance, Saudi Arabia, Singapore and Hong Kong, which have such limited domestic fibre resources as to preclude their consideration as potential pulp producers, were among the non-producing countries which were found above the floor line. There are also cases of countries having large forest resources (89), large population and low *per caput* income which suggests the probability of major pressures to convert existing forest land to agriculture. In these cases wood may be used for direct household consumption to an extent that sufficient fibre to maintain a domestic pulp and paper mill might not be available, after other more essential forest products requirements have been met. Similarly, there are countries within and above the transition space which, though having a limited forest resource, could have adequate fibre to meet their domestic requirements, since the combination of a low population and high *per caput* income places a less severe strain on resource availability for industrial production than a high population-low income situation.

Assuming, on the basis of the above, that forest area *per caput* and income *per caput* together determine the ability of a country to divert sufficient pulpable wood from other uses to sustain a pulp and paper industry, and to consume the output of that industry, a graph using these criteria as coordinates was prepared and an appropriate transition space was determined. Although the majority of the non-producing countries fell below the transition space, a number of them fell within or above; the implication being that those above have, and those within may have, the requisites needed to support a pulp and paper industry.

An analysis of the type outlined above cannot in itself be considered as representing a final basis for selection, since in those countries with high populations, where the forest area *per caput* is low, the actual total area of forest could be more than sufficient to sustain a mill of the desired capacity. Accepting this point, a third graph was prepared with *per caput* forest area and total population as coordinates. By plotting the requisite figures for producing countries on this graph a third transition space was derived; this third transition space was less clearly defined than those in the income-population and income-forest area graphs, since the transition space was wider.

After those countries having no pulp and paper industries were plotted on the graphs, followed by careful subjective analysis, a selection of countries was made using the above or below separation principle to identify those having obvious potential for development from the non-potential and unclear cases.

The first analysis identified those countries worthy of further study. This did not, however, provide the degree to which a country should be selfsufficient. The transition spaces, as described above, can be varied within the scale of paper production to indicate that combination of population, income and resource which has induced a given country to produce a specific level (such as 30, 50 or 75 percent) of its paper requirement. The analysis of this information would indicate which non-producing countries have the basic prerequisites for a domestic pulp and paper industry and provides an order of magnitude for the extent to which self-sufficiency may be attained.

In order to determine this, another set of curves was derived using the same income-population-resource criteria for three levels of production, arrived at by an examination of the present percentage of self-sufficiency derived from production data from individual producing countries and their pulp and paper consumption statistics averaged for the years 1972—74 (35).

All producing countries of the world were classified into one of three production categories as follows:

i) those that produce between 10 and 50 percent of their requirements
ii) those that produce between 50 and 75 percent of their requirements
iii) those that produce more than 75 percent of their requirements

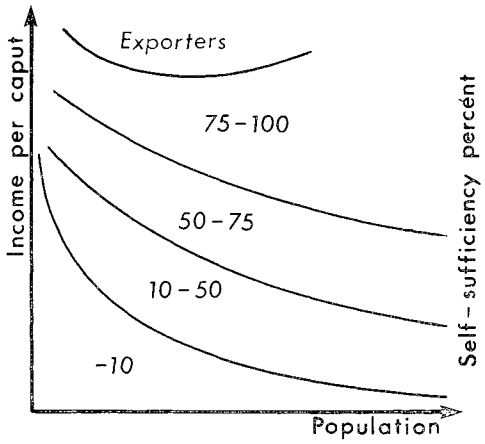


Figure 2. Division of Countries into Self-sufficiency Strata.

Countries which produce less than 10 percent of their requirements were classified as non-producers.

From the points on the graphs, curves were drawn to represent and identify each of the production groups as illustrated in Figure 2. An examination of the plotted data showed that some countries clearly deviated from their production category. If this deviation for any specific country was consistent on all three graphs, this fact was accepted as evidence that the particular country had potential for the expansion of the industry.

Similarly, non-producers were identified on these graphs to determine their potential capacity.

The methodology outlined above is based solely on two indicators: market as an income-population function, and resource availability. The nature and quality of the resource has not been considered, and historic conditions have been assumed with regard to the economics of investment and production. Since more appropriate criteria, incorporating market-resource combinations which will make development viable in the future, cannot be predicted, the analysis has used historic trends, accompanied by subjective judgements, as being the most pragmatic basis for determining the selection of which countries to study.

The analysis indicates that of all countries, which in 1973 had no established pulp or paper industry or produced less than 10 percent of their own requirements, those listed in the following table have the requisite combination of markets and re-

Table 4. Countries Having Potential for Pulp and Paper Industry Establishment. (Consumption ranges in '000 tonnes.)

Degree of self-sufficiency					
75 %+		50 %—75 %		10 %—50 %	
Country	Projected consumption 1981	Country	Projected consumption 1981	Country	Projected consumption 1981
Malaysia	280—300	Ecuador	190	Zambia	65— 70
Mozambique	50	Ivory Coast		Tanzania	25— 30
		Ghana	60—70	Senegal	15— 20
		Bolivia	35—40	(Nigeria)	340
		Zaire	30	(Costa Rica)	170—180
		Honduras	80—90	(Kenya)	100
		Paraguay	20	(Sudan)	45
		Papua New Guinea	15—25	(Ethiopia)	25— 30
		Dominican Republic	75—80		
		Nicaragua	35—40		

Table 5. Countries Having Potential for Expansion of Their Pulp and Paper Industry. (Consumption and Production ranges in '000 tonnes.)

Country	Actual self-sufficiency % in 1973	Desired self-sufficiency %	Projected consumption 1981	Minimum additional capacity requirement for desired self-sufficiency by 1981
Iran	30	75+	1260	870
Guatemala	30	75+	110— 125	60— 75
Panama	20	50—75	190	80
Angola	50	75+	60— 75	30— 35
Cameroon	25	50—75	30— 35	7— 10
Indonesia	30	50—75	340— 360	135—145
Thailand	60	75+	410— 430	160—175
Hungary	60	75+	830— 900	300—360
Greece	60	75+	420— 500	125—185
Venezuela	70	75+	1090—1220	510—610
Bulgaria	70	75+	910— 940	410—430

sources to justify domestic production. The table also groups each country into that category of self-sufficiency which the analysis indicated it should have already attained. For each country the requirements in 1981, as projected by FAO (28), are also given.

The countries are listed in order of priority as indicated by the analysis. Parentheses indicate those countries in which industry is established but had not, by 1973, attained a production level equivalent to 10 percent of their paper requirement.

The similar analysis of those countries which, in 1973, were producing more than 10 percent of their consumption and which, in accordance with the criteria used, could justify investment into the future expansion of their pulp and paper sectors to achieve a high degree of self-sufficiency gave the results tabulated in Table 5.

In addition to the above there are two groups of countries which, on the merit of historic indicators, require further resources in order to meet the desired level of domestic self-sufficiency. The first group requires *new* resources (plantations) as a prerequisite to the establishment of an industry, whereas the second group requires *additional* resources (pulpwood plantations) in order to meet the market conditions. These groups and countries are given in Table 6.

In the case of Costa Rica, Zambia and Senegal, existing resources, in 1973, were

Table 6. Countries Having Potential for Pulp and Paper Industry Establishment or Expansion Provided Additional Resources are Created. (Consumption and Production ranges in '000 tonnes.)

New resource pre-requisite for industry establishment			Additional resource necessary to meet market conditions		
Country	Desired % of self-sufficiency 1973	Paper requirement 1981	Country	Desired % of self-sufficiency 1973	Paper requirement 1981
Jamaica	50—75	115—125	Costa Rica	50—75	170—180
El Salvador	50—75	60— 70	Zambia	50—75	65— 70
Trinidad	50—75	75— 80	Senegal	50—75	15— 20

adequate to support a self-sufficiency of 10 to 50 percent, as indicated in Table 4. The creation of additional pulpwood resources would enable these countries to attain the higher levels of self-sufficiency as shown in Table 6.

Studies of *per caput* consumption as a function of income indicate that deviations from a worldwide income-consumption function are frequent and probably can be explained by other factors such as literacy, industrial development, income distribution and consumption habits of many developing countries. For instance, countries such as Tanzania, Senegal, Paraguay and Papua New Guinea may, because of the impact of such factors, be considerably below world average in *per caput* consumption, and may, therefore, not appear to juistfy the establishment of a new domestic industry. This assumption should not be taken for granted; small market cases of this type should be subject to further investigation in order to establish whether the low apparent consumption level is due to fiscal constraints or to exceptional prices because of location or whether the major portion of import is in the form of converted paper products and thus escapes the statistics which, in many countries, are based on bulk paper trade.

It is also possible that paper production in a country automatically generates additional consumption and, therefore, the presence of such industries has stimulated an increase in the level of consumption in producing countries, compared to non-producing. If this is the case, the extent to which this change in consumption can be expected to occur should be carefully considered for countries such as Tanzania and Senegal, bearing in mind their specific economic conditions and consumption habits.

The screening process as described above is indicative only. It serves the purpose of a rapid and objective comparative analysis designed to supplement the more subjective evaluation of available country information. The analysis serves the function of highlighting discrepancies and as a check to assumptions derived from other sources. The screening process thus facilitated the Pulp and Paper Industries Development Programme to determine the priority areas for more detailed field examination, taking into consideration the limited resources which were at its disposal.

5 The ASEAN Case

Among the countries which stand out as having potential for new industry establishment is Malaysia and among those having potential for expansion are Indonesia and Thailand; all three members of the Association of Southeast Asian Nations (ASEAN). Of the other countries in ASEAN, Singapore has the market and the technological development to support a domestic pulp and paper industry but lacks the resource base, while the Philippines appears to have developed and continues to develop her industry in harmony with resource availability, market requirements and economic development. Within the ASEAN community, which is in the process of developing far-reaching economic cooperation, there appears to be technically a strong case for further development of the pulp and paper industry. The fact that the member countries have agreed to place pulp and paper on their list of essential industries, on which early cooperative programmes are to be designed, appear to guarantee also a political will for such development (6, 8).

Geographically the Association of Southeast Asian Nations comprises Thailand, as the only continentally attached block of land, and a vast archipelago covering over 45° along the equator and extending some 25° in north—south direction. The main consumption centers, which contain some of the most populus urban concentrations in the world, are divorced from the resource areas by large expanses of water or extensive areas of agriculture land. The forest resource is dissected into thousands of islands and, wherever concentrated areas are to be found, the population is low and infrastructure facilities undeveloped. These geographical and demographical characteristics mean that the development of the pulp and paper industry will involve large investments into infrastructure and services as well as into the industry itself and the magnitude of these investments together with the cost of investment will have a very strong impact on the location and viability of the industry.

The fact that the new establishment of paper industries in ASEAN involves pioneering efforts at the very frontier of economic development constitutes, financially, a very serious obstacle, but may, from a socio-economic point of view, be of great value, especially in Indonesia and Thailand, which desperately need geographical diversification of economic activities, so as to relieve the population pressure in the densely populated areas of Java and the central agriculture zone of Thailand. The same need for diversification exists also in the Philippines, where development outside the Metro Manila area is desired, and in Peninsular Malaysia, which needs alternatives to the continued concentration of development to the West Coast.

What is said above indicates that the rational expansion of the pulp and paper industry in ASEAN, because of the geographical nature and vastness of the area, requires careful analysis and affords few obvious lines of action. The development will depend, to a large extent, on political will and inter-country industrial cooperation and, therefore, the analysis of the sector has to involve evaluation and comparison of a large number of development alternatives. A demonstration of the existence of political will and inter-country cooperation was made at the 1976 Expert Consultation on Pulp and Paper in Rome, when an informal request was made to FAO to initiate an analysis of the ASEAN pulp and paper sector.

6 Problem Approach and Analytical Technique

6.1 Introduction

The task as identified by the Pulp and Paper Industries Development Programme, after receiving the request of ASEAN, was to carry out an analysis of the pulp and paper sub-sector of the ASEAN economy and through this analysis develop a tentative plan for the development of the sub-sector.

If a plan is to have any chance of leading to actual implementation of proposed activities it has to have political appeal. This appeal in turn is an indication of how much the implementation of proposed projects can be expected to assist in furthering social and economic aspirations of the people of the country or area for which the plan is made.

Looked upon in this manner the problem will be, not so much to find the optimal solution with regard to some economic criteria, but to find the best among those economically possible alternatives which will attract political support and can be implemented with the resources which are available. In this process the analyst/planner will need the assistance of political decision makers from various levels of the political hieararchy, in selecting policies to be applied, isolating feasible, from a political point of view, intervals within which the solutions may be found and screening alternative solutions until, what is judged to be the best alternative is found.

In short, what is required is a technical analysis under political guidance.

6.2 Political Guidance

The Assistant Secretary of Defence for Systems Analysis of the Johnson Administration, Mr Hain C. Enthoven, defined the role of political judgement and of technical and economic analysis in policy formulation in the following manner: "Ultimately all policies are made ... on the basis of judgements. There is no other way, and there never will be. The question is whether these judgements have to be made in the fog of inadequate and confusing personal opinions, or whether they can be made on the basis of adequate, reliable information, relevant experience, and clearly drawn issues. In the end, analysis is but an aid to judgement ... the judgement is supreme" (20).

Fisher (71) has in similar manner elaborated on the role of the analyst in policy and decision formulation.

Cleland and King (22) attempted to define more precisely the devision of responsibility between the analyst and the political decision makers. They also stress the shortcomings of systems analysis in incorporating all aspects of reality and the impossibility of considering all possible alternatives. "System analysis ... is an imperfect instrument, an advisory art with many limitations" (22). Luenberjer (82) and Hadley (74) also emphasize that no model can be made an exact image of the real world and Luenberjer expands on the need to employ tradeoffs between accuracy in model design and building models that are practical and workable. Similar views are expressed by Adamson (3) who also sees the role of model analysis in assisting in judgement as relatively less important if the data base is weak and the stage of economic development is low.

A thorough review of the role of various participants in the analysis-decision process is provided by Lichfield and others (80) who dwelt, to some extent, on the conflicting views of the analyst/planner and the decision makers.

All the above quoted persons are con-

cerned with present day political decision making and modern analytical facilities and methodology. It should, however, be pointed out that the idea of combining analysis and judgements in problem solving is not a modern phenomenon. As early as 1763 the Reverend Thomas Bayes (11) advocated this in the Royal Society.

A concrete example of how analysis with political guidance has been applied practically was provided by Schultze (91) in a series of lectures delivered at the University of California, Berkeley in 1966. In these lectures he describes the Planning, Programming, and Budgeting System (PPB) of the US Department of Defence established by Secretary of Defence, Robert S. McNamara, during the Kennedy Administration and which later was applied also to civil agencies by president Johnson. The PPB, in short, is a process of evaluations and analysis as assistance in the bargaining process which establish budget allocations according to judged relative merits of projects.

An application to forestry of analysis with political guidance was made in Malaysia by FAO (4, 30), when assisting the Government in developing a plan for forest and forest industry development. In this planning exercise the interaction between the analyst/planner and government decision maker was formalized in a manner which provided for presentation of estimated effects of the implementation of alternative strategies, in relay sets, with Government policy decisions on each successive set, so that the search area was narrowed down step by step until the final plan emerged (27). In the Malaysia exercise there was no attempt, by the analyst/planner, to determine an optimal strategy. The selection was purely political but with analytical aid.

It may very well turn out that the plan which is developed and the policy decisions which have been made have to be changed very soon after the plan has been formulated and the policies determined, because some of the assumptions used in the analysis did not hold good in the long term and the forecast which form the basis for decisions and analysis proved to be wrong. Because of this it is sometimes argued that long term planning is futile and the analytical approach unrealistic (17, 81).

However, in general there is an agreement that political decision making needs the assistance of analysis to formulate alternatives, clarify the interactions between key variables and to provide evaluations (71). Especially "when a great deel hangs upon a decision, then it will be prudent to gather information and construct alternative estimates of different possibilities using different hypothesis" (86).

In the use of analysis with political guidance in plan and policy development there is, of course, always a risk that the right balance between analysis and judgement is not found. When planning for something relatively unknown there is a risk that the analysis is trusted more than its data base and accuracy would warrant. On the other hand, if the analysis is introduced into a field where the decision making process traditionally has been based on judgement, the analysis may not be given the attention it deserves.

"It may, indeed, be necessary to guard against the naivite of the systems analyst who ignores political constraints and believes that efficiency alone produces virtue. But it is equally necessary to guard against the naivite of the decision maker who ignores resource constrains and believes that virtue alone produces efficiency" (91).

The planning of the ASEAN pulp and paper sector involved not only finding individual country strategies acceptable to the government concerned. It required also, and most important, the development of industry expansion programmes and product trade patterns which could be supported by all member countries of the Association. As the five countries of ASEAN had reached different stages of technical and industrial development and were faced with widely differing foreign exchange conditions and trade balances, the need for political guidance was accentuated and at the same time difficult to ob-

tain and accommodate.

The Pulp and Paper Industries Development Programme was, throughout the analysis and planning process, free to consult with the government of any one of the five member countries of ASEAN, though the geographical distance between Rome and ASEAN made such consultation difficult. In addition, and in order to provide a common political reference base for the Association as a whole, policy questions could be referred to the ASEAN Experts' Group on Pulp and Paper through its Chairman. Again, the long communication distances precluded intensive use of this guidance.

Thus, political guidance was all the time available, though the time, cost and effort involved in obtaining it made this input to the analysis and plan development less efficient than desired. This is discussed further in Chapter 20.

6.3 **Choice of Analytical Technique**

The probleme to be analysed and solved in the ASEAN case involved finding an optimal supply pattern for pulp and paper, over a period of time which was specified to 20 years, and under various financial and political constraints.

The parameters which could be quantified and used in the analysis can be specified as follows:

a) geographic location, nature and productive capacity of existing raw material resources,
b) geographic location of potential, new resources, the cost of establishing them and their nature,
c) geographic location of existing industry and cost of expanding this industry for various grades of pulp and paper,
d) geographic location of potential new mill sites and the cost of developing them for various grades of pulp and paper,
e) cost of raw material from existing and new sources at existing and new mill sites,
f) cost of transporting intermediates, such as pulp, between mill sites,
g) direct costs of producing various paper grades at various mill sites, new and old,
h) geographic location of consumption areas and their requirement of various grades of paper at future points of time,
i) cost of transporting finished products from existing and potential new mill sites to consumption areas,
j) cost of imported pulps at old and new mill sites,
k) cost of imported papers at the consumption areas, and
l) revenues from export of intermediates and final products.

The basic problem was to find an optimal manner of concentrating raw material to processing points and distributing finished products to consumption areas or, in other words, find an optimal spatial allocation of activities in the pulp and paper sector.

The nature of the problem is not unique to forestry or pulp and paper manufacturing. It is basically a transportation problem and as such applies to many activities in an economy. Mathematical models have been developed, using a transportation problem approach for many economic sector and sub-sector as tools for planning. Examples can be quoted from agriculture (15, 16, 94, 98), petroleum industry (2) and retail trade (25) to mention a few.

All of these models, or almost all of them, when applicable to spatial allocation of activites, use linear programming techniques. As mentioned earlier the problem of finding optimal allocation of activities in the ASEAN pulp and paper economy is a transportation problem, and it is for this type of problem the linear programming technique has been developed. The fact that investment costs, manufacturing expenses and supply from outside sources are involved does not alter this basic characteristic of a transportation problem.

Linear programming has been known and used for a long time and its theory has

been fully accepted. However, the application to large problems, involving many constraints, was hampered by the cumbersome technique of finding the optimal solution until in 1947 Dantzig (23) developed an iterative algebraic technique, named the Simplex Method, which provides exact solutions to any linear programming problem. The Simplex Method is, in addition, relatively easy to programme for computer processing, a fact which greatly widened the applicability of linear programming.

Several of the large computer firms have developed programming products for solving linear programming problems. These products are designed to handle the mathematical mechanics of deriving solutions. When using them for the analysis of a specific problem it is necessary to, in the form of additional programmes, arrange the data, specify the problem and provide for the presentation of results.

From approximately 1965 applications of linear programming to various forestry and forest industry problems are becoming common. Mention can be made of Andersson 1971 (5) and Wardle 1965 (95) for forest management, Tcheng 1960 (93) and Lönner 1968 (83) for forest harvesting, Kidd (79) and associates 1966 for forest regulation, Holley 1968 (76) for timber market studies and Buongiorno (18) and associates 1973 for reforestation.

A good review of application of operation research, including linear programming, to forestry up to 1973 is provided by Martin and associates in US Forest Service General Technical Report NE-8 (84). Kepi made in 1978 a review of various types of models applicable to raw material supply and compared their relative merits and short comings (78).

In the planning of the forest and forest industry development in Malaysia, mentioned earlier, linear programming technique was used to find the best economic distribution of logging and industry activities (29). The linear programming analysis was used after the selection of the general strategy and served, besides determining the optimal allocation of industrial activities, to identify those transport routes which needed improvement and those port facilities which required upgrading and expansion.

In a forestry and forest industry planning exercise which was started in 1976 for Indonesia, FAO in cooperation with the Indonesian Government, has developed a model based on linear programming to establish the most efficient pattern of supply of wood products to the domestic market (19, 39). This model is designed to give optimal locations for logging and industry, identify most efficient supply routes and indicate requirements of port capacities both for domestic supply and export.

The Development Research Center of the World Bank has over a number of years been working on several sector applications of linear programming. The most widely known of these is their fertilizer model (73). The latest successful application is a model for forest sector analysis (13).

The IBRD model was, in the course of its development, applied to a forest industry planning problem in Turkey (14). Later on FAO tested the model performance in a special study on Malaysia (49).

On the merit of the model's performance in these studies it was selected for use in the ASEAN analysis.

The model, which is described in broad outline in Appendix I, is limited with regard to the size of problem which can be calculated in one single computer run. Since ASEAN contains an extremely wide range of potential development options, it was necessary to adopt a step by step approach involving successive elimination of options and aggregation of data.

The process of elimination and aggregation has, by necessity, required some simplification of the problem, based, to some extent, on subjective judgements, as the analysis proceeded. It is possible that these simplifications of the problem precluded the identification of fine distinctions between potential mill sites located close to each other and having similar cost conditions. This possible defect in the analysis was, however, regarded as being only of marginal

importance at the initial stage of strategy development.

The magnitude of the analysis which was undertaken can be illustrated in general terms by the number of different alternatives which were considered for each of the main input factors in the 1977 analysis. These were:

Factor	Number considered
— Pulpwood supply areas	74
— Forest harvesting regimes	6
— Collection points for mechanical wood-based industry residues	65
— Supply areas for other fibres (bagasse, rubber wood, bamboo, straw)	41
— Collection areas for waste paper	34
— Potential pulp and paper industry sites	52
— Market areas	43
— Intermediate products (pulp, processing chemicals, chips)	10
— Finished paper products	7
— Other final products (plywood, lumber, etc.)	4
— Time periods (within the total planning period of 20 years)	4

7 The Pulp and Paper Industry

7.1 Existing Mills in 1977

The pulp and paper industry of the ASEAN nations is characterized by small units using imported pulp and waste paper as raw material. The capacity of the pulping units was, in 1977, sufficient to supply only approximately one third of the fibre requirement of the paper industry. Only two paper mills and one pulp mill had rated capacities of 50,000 tonnes per annum or more, as can be seen from the following tables, while 55 out of 77 paper mills had capacities below 10,000 tonnes per year and 20 of the 28 pulp mills were rated as below 10,000 tonnes capacity (1, 90). It has to be pointed out, however, that the small pulping units in the Philippines are largely geared to the production of high priced abacca pulp for the Japanese market.

Part of the pulp and paper industry of ASEAN is relatively old though the major capacity increment has been realized after 1968, as can be seen in Figure 3 (p. 32).

The diagram also indicates that there appears to be no trend towards larger mill units, though the largest mill in the area,

Table 7. Pulp Manufacturing Units in ASEAN in 1977.

Country	Design capacity '000 TPA —5	5—10	10—25	25—50	50+	Total capacity '000 TPA	No. of mills	Average capacity '000 TPA
Indonesia	4	4	4	1	—	129	13	9.9
Malaysia	—	—	—	—	—	—	—	—
Philippines	5	4	—	1	1	231	11	21.0
Singapore	—	—	—	—	—	—	—	—
Thailand	1	2	1	—	—	39	4	9.8
Total	10	10	5	2	1	399	28	14.25

Table 8. Paper Manufacturing Units in ASEAN in 1977.

Country	Design capacity '000 TPA —5	5—10	10—25	25—50	50+	Total capacity '000 TPA	No. of mills	Average capacity '000 TPA
Indonesia	11	8	5	—	—	165	24	6.9
Malaysia	1	2	—	—	—	20	3	6.6
Philippines	8	2	6	3	1	399	20	20.0
Singapore	2	—	—	—	—	6	2	3.0
Thailand	12	9	4	2	1	312	28	11.2
Total	34	21	15	5	2	902	77	11.7

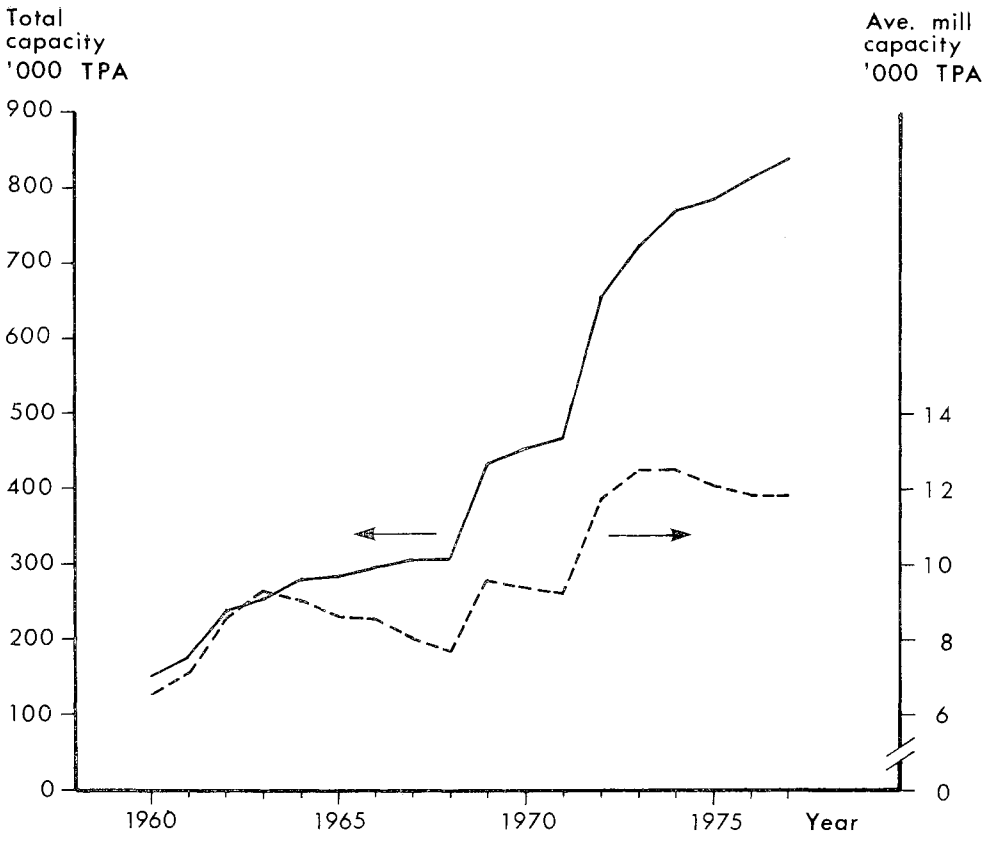


Figure 3. Development of the ASEAN Pulp and Paper Production Capacity since 1960.

PICOP at Bislig, Mindanao, came into operation in 1972.

The paper producing capacity installed up to end of 1977, distributed on paper machine types, is given in Table 9 (1, 90).

Table 9. Paper Manufacturing Capacity in 1977 Distributed on Grade/Type of Paper. ('000 TPA.)

Paper grade	Indonesia	Malaysia	Philippines	Singapore	Thailand	Total (rounded)
Newsprint	—	—	75	—	—	75
Printing and writing papers	101.5	—	22.5	—	62	186
Kraft paper	—	—	122	—	157	279
Cigarette paper	2.5	—	—	—	—	3
Tissue paper	1.5	—	7.5	—	18	27
Boxboards	19	—	45	—	24	88
Light grades	35	20	55	6	52.5	168
Heavy grades	5	—	75	—	—	80
Total (rounded)	165	20	402	6	313	906

Table 10. Paper Mill Capacity Under Construction in 1977 Specified on Country and Product Line. ('000 TPA.)

Country	Newsprint	Printing and writing	Packaging paper	Other paper	Boards	Total
Indonesia	—	65	18	1	12	96
Malaysia	—	—	—	—	—	—
Philippines	20	—	—	—	—	20
Singapore	—	—	—	—	—	—
Thailand	—	—	65	—	—	65
Total	20	65	83	1	12	181

7.2 **Expansion Plans in 1977**

The following expansions of paper manufacturing capacity within ASEAN was under active construction in 1977 (34), Table 10.

In addition to the above a number of projects for new establishment and expansion were in stages of advanced planning. In these projects the capacities in Table 11 were considered (34).

There were also plans for establishing capacity for a total of 130,000 TPA of market pulp in Thailand and 175,000 in the Philippines.

Several other projects involving all the member countries were being discussed in 1977 and some of these had reached a stage when pre-feasibility studies were initiated.

7.3 **Raw Material Resources**

Ninety percent of the forest resources of the ASEAN countries is made up of tropical hardwoods most of them tropical reinforest species in various admixtures. A general characteristic of this hardwood resource, is its large number of species covering wide ranges of basic waight, hardness and colours.

Indigenous coniferous species are few (mainly Pinus and Agathis spp.) and mainly found in high-lying areas with difficult access. Extensive areas of coniferous are found in Northern Luzon, Northern Sumatra, Northern and Eastern Thailand. The areas of coniferous (Pine) forests in these four geographical locations, as estimated from aerial photographs by respective

Table 11. Pulp and Paper Industry Expansions in Advanced Stage of Planning in 1977 Specified on Country and Product Line. ('000 TPA.)

Country	Newsprint	Printing and writing	Packaging paper	Other paper	Boards	Total
Indonesia	—	137	—	—	9	146
Malaysia	—	—	—	—	—	—
Philippines	—	80	—	—	24	104
Singapore	—	—	—	—	—	—
Thailand	160	115	155	10	—	440
Total	160	332	155	10	33	690

country's Forest Department, are as follows:

Table 12. Areas of Extensive Coniferous Forests. ('000 Hectares.)

Hectares	
Northern Luzon	200
Northern Sumatra	200
Northern Thailand	150
Eastern Thailand	100
Total	650

All ASEAN countries except Singapore have implemented forest plantation programmes. The major portion of these plantations are aimed at providing raw material for pulp and paper manufacturing. The areas planted up to end of 1975 are given in the table below:

Table 13. Pulpwood Plantations Established up to End of 1975 Specified on Species and Country. (In '000 Hectares.)

Country	Coniferous	Broadleaved
Indonesia	150	30
Malaysia	5	—
Philippines	42	2
Thailand	6	1
Total	203	33

The estimated rotation period for the coniferous species is between 10 and 15 years with a total volume production of 15—18 m^3 per annum. Corresponding figures for broadleaved pulpwood species, mainly Albizia falcataria, are 8—10 years and 25 m^3 per year.

are concentrated to Central and East Java and the Lake Toba area of Sumatra. In the Philippines the emphasis is in N. E. Mindanao and the area North of Manila. Main plantation areas in Malaysia are located in Central and South of the peninsula, and in Southeast Sabah and in Thailand in the northernmost province (see Map 1, p. 36).

The four forest countries of ASEAN, Indonesia, Malaysia, the Philippines and Thailand, have plans and budgetary commitments for continued plantation establishment. In 1977 these plans considered the following annual areas:

Table 14. Planned Annual Pulpwood Plantation Area Specified on Country and Main Species. ('000 Hectares.)

Country	Coniferous	Broadleaved
Indonesia	9	3
Malaysia	2	—
Philippines	1	—
Thailand	2	—
Total	14	3

The economies of the ASEAN countries, except Singapore, are largely based on agriculture and residues from this sector, in the form of rubber wood, rice straw, bagasse, etc. constitute raw material resources of considerable size. The estimates of the magnitude of this resource, which can be made from available agricultural statistics, are summarized in Table 15. The table also gives estimated yield from pulpwood plantations and potential available quantities of residues from mechanical forest industries.

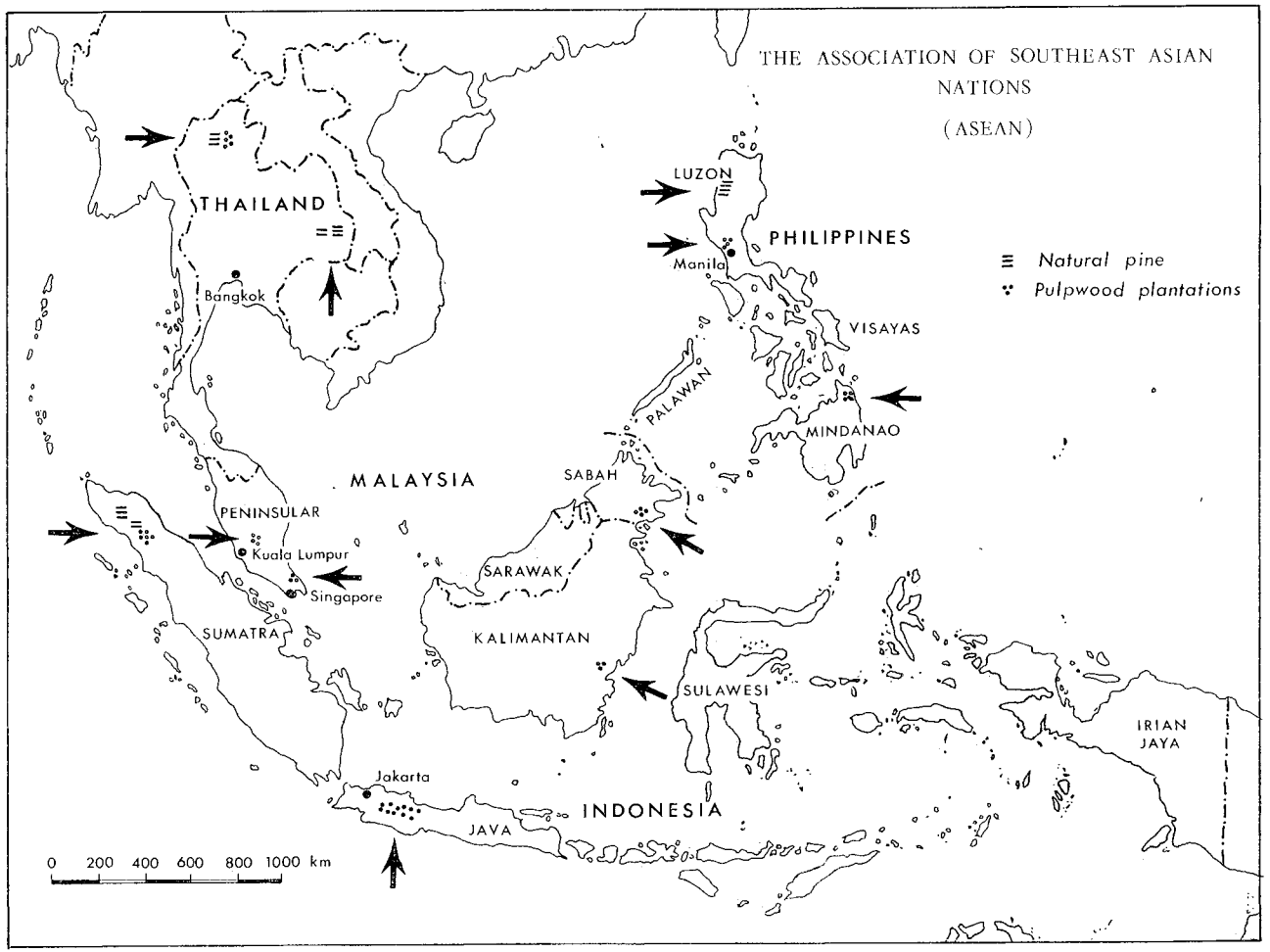
Table 15. Estimated Physical Availability of Sawmill and Plywood Mill Residues, Plantation Pulpwood ('000 m^3) and Agricultural Residues ('000 TPA) in ASEAN Member Countries in 1980—2000, Average per Year.

Country	Mill residues	Pulpwood		Rubber wood	Straw	Bagasse
		Long fibre	Short fibre			
Indonesia	13,300	3,780	14,600	30	300	1,100
Malaysia	3,900	1,970	14,000	1,210	180	350
Philippines	5,700	3,050	17,100	—	3,400	1,150
Singapore	400	—	—	—	—	—
Thailand	11,900	660	13,000	3,200	3,950	130
Total	35,200	9,460	58,700	4,440	7,830	2,730

It is estimated that the waste paper quantities indicated in Table 16 can be made available to the paper industry.

Table 16. Waste Paper Availability in ASEAN at Various Points of Time. ('000 TPA.)

Country	80—85	85—90	90—2000
Indonesia	30	35	50
Malaysia	55	65	70
Philippines	90	95	110
Singapore	55	80	120
Thailand	35	45	70
Total	265	320	420



Map 1. Location of Areas of Natural Pine and Pulpwood Plantations.

8 Field Work in 1976

The collection of data for the first analysis took place during the period August to December 1976 and utilized the widest possible variety of sources. Field visits, comprising a total of three man-months, were made to each country where planners and industrialists were interviewed. However, the field team, which consisted of two forest economists and one logging engineer, had no pulp and paper industry expert, something which constituted a risk for omissions in the data.

The field data were supplemented by data from official statistics, multilateral and bilateral international assistance, reports and consultancy studies.

Altogether some six man-months of PPIDP time were used for data collecting in 1976.

9 Data and Assumptions for the 1977 Analysis

9.1 **Input Data**

The input data used in the analysis were obtained from agencies and industries, public as well as private, in the countries concerned, from published documents and from official FAO reports and papers. Each major group of data was verified by appropriate departments in the ASEAN member countries and adjustments, if this was judged as justified, were made before they were adapted for the computer model.

Similarly, all assumptions were discussed in meetings with officials in the various countries of ASEAN before they were given their final form and applied to the analysis.

The main data fields considered in the analysis were those of:

- Fibre resources—volume, composition and distribution,
- costs of harvesting and collecting fibre raw material,
- costs of transporting the fibre resources to the mill site,
- cost of investment into mills and their required infrastructure,
- cost of processing in mills, including cost of labour, energy, chemicals and other inputs,
- costs of distributing finished product to consumers, and
- costs of import of finished and intermediate pulp and paper products and raw materials.

Those input data which are specific to the individual countries of ASEAN are summarized in PPIDP Working Paper 8 and Annexes 1—3 of Working Paper 20 (49, 50, 63, 64, 65). For ease of reference certain data applicable to ASEAN as an integrated sub-region are summarized below.

9.1.1 *Paper Requirements*

The paper consumption forecasts made by FAO in 1975 for the period up to 1991 (38) have been extended to the year 2000 and incorporated in the input data. These forecasts were based on the historic trend for the period 1960 to 1972 and on estimated future growth trends for population and GDP. The analysis has used the low consumption alternative of the FAO forecasts with the exception of newsprint in Thailand and the Philippines where the high consumption alternative appears to be more realistic in the light of actual trends which have been established since 1972. The requirement of printing and writing paper in Singapore, and of industrial papers in the Philippines has been reduced to below that of the FAO forecasts for the same reason.

Values for the consumption of paper as used in the analysis are summarized in Table 17, which also gives the actual consumption in 1972 as an average for the three-year period 1971 to 1973.

Projections of paper consumption are based on the assumptions in Table 18 with regard to the growth of population and income.

9.1.2 *Import Prices*

Throughout the analysis, the prices of imported pulps and papers are based upon average estimated c.i.f. prices derived from the export prices which prevailed during the latter part of 1976 in the major supply countries. These c.i.f. prices were adjusted to allow for the cost of delivery to various locations in ASEAN and thus varied between countries. See Table 41 for example.

Table 17. Consumption of Paper and Paper Boards in ASEAN 1972, 1985, 1995 and 2000. (In '000 TPA.)

Product	1972	1985	1991	1995	2000
	Actual	Forecasts			
Newsprint	256	430	678	825	1050
Printing and writing	216	535	840	1050	1380
Linerboard		395		855	
Sack kraft		195		410	
Fluting	577	130	2165	285	4330
Folding boxboard		330		800	
Wrapping paper		315		595	
Total	1049	2330	3683	4820	6760

Table 18. Estimated Population and Income Growth in ASEAN Member Countries.

Country	Population growth %		GDP growth % Low—high range	
	up to 1981	1981 onwards	up to 1981	1981 onwards
Indonesia	2.4	2.4	7.0—8.5	7.0—9.0
Malaysia	2.8	2.5	5.5—7.3	6.0—7.5
Philippines	3.3	3.3	5.5—7.0	6.0—7.5
Singapore	2.5	2.5	4.0—6.0	5.5—7.5
Thailand	3.3	3.3	6.0—8.0	6.0—8.0

9.1.3 *Industry Sites*

A total of 52 potential industry locations were tested in the analysis for the supply of various grades of pulp and paper to both the internal domestic market and the intra-ASEAN market; these locations are listed in Appendix II, and their broad geographical distribution, by country, is summarized below:

Country	No. of Sites
Indonesia	19
Malaysia	8
Philippines	16
Singapore	1
Thailand	8
Total	52

With the exception of the site in the vicinity of Chiang Mai in Thailand, all sites have been investigated in recent years by various domestic or expatriate firms with regard to their suitability for pulp and paper industries.

9.1.4 *Planning Periods*

The analysis covers a twenty-year period starting in 1981 since this is the first point of time at which it can be realistically foreseen that any project can be developed to the investment phase. The first period of 1981—1985 is regarded as the first investment period which could lead to the operational start-up of a mill by 1985.

In the summary of main results, in Chapter 10, investment is shown as taking place in two periods only: up to 1985 and from 1986 to 1995. During either period, the investment can be phased either through the construction of a specific mill in stages or between two or more mills in a specific locality. Completion of construction of the recommended capacity by 1995 is assumed, so that this can be fully operational to meet the forecasted demand in the period 1996—2000.

9.2 Major Assumptions

The following assumptions have been applied to the analysis of data:

— All investments yielding a financial rate of return of less than 10 percent before payment of taxes are rejected,
— those pulp and paper industries which were in production in 1976 can continue to operate up to the year 2000 provided that the solution of the analysis does not make them financially obsolete,
— all potential raw material resources, as specified in the individual country reports, will be available as required,
— all new pulp and paper mills, together with major expansions of existing mills, will incorporate full effluent treatment,
— no tariffs or other trade regulations will apply to the trade with pulp, paper or raw material required for the manufacture of pulp or paper between member countries of ASEAN,
— no external duties are levied on the import of pulp and paper making equipment, pulp and paper, or raw materials required for their manufacture into the ASEAN community,
— there will be no constraint on the availability of capital or foreign exchange either for investment or import,
— expatriate personnel having skills specific to the pulp and paper industry will be required to assist in mill construction, start-up and training for all new production units, and
— basic skills required for the construction of buildings and roads as well as for water and electricity installations will be available within the individual countries in which they are required.

The following fibre furnishes for the various grades of paper have been assumed throughout the analysis:

Table 19. Fibre Furnish for Different Grades of Paper 1977. (Percentage.)

Pulp grade	Liner board	Sack kraft	News print	Fine paper	Fluting	Folding boxboard	Wrapping paper
Unbleached hardwood pulp							20
Bleached hardwood pulp				75		15	40
NSSC pulp					85		
Groundwood, softwood			82[1]				
Unbleached softwood pulp		100				2	10
Bleached soft pulp			18[1]	25		20	20
Board grade pulp	100				15		
Waste paper						63	10

[1] For the Philippines the fibre furnish for newsprint is assumed to be 80 % refiner groundwood and 20 % bleached kraft pulp, all from hardwood.

10 Results of the First Analysis (1977)

10.1 General

The analysis identifies two distinct types of pulp and paper industries within ASEAN. These are:

— those industries which make a major contribution to intra-ASEAN trade in paper but which also supply local domestic requirements; and
— those industries which contribute solely to the domestic supply of paper within individual countries.

In the following are given, in broad detail, descriptions of those mills or groups of mills which have intra-ASEAN trade implications. Those mills which will supply local markets in their home countries only, and consequently are of limited interest to ASEAN as a whole, are summarized in Table 25 (p. 45).

10.2 ASEAN Mills

Five localities having significant opportunities for investment have been identified, of which one, although acting as a purely domestic supplier, will enable the release of a higher proportion of the production from one of the other four, for intra-ASEAN trade.

The five potential localities suitable for the establishment of ASEAN mills are:

Table 20. Suggested Location of ASEAN Mills (1977 Analysis).

Country	Reference No.	Locality
Indonesia	1	North Sumatra (Pematangsiantar Bireun)
Malaysia	2	Pahang (Temerloh area)
	3	Johore (Sedili)
Philippines	4	North Mindanao
	5	Luzon (Bataan Bulacan)

The analysis evaluated five potential mill sites in Kalimantan (Indonesia); these were rejected for the reason that production at any location in Kalimantan would not be financially competitive (in terms of purely domestic or ASEAN trade) with that from mills located in Java or Sumatra, or with direct imports, due to the high costs of investment into basic infrastructure and the costs of transporting finished products to the main consumption centres.

The analysis indicates a potential for the establishment of folding boxboard production in Singapore, with a capacity of some 120,000 TPA for purely domestic use based on waste paper and imported pulp. Due to a lack of raw material resources, Singapore must rely on import of all other paper grades.

A substantial expansion of production for domestic supply is suggested in the country report for Thailand. Although Thailand possesses resources in sufficient volume for expanded production, these, because of their location and quality, are not financially competitive in the context of total ASEAN resources and hence have no foreseeable role to play in intra-ASEAN trade

during the period up to the year 2000.

The main features of the suggested ASEAN mills are summarized below:

1. Northern Sumatra (Indonesia)

The analysis identifies the area lying between Pematangsiantar and Bireun as being the financially optimal locality for the establishment of large scale capacity expansion in Indonesia, in the context of ASEAN market requirements. The potential for gradually expanding manufacturing capacity to give a total production of 885,000 TPA by the period 1996—2000 is also confirmed. This proposed capacity expansion can be spread, if so required, over four potential mill sites within the area; the phasing of this capacity growth and the extent to which any particular mill site is developed must be determined by feasibility studies.

The production in the above locality will be based on the use of indigenous pine and hardwoods. The major part of the fibre supply will be derived from a more effective utilization of the existing growing stock including the use of small size and defective trees which have not previously been removed in logging operations, together with a substantial volume of fibre from logging residues and a lesser quantity from the mechanical wood-based industries which are already established in the area.

The financially optimal product mix for the period 1996—2000 is identified as:

Pulp	*Production*
Kraft pulp	365,000 TPA (of which 225,000 TPA is bleached)
Groundwood pulp	490,000 TPA
Paper and Paperboard	*Production*
Linerboard	150,000 TPA
Newsprint	575,000 TPA
Fine paper	60,000 TPA
Wrapping paper	100,000 TPA

(Production figures in all cases are rounded up to the nearest 5000 tonnes)

In the period 1996 to 2000, the following volume of fibrous raw material will be required each year to meet the production output as indicated above:

Softwood pulpwood	2,250,000 m^3
Hardwood pulpwood	400,000 m^3
Waste paper	11,000 tonnes

Approximately 9000 tonnes of waste paper per year would be imported from Penang in Peninsular Malaysia.

The first phase of development would comprise the construction of newsprint capacity to the extent of 165,000 TPA. The second phase should be in the form of a gradual build-up of capacity at the site, or sites to be determined by feasibility studies, and phased in a manner which would ensure that it would be operational by 1996. The second phase would increase the total installed capacity of newsprint in the Pematangsiantar Bireun locality from 165,000 to 575,000 tonnes and would also include the manufacture of linerboard, fine paper and wrapping paper to the extent indicated above.

Investment in the first stage is estimated at US$ 300 million, and in the second stage at US$ 950 million to give a total investment of US$ 1250 by 1995.[1]

The newsprint produced in the first stage of development would be exported to Malaysia and Thailand, as well as used for domestic consumption. An optimal distribution of the production in 1996—2000, taking into consideration the production of other ASEAN as well as domestic mills, would be:

Table 21. Optimal Distribution of Paper Produced at Northern Sumatra in 1996—2000. ('000 TPA.)

Paper grade	Domestic (Sumatra)	Malaysia	Singapore	Thailand
Linerboard	12	61	75	—
Newsprint	11	89	187	285
Fine paper	22	34	—	—
Wrapping paper	7	61	32	—

[1] All cost estimates are at 1976 prices.

2. Temerloh (Malaysia)

Since a number of sites in the Temerloh Mentakab area appear to be equally viable, they have been treated in the analysis as a single locality under the name Temerloh. All sites are based on water from the Pahang river.

The analysis indicates that the Temerloh area is the financially optimal site for a major pulp and paper industry in Malaysia due to its location relative to readily available supplies of hardwood residues from the large mechanical wood processing industry which is well established in the vicinity, and the potential supplies of long fibre from pine plantations which are already established, or are in an advanced stage of planning in the States of Pahang, Selangor, Negeri Sembilan and Trengganu. This concentration of resource within an economic haulage distance to the mill site, together with advantages of infrastructure, makes Temerloh a particularly attractive investment opportunity.

The analysis identified the potential for establishing a total manufacturing capacity of 885,000 tonnes of paper and 30,000 tonnes of market pulp in the Temerloh locality by 1996. This capacity can be distributed between various sites as determined by feasibility studies.

In order to optimise financial returns, the capacity should be constructed in two stages with the product mix ('000 TPA) as indicated below:

Product	1986	1996
Pulp		
Kraft pulp	680	915
(Bleaching	400	625)
(Pulp drying	30	30)
Paper and Paperboard		
Linerboard	200	200
Fine paper	315	510
Wrapping paper	115	175

In the period 1996—2000 the following quantities of fibrous raw materials will be required each year to supply the projected production:

Softwood pulpwood	1,600,000 m^3
Hardwood pulpwood	1,650,000 m^3
Waste paper	18,000 tonnes

Investment in the first stage of development is estimated to be US$825 million. The expansion up to 1996 will require an additional US$365 million to give a total investment, at 1976 prices, of US$1190 million.

The cost of pulpwood plantations is not included in the above investment. However, the pulpwood from plantations is costed to give a rate of return of 10 percent on the investment into the plantations; actual establishment costs for Malaysia have been used. A total area of 90,000 hectares of plantations will be required to support the production envisaged for 1996—2000.

Production in the first stage is mainly to supply domestic market requirements and Singapore; small quantities of linerboard are designated for Thailand and fine paper for Indonesia. The market pulp is exported to Singapore to supplement the supply of waste paper for an envisaged folding boxboard plant.

The optimal distribution of the full output of the second stage in 1996 would be:

Table 22. Optimal Distribution of Paper Produced at Temerloh in 1996—2000. ('000 TPA.)

Product	Domestic	Indonesia	Singapore	Thailand
Linerboard	75	32	85	—
Fine paper	98	110	300	—
Wrapping paper	116	18	34	—
Kraft pulp	—	—	—	30

3. Johore (Malaysia)

The second site in Malaysia to be identified as an optimal location in the analysis is close to Kampong Sedili in Southeast Johore. The proposed capacity is lower than that for the Temerloh area due to the more limited availability of resources; it will obtain its short fibre supply in the form of residues from hardwood logging and mechanical wood processing industries in

the vicinity, and its long fibre supply from pine plantations which have already been initiated in Ulu Sedili. A total plantation area of 35,000 hectares will be required.

The analysis, (in its 1977 format), indicates that the mill should come into production not later than 1996 and not before 1990, assuming that the Temerloh complex is developed on schedule. However, in the event of the mill at Temerloh being delayed for any reason, the mill at Kampong Sedili should be brought into production as soon as possible.

The following production capacities are envisaged:

Kraft pulp mill	230,000 TPA
Bleaching unit	90,000 TPA
Pulp dryer	50,000 TPA
Linerboard mill	125,000 TPA
Fine paper mill	40,000 TPA

The following volume of fibrous raw material will be required each year to supply the mill during the period 1996—2000:

Softwood pulpwood	615,000 m^3
Hardwood pulpwood	215,000 m^3

Investment is estimated at US$270 million. Optimal distribution of products, in '000 TPA is as follows:

Table 23. Optimal Distribution of Paper Produced at Johore.

Product	Domestic	Singapore
Linerboard	42	83
Fine paper	40	—
Kraft pulp	—	50

4. North Mindanao (Philippines)

The analysis indicates that, in the context of intra-ASEAN trade, there is no significant difference in the financial results between expanding the manufacturing capacity which already exists at Bislig and at Iligan. Either, or both of these mills can be expanded to give a total added capacity as summarized below.

A two-phase programme of expansion is envisaged based upon indigenous hardwood and pine plantations. The total area of pine plantation required to meet the production of 1996 amounts to 33,000 hectares.

The first stage of development, which requires an expansion of kraft pulping capacity by 30,000 tonnes and an increase in fine paper capacity by 30,000 tonnes should be completed before 1986 to produce paper for the domestic market with only a minimal export to Sabah.

The second stage, which should be operational in 1996, should add the following total capacity:

Kraft pulp mill	270,000 TPA
Bleaching unit	60,000 TPA
Linerboard mill	85,000 TPA
Sack kraft mill	85,000 TPA
Wrapping paper mill	95,000 TPA

The following volume of fibrous raw material will be required each year to supply the mill during the period 1996—2000:

Softwood pulpwood	800,000 m^3
Hardwood pulpwood	225,000 m^3
Waste paper	10,000 tonnes

The first stage of expansion, which provides paper mainly for domestic supply, requires an investment of some US$90 million.

The second stage of expansion will require an investment of US$240 million.

The optimal distribution pattern of paper from this mill during the period 1996—2000 will be:

Table 24. Optimal Distribution of Paper Produced at North Mindanao in 1996—2000. ('000 TPA.)

Product	Domestic	Malaysia (Sarawak/ Sabah)	Indonesia
Linerboard	64	5	16
Sack kraft	42	6	37
Wrapping paper	79	4	11

It should be noted that this mill will not be entirely sufficient to meet the full requirement of the purely domestic market. Further, domestic market production units have been identified and are described in the country report for the Philippines.

5. Luzon (Philippines)

In the context of intra-ASEAN trade, it will be economic to expand pulp and paper production in Luzon by introducing new integrated mill capacity based on indigenous hardwood and on the coniferous plantations which are planned for Bataan Zambales and Kalinga Bontoc. The export expansion described under North Mindanao (4 above) assumes such an establishment. This also makes it more economic to reduce the expansion for domestic supply in Mindanao and instead increase the production at the new mill in Luzon. The new mill will produce almost entirely for domestic supply but is included here in brief outline because it has a direct effect on the inter-ASEAN paper trade situation.[2]

The new production should be located in close proximity to the already existing mills either at Bataan and/or Bulacan. It should come into operation in 1996 and have the following capacities:

Kraft pulp mill	330,000 TPA
Bleaching unit	155,000 TPA
NSSC mill	15,000 TPA
Groundwood mill	160,000 TPA
Linerboard mill	106,000 TPA
Sack kraft mill	45,000 TPA
Newsprint mill[2]	185,000 TPA
Fine paper mill	75,000 TPA
Fluting mill	15,000 TPA

The following volume fibrous raw material will be required each year to supply the mill during the period 1996—2000:

Softwood pulpwood	1,150 000 m^3
Hardwood pulpwood	245,000 m^3

The investment is estimated to be US$720 million.

10.3 **Domestic Mills**

In addition to the expansion of existing mills and establishment of new mills, as described above, it will be necessary to install further capacity, for purely domestic supply, in order to meet, in the most economic way, the total requirements of the various member countries of ASEAN. These expansions will amount to the totals over the period up to the year 2000 indicated in Table 25.

[2] The newsprint production in Luzon will enable the existing mill at Bislig to release newsprint for export to Indonesia, Sarawak and Sabah.

Table 25. Expansion of Paper Manufacturing Capacity for Local Consumption (1977 Analysis).

Country	Liner board	Sack kraft	Fine paper	Fluting	Folding boxboard	Wrapping paper	Investment
	'000 TPA						US$ Million
Indonesia	100	—	74	—	60	—	485
Malaysia	—	—	—	—	—	—	—
Philippines[1]	75	80	—	—	120	50	430
Singapore	—	—	—	—	120	—	165
Thailand	167	—	295	100	—	166	900
Total	342	80	369	100	300	216	1980

[1] The figures for the Philippines differ from those given in Working Paper 20 and in Supplement No. 3, as all capacity development described in Working Paper 20 is regarded as ASEAN mills.

10.4 **Paper Supply up to the Year 2000**

The total manufacturing capacity of paper and paper board in the ASEAN area in 1996—2000, incorporating the suggested expansions outlined above and assuming that capacities already in existence in 1976 will continue to produce at that time, will be of the following magnitude compared to the projected requirement:

Table 26. Total Manufacturing Capacity and Average Annual Consumption in the Period 1996—2000. ('000 TPA.)

Paper grade	Production	Projected consumption
Linerboard	1020	1020
Sack kraft	210	480
Newsprint	860	960
Fine papers	1270	1270
Fluting	140	345
Folding boxboard	360	980
Wrapping papers	690	690
Total paper and paper board	4550	5745

The import requirement in the period 1996—2000 thus appears to be 1,195,000 TPA, equivalent to some 20 percent of total requirement. It should be noted, however, that the estimates of requirement, as presented above, are conservative and may only represent some 80 percent of the actual requirement in that period. Projected consumption and production for the ASEAN group up to the year 2000 are given in Figure 4.

In accordance with the above estimates, imports will comprise sack kraft, newsprint, fluting and folding boxboard. The production of high quality kraft pulp, and hence the availability of sack kraft, will be constrained by limits on the extent to which long-fibred pulpwood plantations can be established, since the availability of suitable land is limited; newsprint production will also fall short of requirement for the same reason. The production of folding boxboard is determined by the estimated potential availability of waste paper. In the case of fluting, production as defined in this analysis is constrained by low profitability. If the

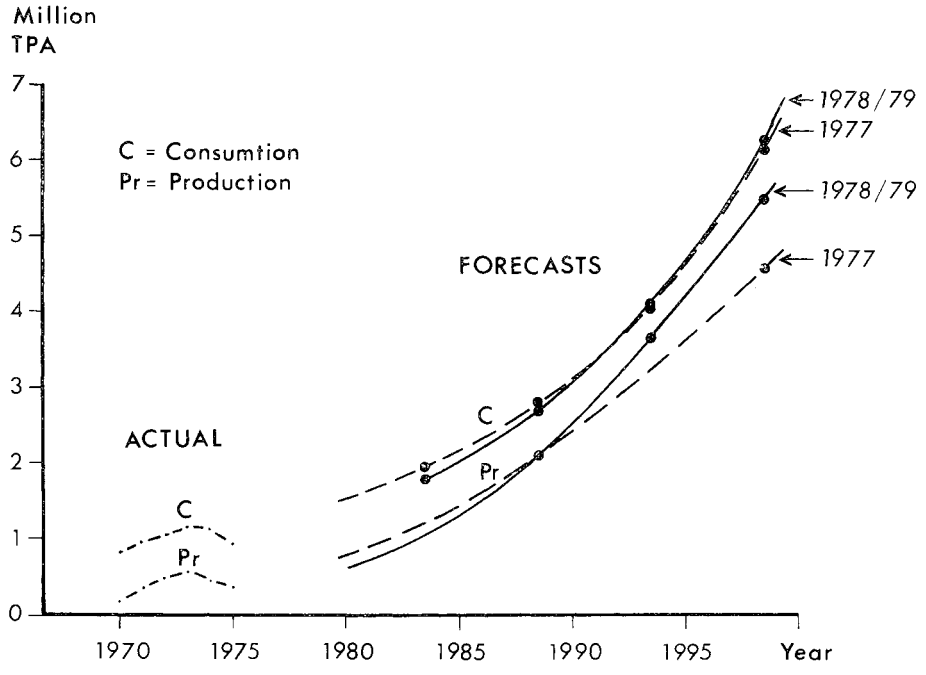


Figure 4. Projected Total Paper and Paper Board Production and Consumption in ASEAN According to 1977 and 1978—79 Analyses.

price is increased by some 10 to 15 percent from an average of US$225 per tonne, the increased production of fluting within ASEAN would then become economic under the assumption that all investments must yield a minimum financial rate of return (IRR) of 10 percent before taxation.

According to the estimates of production and consumption as summarized in Table 26, the annual import requirement in the period 1996—2000 will average 1.2 million tonnes, which is 0.6 million tonnes more than the total paper imported annually in 1970—75. As a percentage of total consumption, however, the import requirement will have decreased from some 60 percent to 20 percent.

Of the total production of 4,550,000 tonnes in 1996—2000, approximately 1,660,000 tonnes or one third, will be traded over national boundaries, and of this some 660,000 tonnes are newsprint and 440,000 tonnes are printing and writing papers. The remaining 560,000 tonnes, or 12 percent of total produtcion, will consist of industrial papers.

With the production, expansion and trade development as suggested, Indonesia and the Philippines will become net exporters of paper; Malaysia will achieve an almost balanced paper trade, while Singapore and Thailand will remain net importers.

The suggested intra-ASEAN trade pattern is summarized in Map 2 (p. 48).

10.5 **Investment Requirement**

The total investment, as identified by the analysis and summarized above, which is required to build up the pulp and paper production capacity within ASEAN to meet 80 percent of the forecasted consumption requirements by the period 1996—2000, is shown in Table 27.

10.6 **Fibre Supply**

The supply of short fibre from mixtures of tropical hardwood species appears to pose

Table 27. Total Pulp and Paper Investment Requirements for ASEAN. (US$ Million.)

Country	Total investment, all mills		ASEAN sub-regional mills only	
	Up to 1985	1986—1995	Up to 1985	1986—1995
Indonesia	370	1365	300	950
Malaysia	825	635	825	635
Philippines[1]	280	1200	90	960
Singapore	165	—	—	—
Thailand	400	500	—	—
Sub-total	2040	3700	1215	2545
Grand total	5740		3760	

[1] See note Table 25.

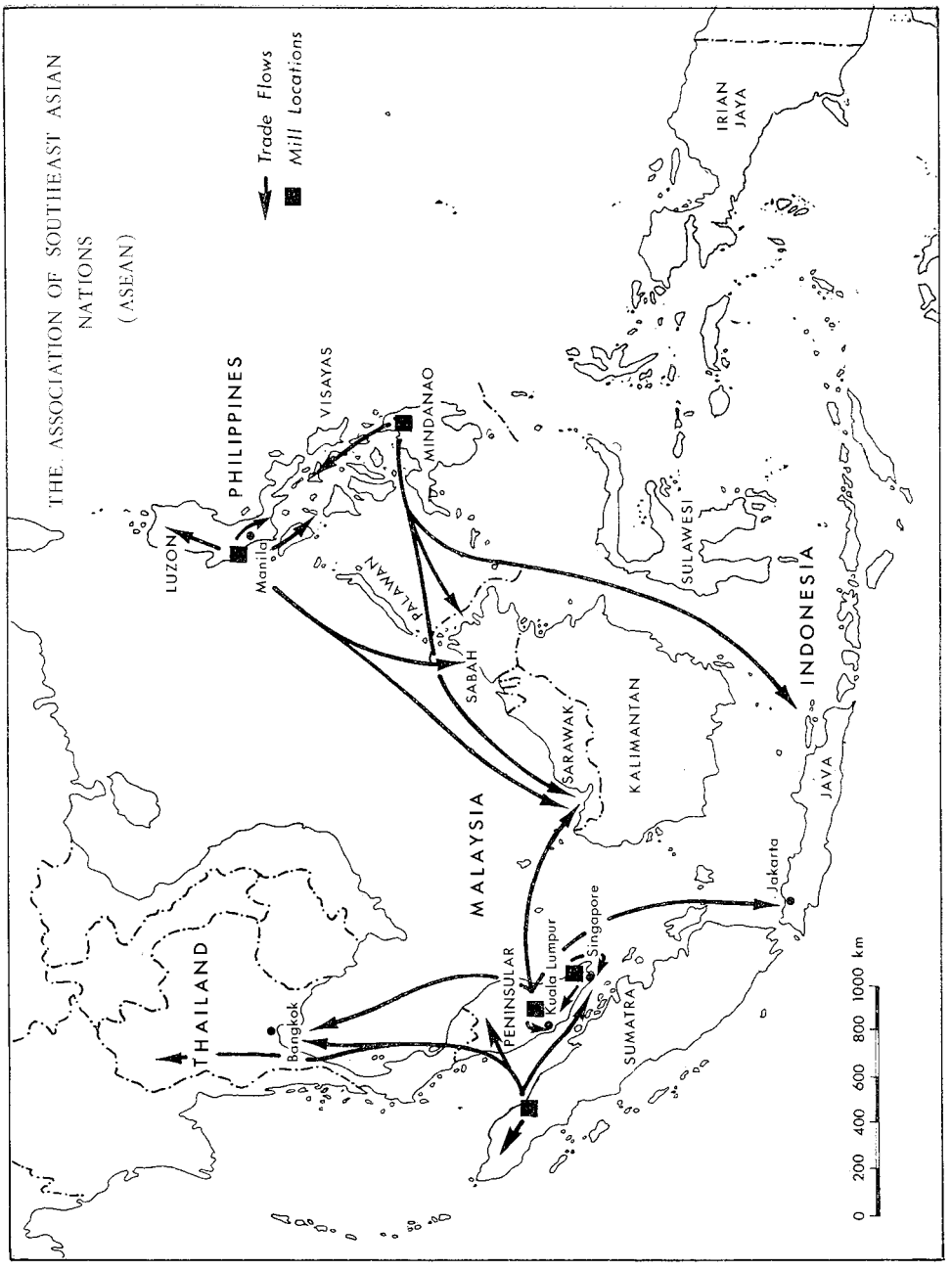
no problem. With respect to the "ASEAN" sub-regional mills, competitive sources of indigenous long fibre are the pine forests—plantations and indigenous—of Northern Sumatra; these can supply the requirement of the suggested capacity expansion at Pematangsiantar Bireun and are adequate to meet the projected paper production to the year 2000. The long fibre furnish for the remaining production units can be most economically provided through the establishment of coniferous pulpwood plantations.

The creation of adequate pine pulpwood plantations applies equally in Luzon, where the indigenous pine forests are economically inaccessible at the present time and are of relatively low quality.

The areas of pine pulpwood plantations which are necessary to meet the production requirements for the period 1996—2000 are:

Country	*Area in Hectares*
Indonesia	60,000
Malaysia	125,000
Philippines	110,000
Thailand	5,000
Total	300,000

It should be noted that without the pulpwood plantations indicated above, it will



Map 2. Production Centers and Trade Flows, 1977 Analysis.

not be feasible to promote the concept of the ASEAN mills for Malaysia and the Philippines, or the domestic mill in Indonesia (Java) as indicated above. This stresses the importance of securing adequate supplies of long fibre through the establishment of plantations. Investment into the early creation of pulpwood plantations is an essential factor in the development of the pulp and paper sector of ASEAN.

11 Meeting of Experts' Group on Pulp and Paper in Manila, 1977

A meeting of pulp and paper experts of ASEAN member countries was convened in Manila, September 26—28, 1977, to discuss PPIDP Working Paper No. 20 which contains the result of the initial analysis of the ASEAN pulp and paper sector. The Coordinator and the Economist of the PPIDP took, on the request of the Expert Group, part in this meeting.

The expert meeting recognized the merit of the analytical approach but was not prepared to express any opinion with regard to the validity or feasibility of any of the suggested mill establishments as only one development option, the optimal solution, was presented. In addition, the Expert Group identified certain possible data errors and questioned some of the assumptions and constraints used in the analysis. However, the meeting agreed unanimously that the analysis should be re-done with updated information and the inclusion of policy alternatives. The meeting suggested the following conceptual basis for the re-evaluation (8).

"Aside from the identification of feasible and viable options for the development at the pulp and paper industry in various mill locations within ASEAN, what is perhaps more desirable to facilitate decision making and specific project implementation is the establishment of a hierarchy of projects in terms of their relative advantages and disadvantages aimed at optimizing the returns on investment, or producing the most of pulp and paper at the least possible cost. Where more than one location is sufficiently viable for implementation and there is a national, ASEAN or non-ASEAN market for the pulp and paper to be produced, this should also be presented as an alternative or alternatives.

"What is deemed desirable is a presentation of both types of pulp and paper industry development potentials within t region divided into: (a) Those that are pected to make a substantial contributi to the intra-ASEAN and inter-ASE trade; and (b) those that are basically mestic market oriented but are also s ficiently viable (above a set break even c off point in terms of returns on inve ments).

"Such presentation must be based on c tain basic assumptions, as to the price inputs and outputs, and the relative pro ability of specific locations assessed on basis of natural factor endowments, av ability of appropriate operative technolo management and technical expertise, as w as the availability of skilled manpo within reasonable wage scales.

"The estimated rate of return on inve ment at specific cost and income assur tions, including the corresponding sei tivity analysis to show how much any gi price change could alter the viability of proposed mill must also be shown. It deemed necessary to make this dual pres tation of the two basic approaches sugges in FAO Working Paper No. 20 for future development of the ASEAN p and paper industry, in order to provide necessary latitude for any of the mem countries concerned to proceed either the basis of regional integration, if this feasible, or to concentrate on the prod tion of the type of pulp and paper tha needs basically for its own requirements

"In brief, the relative advantages and advantages of both an intra-ASEAN inter-ASEAN oriented approach, and national or self-sufficiency-oriented proach, will be presented in this re-anal of FAO Working Paper No. 20, and member country concerned has the opt to proceed either way, although in this c it would have most, if not all, the facts

arriving at a fairly objective decision on what course of action to take, on the basis of the relative costs and benefits that it can expect for itself, as well as for the ASEAN as a whole."

The following terms of reference were suggested by the meeting (7):

"1. Undertake a more detailed review of the forest resource data which is contained in the original analysis since this is known to be weak. Particular emphasis should be placed upon quantifying long-fibre resources, both indigenous forest and pulpwood plantations. Information is required with regard to accessability, availability by location and the cost of supply.

"2. Review the types and sizes of mills as suggested in Working Paper No. 20 with particular regard to the availability of sites, the development costs for specific mill sites. Attention should be given to the quantity, quality and suitability of water supply at each mill site. The cost of disposing effluent together with specific environmental protection requirements should be investigated.

"3. Up-date the projections for paper demand as specified in Working Paper No. 20. Efforts should be made to improve the projected demand for specific grades, particularly within the industrial papers, so as to provide a more specific end-use analysis. Specific fibre furnishes should be defined for those grades of paper which may deviate from acceptable "international standards" where these are likely to gain long-term acceptance on the domestic market.

"4. Up-date all price data for imported pulps and papers.

"5. Review the assumptions contained in Working Paper No. 20 with regard to trade incentives and dis-incentives which apply to intra-ASEAN and to the international trade in paper.

"6. Up-date information on the availability and cost of imported papers.

"7. Review and readjust as necessary all data relating to the costs of transportation both by land and sea.

"8. Provide a more precise geographic location of the major consumption points for specific paper grades (i.e. cement and fertilizer industries, major publishing houses and industries requiring special grades of paper and paperboard).

"9. Investigate the capacity and operating ratios of existing industries manufacturing specific grades of paper and paperboard. Special attention should be given to those industries having multi-purpose machines in order to ensure that existing capacity is channeled into the most competitive lines of production.

"10. Up-date data on:

— manpower availability and cost
— the availability and cost of chemicals with particular emphasis on the local production of necessary chemicals
— changes which have taken place relating to investment incentives
— mill investment and operating costs as used in Working Paper No. 20.

"11. Undertake a special analysis of those areas which were identified in Working Paper No. 20 as having high development potential; this should include a detailed examination of the availability and quality of assoicated infrastructure.

"12. Derive an optimal pattern of development for the pulp and paper industry for individual member states as well as for ASEAN as a unit, based upon the revised data as indicated above, together with such new assumptions as governments may wish to inject into the analysis.

"13. The analysis will be carried out in close liaison with individual member countries of the ASEAN community through the forum provided by the ASEAN Experts' Group on Pulp and Paper, and contacts provided by individual members of that group. According to the wishes of the Experts' Group, alternative strategies should be compiled for comparison of investments and costs.

"14. Consideration will be given to the evaluation of alternative development strategies as required by member governments. In specific cases, where this is regarded as essential as a basis for decision making, special evaluations will be undertaken of the socio-economic impact on development."

12 The 1978 Field Work

The team which was given the task to revise the data base for ASEAN comprised one pulp and paper engineer, as team leader, one paper market research officer and one forest resource expert.

Based on the suggestions made by the Experts' Group in Manila the following terms of reference were given:

> "The team will work in close liaison with individual member countries of the ASEAN community through the forum provided by the ASEAN Expert Group on Pulp and Paper; the widest possible range of contacts should be established within both the public and private sectors.
> "In particular, the team will:

1. Undertake a more detailed review of the forest resource data which is contained in the original analysis, since this is known to be weak. Particular emphasis should be placed upon quantifying the long fibre resource potential, both in indigenous forest and in plantations. Information is required with regard to accessibility, availability by location, and the cost of supply.

2. Review the types and sizes of mills suggested in Working Paper No. 20 with particular regard to the availability of sites and the development costs for specific mill sites. Attention should be given to the quantity, quality and suitability of the water supply at each mill site. The cost of disposing effluent, together with specific environmental protection requirements at each site should also be investigated.

3. Up-date the projections for paper demand as specified in Working Paper No. 20. Efforts should be made to improve the projected demand for specific grades so as to provide a more specific end-use analysis. Specific fibre furnishes should be defined for those grades of paper which may deviate from acceptable "international standards" where these are likely to gain long-term acceptance on the domestic market.

4. Provide a more precise location of the major consumption points for specific paper grades such as cement and fertilizer industries, major publishing houses and industries requiring special grades of paper and paper board.

5. Up-date all price data for imported pulps and papers.

6. Review the assumptions contained in Working Paper No. 20 with regard to trade incentives and dis-incentives which apply to intra-ASEAN trade and to the international trade in pulp and paper.

7. Up-date information on the availability and costs of imported papers.

8. Review and adjust as necessary all data relating to the cost of transportation by both sea and land.

9. Investigate the capacity and operating ratios of existing industries manufacturing specific grades of paper and paperboard. Special attention should be given to those industries having multi-purpose machines in order to ensure that existing capacity is channeled into the most competitive lines of production.

10. Up-date data on:
- Manpower availability and cost
- the availability and cost of chemicals with particular emphasis on the local production of such chemicals
- changes which may have taken place with regard to investment incentives
- mill investment and operating costs as used in Working Paper No. 20.

11. Undertake a special analysis of those areas which were identified in Working Paper No. 20 as having high development

potential; this should include an examination of the availability and quality of associated infrastructure."

Prior to the start of field data collection, the team was briefed by this author in Jakarta and Bogor on January 16—19, 1978. Further briefing sessions were held with the pulp and paper engineer and the resource expert in Bangkok on March 17—18, 1978 and in Jakarta on April 17—18, 1978.

The field work was completed on April 30, 1978. The total input in the field amounted to eight man-months and was subsequently supplemented by correspondence and desk studies amounting to some nine man-months.

The field data were adapted for computer use by the field team and transferred into coding forms for subsequent punching into computer cards. The coding was supervised by the resource expert. Punching was done by the Data Processing Unit of the Management Service Division of FAO. Verification of cards was carried out by the Data Processing Unit in cooperation with the field team.

13 Data Changes

The data used in the 1978—79 analysis differ substantially from those of the previous analysis, depending on several factors:

- The larger number of man-days spent on field investigations provided for sharper and more differentiated estimates of production costs
- a general escalation of costs and prices had occurred due to, among other things, increased oil prices
- member countries had developed definite new policies with regard to utilization of resources, locating industries and influencing market conditions
- technical changes in paper manufacturing, especially with regard to fibre furnish, had become established in the local ASEAN area as well as the world paper market in general
- etc.

The most important of these changes are summarized below specified in three groups of data:

a) technical data
b) raw material and market data and
c) cost data.

13.1 **Technical Data**

13.1.1 *Fibre Furnish*

The most fundamental changes in the technical data are those made in the matrix for acceptable fibre furnishes. The options have been made more diversified and a greater acceptance of short fibre admixtures has been incorporated in all paper grades. Two newsprint grades were used, one with 100 percent hardwood pulp to be used in the Philippines only and one allowing 80 percent short fibre for the rest of ASEAN, as compared to 1977 when all newsprint was assumed to be made from long fibre, except for the Philippines market. Other changes refer to use of substitute fibre—straw, bargasse and bamboo—and the specification of waste paper requirement on three grades instead of only one as in the 1977 analysis.

All fibre furnish changes are summarized in Table 28 (p. 54).

13.1.2 *Optimal Mill Sizes*

The 1977 analysis assumed that conditions, in terms of experience of large scale manufacturing, capacity of infrastructure, government support in, for instance, large scale plantation establishment, loan arrangements and investment incentives, etc., in the ASEAN region would favour establishment of mills having productive capacities of the magnitudes now regarded as optimal in the traditionally paper producing countries in Europe and North America. Consultations, during the field work, and at later points of time, with authorities within and associated with industry in general and the pulp and paper industry in particular, in the ASEAN member countries, resulted in the decision to use a new series of "optimal" mills having capacities somewhat lower than those used in previous analysis. A comparison of "optimal" mill sizes applied in the two analyses is presented in Table 29 (p. 54).

13.2 **Raw Material and Market Data**

13.2.1 *Raw Material*

Substantial changes were made in those matrices containing data on raw material availability. Of these changes only those referring to the availability of long fibre material played an important role in de-

Table 28. Fibre Furnish Alternatives Applied in 1977 and in 1978—79.[1]

	Linerboard								Sack kraft						
	1977				1978—1979				1977				1978—1979		
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
Unbleached Hardwood kraft													50		
Bleached Hardwood kraft															
Unbleached Softwood kraft								20	100				50	29	40
Bleached Softwood kraft															
Unbleached Bagasse kraft		100				24				100				59	
Bleached Bagasse kraft															
Unbleached Bamboo kraft			100								100				60
Bleached Bamboo kraft															
Unbleached Straw kraft				100								100			
Bleached Straw kraft															
Linerboard Grade Hardwood kraft	13				63		70								
Linerboard Grade Softwood kraft	87				19	48	30	80							
NSSC Hardwood															
NSSC Bagasse															
NSSC Bamboo															
NSSC Straw															
Refiner Groundwood, Hardwood															
Refiner Groundwood, Softwood															
Waste paper:															
Browns					18	28								12	
Whites															
News															

[1] Wrapping Paper is not included as this grade was specified in 1977 only.
[2] For the Philippine market only.
[3] Not specified on grade.

Table 29. Optimum Sizes of Paper Production Units in the 1977 and 1978—79 Analyses. ('000 TPA.)

Production unit	1977	1978—79
Linerboard	250	140
Sack kraft	150	100
Newsprint	150	100
Fine papers	100	61
Fluting	150	100
Folding boxboard	60	60
Wrapping papers	100	not applicable

termining the overall result of the analysis and, therefore, only the long fibre data are dealt with here.

The changes in data on long fibre availability, which reflect, in most cases, shifts in government plantation plans, can be summarized as follows:

a) pine plantations in Java were excluded due to their locations in difficult terrains away from good road infrastructure

Printing & writing papers								Newsprint				Fluting								Folding boxboard							
1977				1978—1979				1977		1978—1979		1977				1978—1979				1977				1978—1979			
1	2	3	4	1	2	3	4	1	2[2]	1	2[2]	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
																								18			
75				80	37				20		20									15				16			
																				2							
25	25	25	25	20	18	30	20	18		20										20	20	20	20	20	18	22	27
																					2				32		
	75																				15				9		
																						2				18	
		75																			15						
																							2				17
			75			70	80																15			14	15
												2	2	2	2												
												13	13	13	13												
												85				77											
													85				72										
														85				83									
															85				72								
									80	80	80																
								82																			
																				63[3]	63[3]	63[3]	63[3]				
																23	28	17	28					28	26	28	26
					45																			12	10	12	10
																								6	5	6	15

b) a new plantation programme was envisaged in South Sumatra
c) the pine plantations in Sedili and Central Peninsular Malaysia were drastically reduced according to changes in Forestry Department's plans, and
d) the pine plantations in Luzon were excluded because of changed policy of the Board of Forestry.

For further details reference is made to Working Paper 20 (62) with supplement[1] and Technical Report 1 (69) of the Pulp and Paper Industries Development Programme.

[1] Including Working Paper 8 on Malaysia.

13.2.2 *Market Data*

New projections of consumption of various grades of paper up to the year 2000 were made in 1978, based on information collected during the field investigations and incorporating the findings of the fibre balance forecasts made for the World Consultation on Pulp and Paper in 1977 (21, 77) and the fibre balance projections made in 1978 by FAO (36, 41).

Table 30. Consumption Forecasts Used in 1977 Compared to Those Used in 1978—79. ('000 TPA Average Per Planning Period 1977/1978—79.)

	1981—85	1986—90	1991—95	1996—2000
Linerboard	323/ 273	465/ 421	685/ 670	1006/1059
Sack kraft	159/ 168	228/ 287	328/ 485	476/ 795
Newsprint	358/ 406	494/ 552	685/ 765	956/1056
Fine papers	463/ 503	698/ 764	1078/1160	1703/1763
Fluting	101/ 187	151/ 282	228/ 427	340/ 677
Folding boxboard	256/ 249	396/ 380	611/ 571	969/ 884
Wrapping grades	260/ na	358/ na	503/ na	688/ na
Total	1920/1786	2791/2686	4118/4078	6138/6234

The grade "wrapping paper" was not specified separately in the 1978—79 analysis but is, to some extent, distributed over and included in those other grades which technically are closest to those varieties of paper which are generally used for wrapping and packaging. The major portion of the wrapping grade was, however, included in a miscellaneous group of paper containing tissue paper and minor specialty grades and which was excluded from the analysis. Because of these differences in product grouping consumption the data used in the two analyses are not directly comparable. However, a grade by grade comparison indicates that the projections for folding boxboard and linerboard are lower in the 1978—79 analysis; all other grades have increased, with almost a doubling of fluting.

A tabulated comparison of the paper requirement data used in 1977 and 1978—79 is given in Table 30.

The analysis of price information collected during the 1978 field work indicated that the price level at that time was still unusually low as a result of the recent depression and could therefore not be used in the analysis. Instead a fictive price series was derived. This new series was based on estimates of FOB prices which would be necessary to attract capital into new mill investment in industrialized countries. To these prices were added freight costs from Japan to arrive at CIF rates at consumption centers in ASEAN.

Examples of 1977 and 1978—79 prices are given in Table 41 (p. 72).

13.3 **Cost Data**

All cost items including infrastructure development, investment, raw material costs and operating expenditures were reviewed and checked against recent cost estimates by existing industries and by feasibility studies. This resulted in, besides a general change in cost level reflecting the trend in cost development since 1977, more differentiated costs, referring to country and specific mill location.

The cost changes which affected the result of the analysis the most refer to infrastructure development, investment requirement and cost of power, oil and chemicals. The input data of those items are given in Tables 31—34 below comparing 1977 and 1978—79 figures. For more detailed study of cost data please see Working Paper 20 (62) and Technical Report 1 (69) of the Pulp and Paper Industries Development Programme.[2]

[2] Examples of Cost of Production are given in Table 41 (p. 72).

Table 31. Infrastructure and Site Development Costs for Mill Sites in 1977 Analysis Compared to Those in 1978—79 Analysis. (US$ Million.)

Mill Sites	1977	1978—79
Aceh	2.7	25
Medan	2.7	24
S. Sumatra	4.1	25
C. & W. Java	6.5	51
E. Java	6.5	17
N. Kalimantan	2.7	72
S. Kalimantan	2.7	72
N. Thailand	1.1	21
N.E. Thailand	1.1	21
C. Thailand	1.1	21
S. Thailand	1.1	21
Bangkok	0.25	4
Pahang	1.2	3
Kuala Lumpur	1.0	1
Johore	1.4	4
Sarawak	2.0	24
Sabah	2.0	72
N. Luzon	1.5	21
W. Mindanao	1.5	18
E. Mindanao	1.5	18
Metro Manila	3	4
Singapore	3	3

Note: In the 1977 analysis only mill site development was accounted for while in 1978—79 also infrastructure and township development, where this is required, are included.

Table 32. Investment Cost for Various Mills Calculated According to 1977 Procedure Compared to Corresponding Estimates in 1978—79 Analysis Assuming Optimal Mill Sizes as Applied in the 1977 and 1978—79 Analyses. (US$ per tonne capacity.)

Production Unit	1977		1978—79
	at 1977 opt.	at 1978—79 opt.	at 1978—79 opt.
Kraft Pulp Mill	364	401	516
Groundwood Mill	433	527	659
NSSC Mill	207	247	309
Linerboard Mill	341	416	540
Sack Kraft Mill	480	618	895
Newsprint Mill	509	612	768
Fine Paper Mill	801	968	1300
Fluting Mill	416	478	660
Folding Boxboard Mill	1193	1193	1268

Table 33. Costs per Unit of Power and Oi Used in 1977 Analysis Compared to Cor responding Data in the 1978—79 Analysis.

Country	Power		Oil	
	US$/MWH		US$/Tonne	
	1977	1978—1979	1977	1978—1979
Indonesia	43.4	43	41—60	85—117
Malaysia	31.4	33	98	125—130
Philippines	20.4	19[4]—39	110	117—138
Thailand	15—18.5	27—33	100	116—125

Table 34. Cost of Chemicals Used in 1977 Analysis Compared to Corresponding Data in the 1978—79 Analysis. (US$ per tonne.)

Chemical	1977	1978—79
Salt Cake	115—162	104—132
Limestone	46— 87	12
Sodium Chlorate	330—388	371—456
Sulphur	235—282	94—117
Sodium Carbonate	40— 87	144—172
Sulphuric Acid	na	78—248
Sea Salt	48—107	23— 43
Rosin	397—439	600—651
Starch	285—327	301—318
Alum	136—186	128—148
Clay	130—178	120— 137

[4] Hydroelectric power in Mindanao.

14 The 1978—79 Analysis

The new data files were completed in September 1978 at which time the re-analysis started. The approach of successive elimination of alternatives, developed during previous analysis was applied. A number of possible policy scenarios were tested and contact was all the time maintained with key persons in the ASEAN community and FAO Pulp and Paper Branch.

In April 1979 the analysis had reached a stage when a development proposal, which was judged to stand a good chance of being politically accepted, could be compiled. This proposal was presented, in the form of a preliminary report, to the member countries of ASEAN for their consideration. A series of meetings for the Programme Coordinator were then scheduled with authorities in the various countries in May and June of 1979, culminating in a discussion with the ASEAN Experts' Group on Pulp and Paper on 13—15 June.

Some complimentary analysis was carried out during June—September 1979 and the drafting of the report on the 1978—79 analysis was finalized by the end of September.

The analysis incorporated a large number of resource and market development alternatives and several political scenarios, with regard to balance of intra-ASEAN trade, investment levels and supporting policies like subsidies on oil and power, allocation of wood resources to other uses and infrastructure development. These alternative scenarios are documented at FAO Headquarters and to some extent presented in the special country reports which are being drafted, providing alternative action plans for each member country of the Association.

In the following chapter the results of the analysis are presented, in concentrated form. Further details are given in PPIDP Technical Report 1 (69) and in PPIDP documentation on the "ASEAN Pulp and Paper Analysis".

15 Results of the 1978—79 Analysis

15.1 Choice of Localities for New Production

Ten potential industry locations, out of thirty tested, were identified as forming an optimal basis for a planned programme for the expansion of the ASEAN Pulp and Paper Sector. In seven of these, mills should be established during the first five-year period (1980—85) to be operational by 1986. These locations are:

— Northern Sumatra (Northern coast of Aceh and North Sumatra provinces)
— South Sumatra
— Northeast Kalimantan
— Temerloh
— Kuala Lumpur
— Northeast Mindanao
— Northwest Thailand
(see Map 3, p. 60)

During the second five-year period the Tawau area of Sabah should be developed for pulp and paper production and one or several mills be established. These mills should come into production in 1991. In the same year new additional capacity in Central Tailand should come into production.

The tenth mill location to be developed is South Kalimantan (Banjarmasin area). The mills there should come into production by 1996.

At this point attention should be directed to the fact that no development in Java has been envisaged due to doubt that the long fibre resources are economically accessible and that the social economic as well as the natural environment can accomodate further expansion of highly polluting industries and due to lack of clear policy guidance from the Government of Indonesia. For similar reasons the Manila areas was excluded. The Sedili locality was also eliminated from the list of potential sites as doubts were expressed that the water supply was sufficient in quantity and quality and that long fibre plantations could be established. These localities, close to major consumption centres, should not be ruled out but investigated further. They could play a very important supporting and complimentary role to the ten main localities mentioned above and, due to inherent constraints, mainly in the form of limited raw material resources, will not eliminate any of these as prime locations for development during the period 1980—2000.

15.2 Capacity Development

15.2.1 *Northern Sumatra*

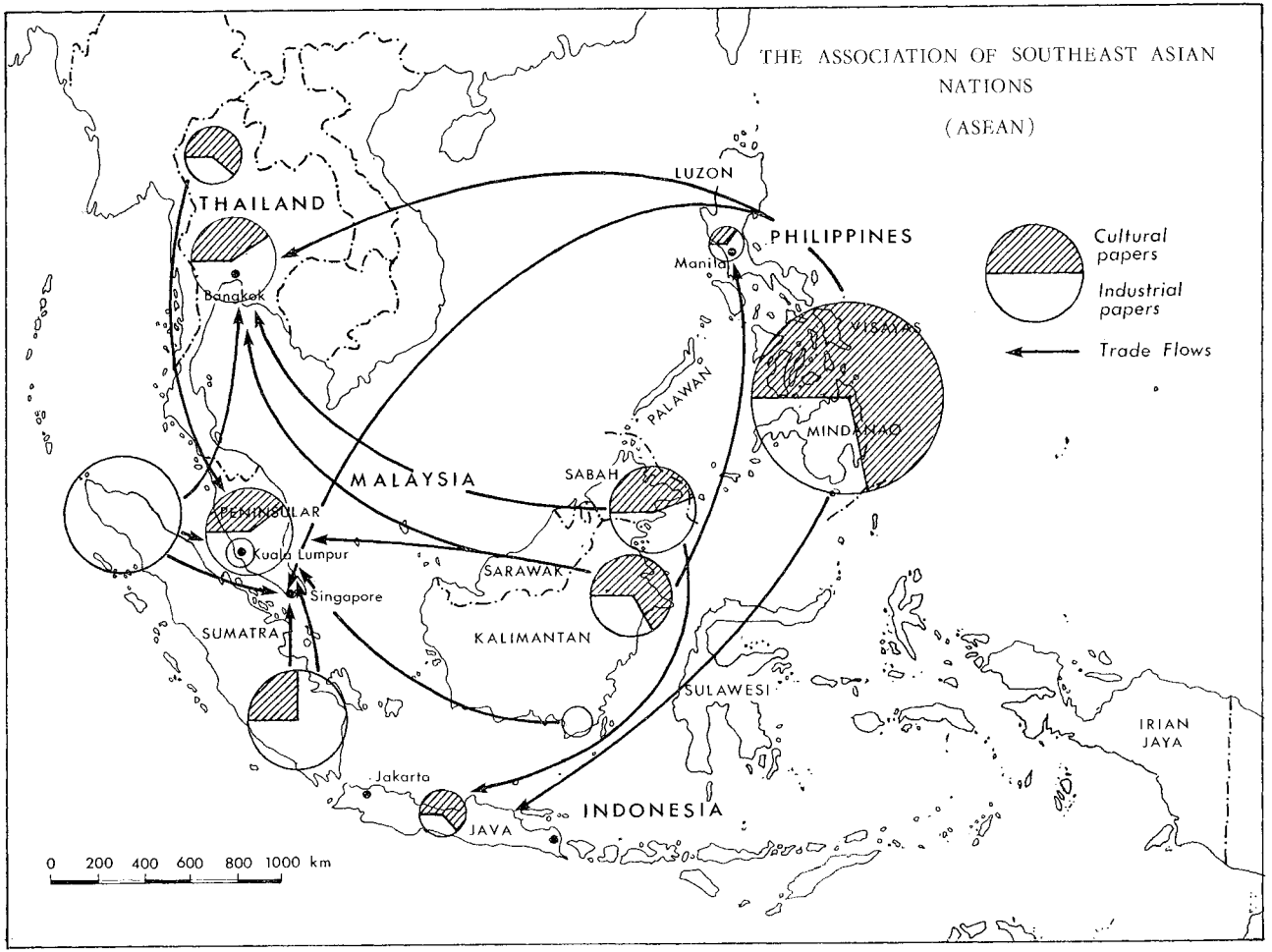
The Northern Sumatra locality refer to several mill sites along the Northern coast of the provinces of North Sumatra and Aceh. The production can be concentrated to one mill site, but should, because of the economics of pulp wood supply, be divided to at least two sites: Kuala Tanjong and Biruen.

Pollution control and a drive for geographical diversification of employment may favour the use of more than two mill sites.

The production should start in 1986 with 140,000 TPA of linerboard, expand in 1991 with 77,000 TPA of sack kraft and in 1996 reach the following capacity figures:

Linerboard	326,000 TPA
Sack kraft	186,000 TPA
Folding boxboard	150,000 TPA

Production will be based on locally available hardwood pulpwood in the form of



Map 3. Production Centers, Capacity Expansion and Trade Flows, 1978—79 Analysis.

residues from mechanical forest industries and logging. The long fibre component comes from indigenous pine stands and pine plantations. If the plantation programme is not expanded over and above current plans, import of 30,000 TPA of bleached long fibre pulp will be required after 1996. The total requirement of long fibre pulpwood after that year is 750,000 m^3 per year.

In the period 1986—1995, 27,000 TPA of waste paper have to be imported. This import requirement will grow to 133,000 tonnes in 1996. The main sources of waste paper will be Singapore and Jakarta.

Capital requirement will be as follows:

1980—1985	US$170 million
1986—1990	US$125 million
1991—1995	US$524 million
Total	US$819 million

During the period up to 1995 the paper produced at Northern Sumatra will be shared between Indonesia and Singapore with small quantities of sack kraft (after 1991) going to Malaysia and Thailand. After the expansion comes into production in 1996 the best distribution is:

	Domestic Indonesia ('000 TPA)	Malaysia	Thailand	Singapore
Linerboard	58	103	95	70
Sack kraft	104	27	30	25
Folding boxboard	133	7	—	10

15.2.2 *South Sumatra*

The mill site identified in the province of South Sumatra is located at Palembang which has a port and is surrounded by readily accessible hardwood forests and land having good potential for industrial long fibre plantations.

The production should start in 1986 with a 100,000 TPA boxboard mill. A major pansion should take place during the pe 1986—1990 when the boxboard produc should be increased to 225,000 TPA capacity for the production of 200,000 T of fluting and 78,000 TPA of fine pa should be added. Further capacity for paper production should be added bet 1991—1995 giving the following total c city in 1996:

Fine paper	139,000 TPA
Fluting	200,000 TPA
Folding boxboard	225,000 TPA

The envisaged plantation establishmer not yield long fibre material before when the outturn is estimated to be 1 m^3 per year which, at that time, is n ficient to fulfill the total requirem long fibre. Therefore, the following (ties of long fibre pulp have to be im

1986—1990	20,000 TPA
1991—1995	58,000 TPA
1996—2000	36,000 TPA

The requirement of short fibre pulp locally available in the form of from logging and mechanical fo dustries.

The waste paper component has t ported from Java and Singap amounts to the following quantitie

1986—1990	47,000 TPA
1991—1995	156,000 TPA
1996—2000	156,000 TPA

Capital requirement is estimated

1981—1985	US$200 million
1986—1990	US$502 million
1991—1995	US$149 million
Total	US$851 million

The production is mainly for th Indonesian market (some 6(Singapore receives the major po quantities exported to other AS tries. After 1996 the most effici tion appears to be:

	Domestic Indonesia ('000 TPA)	Malay-sia	Singa-pore
Fine papers	—	53	86
Fluting	155	—	45
Folding boxboard	175	—	50

15.2.3 *Northeast Kalimantan*

The mill site is identified as Tidung Papa in the Tarakan locality of the province of East Kalimantan.

The first production unit to be established should be a pulp mill producing bleached hardwood kraft pulp for the paper industry of Java. The mill should come into production in 1986 and have a capacity of 131,000 TPA. A major expansion should take place in the period 1991—1995 giving the following productive capacity in 1996:

Fine papers	305,000 TPA
Fluting	100,000 TPA
Folding boxboard	60,000 TPA
Bleached hardwood export pulp	131,000 TPA

The required hardwood pulpwood is available in the vicinity of the mill site. 15,000 hectares of new pine plantations are envisaged to be producing some 168,000 m^3 from 1996 onwards. This does not fill the total requirement of long fibre and 38,000 tonnes of bleached long fibre pulp have to be imported per year after 1995.

25,000 TPA of waste paper have to be obtained from Singapore.

The requirement of investment capital is estimated as follows:

1981—1985	US$222 million
1991—1995	US$754 million
Total	US$976 million

The production of export pulp will be shipped to industries in Java. The paper produced at Tidung Papa will best be distributed in the following way:

	Domestic Indonesia ('000 TPA)	Malay-sia	Philip-pines	Thai-land
Fine papers	305	—	—	—
Fluting	—	14	71	15
Folding boxboard	60	—	—	—

15.2.4 *South Kalimantan*

The mill site identified in the province of South Kalimantan is located close to Banjarmasin at the Barbito River. The surrounding area contains large resources of hardwood pulpwood and has proven potential for the establishment of pine plantations.

The analysis indicates that the industry at Banjarmasin should not come into production before 1996 at which time the following production capacities should be ready:

Linerboard	186,000 TPA
Fluting	100,000 TPA

The requirement of short fibre material will be obtained from the surrounding indigenous forests and an envisaged area of 15,000 hectares of pine plantations will provide 162,000 m^3 annually of long fibre pulpwood.

60,000 TPA of waste paper should be obtained from Surabaya.

The total mill investment is estimated to US$356 million.

Almost the entire production is for the Java market; only 8,000 TPA of fluting is exported to Malaysia.

15.2.5 *Temerloh*

The production units which should be installed at the Pahang River in the Temerloh area will almost exclusively supply the Malaysian market, and by doing so releases the production potential of Sabah for intra-ASEAN trade.

The first stage of the establishment of industries, which should be operational by 1986, should include 57,000 TPA of liner-

board capacity, 18,000 TPA of sack kraft, and 78,000 TPA of fine papers. A major expansion should take place during the period 1986—1990 resulting in the following total capacity from 1991 onwards:

Linerboard	157,000 TPA
Sack kraft	18,000 TPA[1]
Newsprint	100,000 TPA
Fine papers	117,000 TPA
Fluting	100,000 TPA

The mills of Temerloh should also produce bleached and unbleached hardwood pulp for the folding boxboard mill(s) in Kuala Lumpur as follows:

	1986—1990	1991—1995	1996—2000
	('000 TPA)		
Bleached hardwood pulp	14	18	26
Unbleached hardwood pulp	16	20	29

Hardwood pulpwood will be available in the form of residues from the concentration of mechanical forest industries at and around Temerloh and from logging. The pine plantations near Temerloh are expected to yield 50,000 m^3 per year during the period 1986—1990 and thereafter 140,000 m^3 per year. This is not sufficient for the envisaged production and the following quantities of pulps have to be imported:

	1986—1990 ('000 TPA)	1991 onwards
Bleached long fibre pulp	13	20
Semi-bleached long fibre pulp	—	21
Unbleached long fibre pulp	10	10

[1] Sack kraft should be produced on the same paper machine as linerboard.

During the period 1986—1990, 11,000 tonnes of waste paper is required per year From 1991 onwards this requirement is increased to 55,000 tonnes. The main source of waste paper will be Kuantan and Kuala Lumpur.

The requirement of investment capital is estimated as:

1981—1985	US$228 million
1986—1990	US$404 million
Total	US$632 million

Small quantities of newsprint and fluting are exported to Thailand and the Philippines before 1996.

15.2.6 *Kuala Lumpur*

The analysis locates all production of folding boxboard for the Malaysian market Kuala Lumpur except for a small supply from Northern Sumatra, as this town is the major center of demand for this grade papers. However, production of folding box board can economically be carried out small manufacturing units and the analysis is not detailed enough to indicate if there are advantages in spreading this product also to other places. Further studies should therefore be undertaken to determine geographic diversification of folding box board production, to other demand centers like Penang, Ipoh, Kuantan and Johor Bharu, is feasible.

As it stands the analysis indicates that the production capacity for folding box board at Kuala Lumpur should be increased from existing 13,000 TPA to 88,000 TPA in 1986 and further to 113,000 tonnes by 1991 and 163,000 by 1996.

The short fibre pulp component is obtained from the production units at Temerloh. The requirement of long fibre pulp to be imported and this import will amount to 15,000 TPA in 1986—1990 increasing to 20,000 tonnes in 1991—1995 and 30,000 tonnes in 1996—2000.

All waste paper required for the envisaged production is obtained from

Kuala Lumpur and Kelang areas.

The requirement of investment capital is estimated as:

1981—1985	US$148 million
1986—1990	US$ 78 million
1991—1995	US$119 million
Total	US$345 million

15.2.7 *Tawau*

Tawau in Southeast Sabah has been identified as a suitable mill site and the State Government has, with this in mind, initiated a programme of pine plantation establishment in the surrounding area.

The production of the Tawau locality should start in 1991 with a production capacity of 186,000 TPA of linerboard. During the period 1991—1995 sack kraft and newsprint production units should be established giving the following total capacity in 1996:

Linerboard	186,000 TPA
Sack kraft	109,000 TPA
Newsprint	200,000 TPA

The production should be based on indigenous hardwood pulpwood and the yield from 15,000 hectares of pine plantation, which from 1991 onwards is envisaged to be 162,000 m^3 per year. This local long fibre supply will not be sufficient after 1995 and, therefore, for the period 1996—2000, 58,000 tonnes of unbleached and 42,000 tonnes of semi-bleached long fibre pulp have to be imported annually. The requirement of 35,000 tonnes of waste paper annually can be supplied from the Manila area of the Philippines.

The requirement of investment capital is as follows:

1985—1990	US$261 million
1991—1995	US$340 million
Total	US$601 million

The optimal distribution of total paper production in 1996—2000 is:

	Indonesia ('000 TPA)	Philippines
Linerboard	21	165
Sack kraft	109	—
Newsprint	200	—

15.2.8 *Northeast Mindanao*

The general area of Northeast Mindanao has been identified by the analysis because of resource and cost advantages, as having great potential for development within the context of ASEAN pulp and paper sector expansion. The area contains several mill sites—new as well as with established industries. The analysis cannot, at this stage, isolate any one of them as having definite competitive advantage over the other. In order to define precise locations for various sub-projects within the total investment opportunity, special studies have to be initiated. The presentation here, therefore, treats Northeast Mindanao as one locality or development area.

The development should start during the 1981—1985 period by installing 154,000 TPA of sack kraft capacity, increasing the existing newsprint capacity from 100,000 TPA to 400,000 tonnes and add 122,000 TPA of fine paper capacity to the existing 7,000.

The sack kraft capacity should be increased to 231,000 TPA during 1985—1990 and the fine paper capacity to 290,000 tonnes. Further expansion should take place in the period 1990—1995 providing the following total production capacity in 1996:

Linerboard	37,000 TPA (existing)
Sack kraft	231,000 TPA
Newsprint	500,000 TPA
Fine papers	290,000 TPA
Fluting	12,000 TPA (existing)
Folding boxboard	25,000 TPA

The fibre requirement will be met by indigenous hardwoods together with the yield from 15,000 hectares of pine plantations

supplemented by import of long fibre pulps. The local long fibre pulpwood production is estimated to be 30,000 m^3 per year during the period 1986—1995 and thereafter increase to 56,000 m^3 per year.

The requirement of imported pulps will be as follows:

	1986—1990	1991—1995	1996—2000
	('000 TPA)		
Bleached long fibre pulp	15	42	20
Unbleached long fibre pulp	82	123	123

A total of 12,000 TPA of waste paper will be required from 1996 onwards. This can be obtained from consumption centres in North Mindanao and from Manila.

The requirement of investment capital is as follows:

1981—1985	US$ 758 million
1986—1990	US$ 512 million
1991—1995	US$ 89 million
Total	US$1359 million

The production of papers in the Northeast Mindanao area is supplied to the local Philippines market and to Indonesia and Singapore, with some newsprint going to Malaysia (Sarawak and Sabah) in 1986—1990. Indonesia will receive over 50 percent of the production in 1986—1990 and close to 70 percent in 1991—1995. Singapore's share is only 11 percent in 1986—1990 and 3 percent in the following five-year period. In 1996—2000 the distribution will be as follows:

	Philippines Domestic Market	Indonesia	Singapore	Thailand
	('000 TPA)			
Linerboard	37	—	—	—
Sack kraft	110	121	—	—
Newsprint	165	270	65	—
Fine papers	149	141	—	—
Fluting	12	—	—	—
Folding boxboard	23	—	—	2

15.2.9 *Northwest Thailand*

The indigenous pine forests in Northern Thailand will form an important raw material resource for a new pulp and paper production center. Several mill sites are available and can be used. They cannot be given any competitive ranking in this analysis. Further studies have to be conducted before a definite choice of production site(s) is made.

The expansion of the industry should start with the establishment of a 100,000 TPA newsprint mill which should come into production in 1986. In the period 1986—1990 a 62,000 TPA sack kraft mill should be added and in the following five-year period the newsprint mill should be expanded and a unit for production of fluting be added, giving the following total capacity in 1996:

Sack kraft	62,000 TPA
Newsprint	200,000 TPA
Fluting	65,000 TPA

The fibre requirements could be met by the indigenous forests. Current yield estimates, however, indicate that the outturn from the pine forest may not be sufficient but will have to be supplemented by import of some 13,000 TPA of unbleached long fibre pulp in 1991—1995 and 21,000 TPA of semi-bleached pulp in 1996—2000.

In the period 1996—2000, 16,000 TPA of waste paper is required which can be supplied from consumption centres in Northern Thailand and from Bangkok.

Capital requirement is as follows:

1981—1985	US$150 million
1986—1990	US$101 million
1991—1995	US$185 million
Total	US$436 million

Up to 1996 the entire production will be absorbed by the domestic Thai market. In the period 1996—2000, 10,000 TPA of newsprint will be exported to Malaysia.

15.2.10 *Central Thailand*

Central Thailand has an established pulp and paper industry distributed over several mill sites including Bangkok. The production of this industry is based on rice straw, bagasse and imported pulp. The analysis indicates that there is a competitive potential for expanding the existing industry in the Central Thailand area in general, though the analysis is not sharp enough to pinpoint specific locations where new capacity should be installed.

The expansion should start in 1986—1990 by building out the existing capacity of 55,000 TPA of fine papers to 155,000 tonnes. In the following five-year period the fine paper industry should be further increased and at the same time the existing boxboard industry, presently rated at 77,000 TPA, should be expanded. The total installed capacity in 1996 will amount to:

Fine papers	194,000 TPA
Folding boxboard	102,000 TPA

The expanded production will be based mainly on bagasse and imported long fibre pulp. The import of bleached pulp will amount to 26,000 TPA in 1991—1995 and 41,000 tonnes in 1996—2000.

In 1996—2000 added capacity will require 12,000 TPA of waste paper which can be obtained from the Bangkok area.

Capital requirement is estimated as:

1986—1990	US$218 million
1991—1995	US$139 million
Total	US$357 million

The entire production will be absorbed by the domestic market.

15.3 **Retained Existing Capacity**

In Chapter 12 was mentioned that two areas, Java and Manila, were assumed, for various reasons, not to be considered for industry expansion. The existing industry, together with new additions now being installed, was assumed, however, to continue production up to the year 2000 if this appears economic. The analysis confirms that it is feasible to retain production at capacity in these two areas. It also indicates that production at Ujung Pandang, Sulawesi, should continue at full capacity.

The production in these three localities—Java, Ujung Pandang and Manila—will be of the following magnitude throughout the period up to the year 2000:

	Java	Ujung Pandang	Manila
	('000 TPA)		
Linerboard	10	—	3
Sack kraft	—	—	30
Fine papers	158	15	61
Fluting	15	—	17
Folding boxboard	71	—	77

The total production of these already established mills will be absorbed locally.

15.4 **Paper Imports**

The paper production envisaged under the development programme presented in the previous section will not supply all the projected paper requirement of ASEAN. Resource constraints preclude further expansion of production of some paper grades and the price and cost data governing the analysis make expansion in other grades uneconomic. The import, which is required to supplement regional ASEAN production, is specified in Table 35. This table also summarizes the production data presented in section 15.3.

Table 35. Production of Papers in ASEAN in 1986—2000 and Requirement of Import Specified on Grades of Paper and Planning Period. ('000 TPA.)

Paper Grade	Production			Import		
	1986—90	1991—95	1996—2000	1986—90	1991—95	1996—2000
Linerboard	317	603	975	104	67	84
Sack kraft	257	473	691	30	12	104
Newsprint	500	700	1000	52	65	56
Fine papers	496	874	1279	268	286	484
Fluting	99	399	664	183	28	13
Folding boxboard	380[1]	563	873	—	8	11

[1] There exists an over-capacity for folding boxboard production in 1986—90 of 11,000 TPA in Thailand and 22,000 TPA in the Philippines.

The regional production can supply some 75 percent in 1986—1990 and close to 90 percent thereafter. It should be remembered, however, that a number of specialty papers, like cigarette paper, tissue, etc., are not included in the forecasted demand. The requirement of each one of these grades is small, but together they may account for some 5—10 percent of the total requirement. Because of the diversity of their raw material requirements and production processes these papers were not included in the analysis. However, as many of them economically can be manufactured in small, labour-intensive production units, they could play a role in the industrial development of certain areas of ASEAN and should therefore be subject to special studies.

16 A Comparison Between 1977 and 1978—79 Results

16.1 Introduction

The outcome of the 1977 and 1978—79 analyses are not comparable in the sense of being two alternative solutions to one and the same problem. They are based on different sets of data and incorporate different assumptions and policies. Furthermore they represent two stages in the combined development of plan and policies, in which process the first plan, here represented by the result of the 1977 analysis, has influenced policies and attitudes which constitutes input to the 1978—79 analysis and plan. However, it could be useful to compare the results with the aim of tracing the cause of differences and test to what extent these changes are sensitive to the accuracy of data inputs.

The comparison presented in the following will not go into all details but be limited to the geographical distribution of production and the production/requirement situation. Each broad feature as derived in the two studies will be compared and an attempt will be made to find an explanation, in the input data and assumptions, to any differences. Whenever the sensitivity analysis, which was carried out in 1979, indicates that small relative alterations in the data which has caused the changes can reverse these changes or cause further changes, this will be taken note of.

The model will identify an alternative as optimal if the cost of total supply, over the 20-year planning period, of that alternative is a fraction of a dollar lower than the best other option. This means that alterations in the data, even if these are small, can have far-reaching effects.

16.2 Choice of Mill Locations

The localities arrived at in the two studies as having potential for pulp and paper industry development are listed in Table 36 below. In the table is also indicated if the site is selected in 1977 or in 1978—79 or in both studies.

The two studies differ with regard to eight sites. Of these, Java, Sedili, Manila and Singapore were excluded in the 1977—78 analysis because their potential was not fully clarified; they are however recommended to be subject to special studies to determine their suitability. Thus, the analysis gives different indications for South Sumatra, the two sited in Kalimantan and for Tawau only.

The analysis of the pulp and paper sector development potential in Indonesia (49), involving various possible development scenarios, indicates that mill establishment in South Sumatra and Kalimantan is closely

Table 36. Mill Localities Identified as Having Potential for Development.

	1977	1978—79
North Sumatra	×	×
South Sumatra		×
Northeast Kalimantan		×
South Kalimantan		×
Java	×	
Ujung Pandang	×	
Temerloh	×	×
Kuala Lumpur	×	×
Sedili	×	
Tawau		×
Manila	×	
Northeast Mindanao	×	×
Northeast Thailand	×	×
Central Thailand	×	×
Singapore	×	

Table 37. Paper Supply to Singapore and the Philippines in 1996—2000 as Derived in 1977 and 1978—79 Analyses Specified on Origin. ('000 TPA, 1977/1978—79.)

Commercial origin	Liner-board	Sack kraft	Newsprint	Fine papers	Fluting	Folding boxboard	Wrapping paper
Singapore							
Northern Sumatra	75/70	—/25	187/—	—	—	—/10	32/na
South Sumatra	—	—	—	—/86	—/45	—/50	—
Temerloh	85/—	—	—	300/—	—	—	34/na
Sedili	83/—	—	—	—	—	—	—
Mindanao	—	—	—/65	—	—	—	—
Domestic	—	—	—	—	—	120/—	—
Import[1]	—	93/—	—	440/29	81/—	116/—	7/na
Philippines							
Northeast Kalimantan	—	—	—	—	—/71	—	—
Tawau	1/165	—	—	—	—	—	—
Mindanao	125/37	90/110	204/165	163/149	36/12	118/23	140/na
Luzon	64/3	42/30	—	—/61	—/17	—/77	50/na
Import[1]	—	—	—	—/70	12/—	23/—	—/na

[1] From outside ASEAN.

dependent on the development in Java. If the restriction with regard to industry expansion in Java was removed, South Kalimantan should not be developed for pulp and paper and South Sumatra and Northeast Kalimantan should not expand to the capacities indicated by the analysis presented in Chapter 15. Instead expansion should take place in East Java and, maybe, also in South Sulawesi. The latter possibility has to be verified through further investigations.

In the 1978—79 solution the bulk of the production of South Sumatra, which is not delivered to Java, should be shipped to Singapore. The bulk of the export outside Indonesia from Northeast Kalimantan should optimally be delivered to the Manila area of the Philippines and the production of Tawau should be distributed approximately two third to Indonesia (Java) and one third to the Philippines (Manila area). (See sections 15.2.2, 15.2.3 and 15.2.7 for South Sumatra, North-East Kalimantan and Tawau respectively.) Singapore receives fine papers, fluting and folding boxboard from board and fluting from Tawau and Northeast Kalimantan.

The solutions derived in the 1977 analysis indicate that Singapore should get her supply from Northern Sumatra, Temerloh and Sedili in Malaysia and from domestic production and through import from outside ASEAN. The Philippines on the other hand should, according to the 1977 solution, rely almost entirely on domestic supply. The above points are summarized in Table 37.

The comparison between the 1977 and 1978—79 analyses which is made in Table 37 is not clear-cut, as there is also a change in projected total requirement, especially for Singapore, a reduction in potential production in Temerloh due to reduced supply of long fibre material and a shift in production from Northern Sumatra to Mindanao. This latter change will be discussed below. However, some conclusions can be made:

— If the long fibre supply in Central Peninsular Malaysia can be expanded over and above what is assumed in the 1978—79 analysis, Temerloh will be a more economic supplier of paper to Singapore than South Sumatra

Table 38. Comparison of Manufacturing Cost of Nine Mill Locations in ASEAN—Indices with South Sumatra = 100.

Mill Location	Liner-board	Sack kraft	Newsprint	Fine papers	Fluting	Wrapping papers
South Sumatra	100	100	100	100	100	100
South Kalimantan	84	88	88	95	87	89
Northeast Kalimantan	100	100	100	99	100	100
East Java	97	99	95	99	92	94
Temerloh	99	93	97	100	96	99
Sedili	99	93	97	99	96	99
Tawau	103	96	100	99	99	100
Manila	97	94	95	96	94	94
North Luzon	91	81	89	94	89	92

— if there is a supply of long fibre material in South Johore and a feasible mill site can be found, supply from this mill to Singapore has competitive advantage over supply from South Sumatra
— if production capacity in the Manila area can be expanded, and plantation of long fibre can be made available in those amounts assumed in the 1977 analysis and if mill expansion is not restricted in Java, Tawau and Northeast Kalimantan should not be developed before the year 2000.

The conclusion made above and what is concluded from the Indonesia analysis is further confirmed by the manufacturing cost data. They show no cost advantage of South Sumatra over Sedili and Temerloh or of Tawau and Northeast Kalimantan over Manila and North Luzon, and East Java compares favourably with South Sumatra and South Kalimantan. The manufacturing cost data for these mill localities are compared in Table 38.

Comparison of investment costs in the same manner does not indicate any cost disadvantage of the excluded mill localities.

What is said above does not contradict the statement made in 15.1 that Java, the Manila area and Sedili will not eliminate any of the localities identified as prime locations for development. Specific problems of water supply, competition for raw material resources, effluent disposal and air pollution are restricting the pulp and paper industry development in Java, Metro Manila area and in Johore (Sedili). What is highlighted in the discussion earlier only strengthens the point that these areas have to be considered in further investigations of the pulp and paper sector of ASEAN and their potential as development sites clarified.

The results of the 1978—79 analysis show, compared to those of 1977, geographic shifts in the location of the manufacture of specific grades of paper. The most noticable of these shifts involves the transfer of all newsprint manufacturing from Sumatra to first of all Mindanao but also to Northern Thailand, Temerloh and Tawau. The newsprint manufacture has also increased from 860,000 TPA or 90 percent of requirement in 1996—2000, according to the 1977 analysis, to 1,000,000 TPA or 95 percent of requirement in the same period in the 1978—79 analysis, which also reflects the slightly higher forecasted requirement used in the later study.

The lower requirement of long fibre material specified for newsprint in the fibre furnishes used in the 1978—79 analysis compared to those applied in 1977 allows the shift to Mindanao. The major cause, however, is a drastic reduction in the estimated costs of power in Mindanao as can be seen from Table 33. The cost per MWH in Mindanao was in 1977 estimated as US$ 33, while the 1978 estimate put it at US$ 19. The power costs applied for Sumatra is the same in the two analyses.

Table 39. Total Optimal Paper Production and Supply Relative to Requirement as Derived in 1977 and 1978—79.

Analysis Year	Total Production '000 TPA			Supply as Percent of Requirement		
	1986—90	1991—95	1996—2000	1986—90	1991—95	1996—2000
1977	1900	3100	4450	68	77	79
1978—79	2080	3610	5480	78	89	88

A test of the effect of changes in power costs shows that if the price per MWH is increased to US$ 30 in Mindanao, the expansion there will be re-located to Sumatra. Similarly if the price in Sumatra is reduced to approximately US$ 30 the capacity build-up will take place in that area rather than in Mindanao.

16.3 Balance between Production and Requirement

In both analyses the supply of long fibre pulpwood constitutes an absolute constraint to the expansion of total paper production. This constraint is less severe in the 1978—79 analysis because of the acceptance of higher admixtures of short fibre in most paper grades. This is clearly reflected in total production and in supply relative to requirement as can be seen in Table 39.

The conclusion that expansion of manufacture partly is a result of better supply, relative to requirement, of long fibre material, is further strengthened by the fact that production of sack kraft, the paper grade requiring the highest admixture of long fibre, is suggested to be 87 percent of projected consumption in the 1978—79 analysis compared to only 44 percent derived in the earlier analysis.

Regional ASEAN supply relative to projected requirement for various grades of paper obtained from the two analyses is presented in Table 40.

The availability of long fibre alone is, of course, not sufficient to explain the expansion of production. The additional production also has to be economic. The prices of import (c.i.f. Singapore) and cost of production, exemplified by those of Northern Sumatra, are given in Table 41 for the two analysis occasions.

It should be pointed out that even if the required fibre quality is available and if the economics of production is satisfactory, production may still not reach 100 percent of requirement due to the fact that economies of scale and optimal size of production units are involved. Under-production of some 5—10 percent, in the case of ASEAN, can be explained by these considerations.

A study, grade by grade, of tables 40 and 41 and referring back to table 28, giving acceptable fibre furnishes, provides explanations to the change in production.

Linerboard production is, in relative terms, reduced and this reduction is mainly caused by short supply of long fibre in those localities where this production is developed. Some of the reduction stem from the fact that full units of 140,000 TPA are aimed at.

The fibre furnish for linerboard, as prescribed in the model, requires the admixture of board grade long fibre pulp (high yield kraft pulp) which is presently not traded

Table 40. Production as Percentage of Requirement Derived from the Results of the 1977 and 1978—79 Analyses.

	1977	1978—79
Linerboard	100	92
Sack kraft	44	87
Newsprint	90	95
Fine papers	100	73
Fluting	41	98
Folding boxboard	37	99
Wrapping papers	100	na

Table 41. Import Prices and Manufacturing Costs of the 1977 Analysis Compared to Those of 1978—79. (US$ per tonne.)

Paper Grades	Prices (c.i.f. Singapore)				Costs[2] (Northern Sumatra)			
	1977	1978—79	Difference $	Difference Percent	1977	1978—79	Difference $	Difference Percent
Linerboard	315	530	215	68	200	290	60	44
Sack kraft	370	600	230	62	250	385	135	54
Newsprint	390	560	170	44	245	380[3]	135	55
Fine papers	565	775	210	37	340	540	200	59
Fluting	215	370	155	72	195	310	115	59
Folding boxboard	500	630	130	26	315	420	105	33

[2] Ex-mill cost price including depreciation and 10 percent interest on capital.
[3] In Mindanao the production cost is estimated at US$ 355.

internationally and is assumed not to be available in the world market in the future. Consequently further expansion of linerboard manufacture based on imported pulp is not a feasible solution in the 1978—79 analysis.

Sack kraft production is indicated to be low, relative to requirement, by both analyses. This grade requires the highest percentage of long fibre of those papers included in the analysis and have to compete, economically, with other grades for available resources. In the 1977 analysis it could not compete, in terms of contribution to the objective function, with any other grade but linerboard, as can be concluded from Table 41. Sack kraft and linerboard yielded in that analysis about the same contribution at mill, but linerboard has a slightly lower distribution cost and is therefore preferred.

A further expansion of sack kraft manufacture based on imported pulp is economically not feasible. The cost of such production will be US$ 160, according to the 1977 analysis, and US$ 55, according to the 1978—79 analysis, above the import price.

Newsprint production is in both analyses a competitive use of long fibre. In 1977 the contribution to the objective function by this manufacture was clearly better than linerboard and sack kraft and in 1978—79 on par with sack kraft. The absolute availability of long fibre limited the production in the 1977 study, while in 1978—79 the shortfall of 5 percent of requirement is a matter of adjusting production to practical maximum per mill unit.

The investment in a newsprint mill has a large fixed proportion which implies that economies of maximizing production is pronounced. The additional requirement is 56,000 TPA in 1996—2000 and the minimum economic production, according to model input data, is 66,000 TPA. If this constraint was not there it would be economic to produce newsprint from domestically produced short fibre refiner groundwood and imported bleached long fibre kraft pulp.

Fine papers contribute more per tonne of production to the objective function than the other papers in both analyses. Only linerboard in 1978—79 has a margin of import price over costs of the same magnitude. One should therefore expect that the 1978—79 analysis should suggest that production should nearly equal requirement as did the 1977 study.

Fine paper is a very heterogeneous group containing a large number of special grades which, each one of them, contribute only small fractions to total requirement but taken together are a significant portion of the fine paper group. Examples of these specialty papers are duplicating paper, liteograph paper, paper for banknotes, bible

paper, onionskin, etc. Normally these papers are not manufactured by large mills catering for bulk supply but by small units often integrated with converting industries. To take account of this it was decided to reduce the requirement of fine paper, in the 1978—79 analysis, by 25 percent. This means that also in the 1978—79 analysis fine paper production nearly equals requirement. Another result of this reduction, in case it is later found that production of this grade can be expanded, may be that suitable mill sites are pre-empted.

The solution derived in 1978—79 involves complete utilization of all available long fibre resources. If production of fibre board and particle board is considered, as it is in the model, also all short fibre pulpwood is utilized in 1996—2000 in those wood supply regions where pulp and paper mills are located; with one exception: South Kalimantan. As it appears to be economic to base production of fine papers on domestically produced short fibre pulp and imported long fibre pulp—the margin at mill is of the order US$ 200 per tonne—establishment of fine paper production in South Kalimantan, in addition to the production suggested for that locality, appears feasible.

Though the wood supply areas containing selected mill locations have their resources fully utilized under the suggested industry expansion programme, there are other areas where ample supply of short fibre wood is available. Ideal location of production, from the point of view of production and distribution costs would be Johore (Sedili) and Greater Manila area.[4] These localities, close to major consumption centers, were excluded, for reasons explained in Chapter 16, from the 1978—79 analysis but it has been suggested that they should be subject to further studies, and it is obvious that investigations of the feasibility of fine paper production should be included in these studies.

Fluting is the only paper grade included in the study manufactured from 100 percent short fibre. The volume of production is consequently not as severely restricted by resource availability as the other papers.

In the 1977 analysis the margin between import price and cost of manufacture was only US$ 20 for fluting. This small margin allowed distribution only to consumption centers close to the mill sites. Consequently the estimates of production fell short of total requirement.

In the 1978—79 analysis the import price exceeds cost of production by some US$ 60 and this allows the production of total requirement and distribution to all consumption centers of ASEAN. However, small changes in price or costs or in both can again make the production of fluting uneconomic.

Folding boxboard has in both analyses differences between import prices and costs of production which comfortably would make production of the total requirement possible. However, in 1977 the projected availability of waste paper constituted an absolute constraint to total production of folding boxboard and wrapping papers. Both these grades required in that analysis waste paper in all fibre furnish options. Wrapping papers had a more favourable difference between production costs and import price, and therefore production of this grade was expanded until total requirement was met before resources were channeled into the manufacture of folding boxboard. No such constraint was present in the 1978—79 analysis.

In summary the following points can be made:

a) Availability of long fibre raw material is determining the total production of linerboard and sack kraft and the geographic location of this production
b) cost of power has determined the location of newsprint production
c) production of fine papers does not equal requirement in the 1978—79 analysis because of technical steering and
d) in the cost and price situation, represented by the model inputs, production of fluting is sensitive to relatively small changes in the data base.

[4] See Table 38 (p. 70).

17 Reaction to the 1978—79 Analysis

The results of the 1978—79 analysis were in April 1979 compiled in the form of a preliminary report draft and circulated to government authorities and industrialists in the ASEAN member countries and to office holders in the ASEAN Secretariat and members of the ASEAN Experts' Group on Pulp and Paper.

In May and June 1979 the Coordinator of the Pulp and Paper Industries Development Programme visited all ASEAN member countries to discuss the results of the analysis with various government authorities and with representatives of the industry and to enquire what further analysis they would regard necessary. As a conclusion of these discussions the draft results were discussed with the Experts' Group in a meeting in Manila on 13—15 June 1979.

The ASEAN Experts' Group on Pulp and Paper decided, after discussions among themselves and with the Programme Coordinator, that the study was sufficiently advanced to form the basis for a policy decision on ministerial level within the Association. The draft report was therefore entered on the agenda of the meeting of the Economic Ministers of ASEAN in Manila on September 7—8, 1979.

The Economic Ministers accepted the draft report as a basic strategic plan for the development of the pulp and paper sector of ASEAN and instructed the Secretariat to approach FAO with a request for assistance in carrying out feasibility studies. In first hand the feasibility studies should cover those localities identified as having advantages for expansion and new establishment in the five-year period 1981—1985. The Ministers instructed that special attention be given to the mill sites in Northern Sumatra, Temerloh, Central Thailand and Mindanao.

The Secretariat, when approaching FAO, also requested on advise from the Ministers and the Experts' Group that the econometric model be transferred to Jakarta and thereby made directly accessible to the ASEAN Secretariat (8).

18 Problems of Implementation[1]

18.1 Introduction

The analysis of the development potential of the pulp and paper industry within ASEAN, as summarized in previous chapters, is based on the fundamental assumption that any development pattern derived, within the constraints of resource availability, projected paper requirements and product cost and prices, can be realized. This in turn implies that:

— capital in sufficient amounts can be attracted for investment
— there exists a political will to implement the proposals
— sufficient expertise is available to plan, construct and start-up the new industrial units, and
— manufacturing capacity for mill equipment is available.

18.2 Capital Availability

The requirements of capital, which are summarized in Table 42, appear to be high. However, the requirements for Indonesia, Malaysia and the Philippines are rather modest compared to total investments under recent development programmes and are not exceptional compared to earlier investment into other industries. Only Thailand has hitherto not experienced industrial investment of this magnitude.

Indonesia, Malaysia and the Philippines have national plans which indicate that both the private and the public sectors are capable of allocating capital of the magnitude required for pulp and paper sector development. Under ASEAN investment agreements it is possible to inject capital from other member countries, including Singapore, into Thailand, should this be required (9). The allocation of funds for pulp and paper industry development will, it thus appears, depend on the attractiveness of this industry compared to other investment possibilities.

Table 42. Requirements of Capital for Investment into the Optimal Pulp and Paper Industries Development Alternative. (US$ Million.)

Country	1980—85	1986—90	1991—95
Indonesia	592	627	1783
Malaysia	376	743	459
Philippines	758	512	89
Thailand	150	319	324

The analysis has rejected all investment which does not yield at least 10 percent on capital before taxes. It has been assumed that international lending institutions will be prepared to provide funds, should this be required, if the expected returns are above 10 percent and, therefore, this minimum return condition was introduced to ensure that the assumption of availability of funds had a realistic base. However, considering also other investment opportunities and development priorities, 10 percent may not be regarded, by private and public investors, as attractive. If that is the case, it may be difficult to attract investment capital for the folding boxboard mills in South Sumatra and Kuala Lumpur and the market pulp mill in East Kalimantan, as these invest-

[1] This discussion is carried out with the background of information compiled from FAR EASTERN ECONOMIC REVIEW 1978 and 1979, Economist Intelligence Unit reports on Indonesia, Malaysia, Philippines, Singapore and Thailand for 1978 and 1979, The Asian Wall Street Journal 1978 and 1979 and the Far East and Australia 1978—1979, Survey and Directory of Asia and the Pacific (70, 24, 10, 26).

ments appear to yield just 10 percent return. The return expectations of the suggested investments in Sabah and Central Thailand are of the order of 13—14 percent and even that may not be sufficient to make these opportunities attractive. The other mills, identified by the analysis, have prospects of yielding over 15 percent return before taxes and should, in the ASEAN investment market, have no problem attracting capital.

The indications are, therefore, that capital can be available for the larger part of the suggested investment programme from internal sources and, if the policy of international lending institutions does not change, capital can be obtained for the total programme provided that the projects warrant priority rating in the development plans of ASEAN and its member countries.

18.3 Political Will

The political attractiveness of projects depends on their ability to contribute towards the attainment of national aspirations. The current development plans of the ASEAN countries place strong emphasis on increased national earnings, foreign exchange savings and employment creation. It is, therefore, in the context of these aspirations the pulp and paper industries have to be viewed in order to assess their political appeal.

The contribution from the total paper industry expansion to national earnings, as suggested by the analysis, in terms of net national product for ASEAN as a whole, amounts to some US$ 800 million per year during the period 1986—1990 and increases to just below US$ 1500 million in period 1991—1995. Compared to the investments required to generate these earnings, they are small. Each dollar of investment creates US$ 0.4 of net national product per year, which is not an impressive performance by industry investment.

The foreign exchange savings which will be realized, if the suggested pulp and paper capacities are created, are estimated to be of the order of US$ 1300 million in the period 1986—1990 and US$ 2100—US$ 2200 million in the period 1991—1995. These figures represent gross savings of non-ASEAN foreign exchange and are offset by the substantial foreign exchange drain associated with investment. However, taking these expenditures into account, there is no doubt that substantial foreign exchange savings can be achieved in the long term, though an initial drain of reserves is unavoidable.

The extent to which employment opportunities are likely to be generated through the development of the ASEAN pulp and paper sector, as suggested here, is difficult to define with precision. Much depends on the policies which are to be adopted with regard to capital or labour intensive programmes for each of the many employment areas involved.

The estimates of manpower requirements which were made in the analysis refer to mill operations only and assume capital intensive technology. These estimates are contained in Table 43.

In the same table are also given estimates for logging, based on an average output of 350 m^3 per man year,[2] and for plantations, assuming that every 60 hectares of plantation provides full time employment for one man.[3]

The estimates are indicative only and higher figures can be derived if labour intensive operations are assumed. However, they indicate that a significant contribution to employment creation can be expected from an expanded pulp and paper sector. Seen in relation to the investment which have created these job opportunities, they are not spectacular; compared to industry

[2] Data collected during the field work indicate that labour requirement for logging, including transport to roadside, of hardwood logs is one full man year per 350—450 m^3. As it is assumed that pulpwood logging, because of small dimensions and the need for de-limbing, will have a higher labour requirement, the lower productivity figure has been used here.

[3] The figure is an average for plantation established within ASEAN during 1977 and includes site preparation, nursery work, planting and tending.

Table 43. Estimates of New Employment in Pulp and Paper Production, Logging and Plantation Establishment. (Number of full time employees.)

Country	in Mill	in Logging	in Plantation	Total
Period 2				
Indonesia	2800	3350	2490	8640
Malaysia	1800	1640	850	4290
Philippines	3400	4560	1310	9270
Thailand	900	790	480	2170
Total	8900	10340	5130	24370
Period 3				
Indonesia	5900	6770	2490	15160
Malaysia	4600	5870	1850	12320
Philippines	5100	7260	1310	13670
Thailand	2800	2570	800	6170
Total	18400	22470	6450	47320

investment in general, they are no more than average.

The data in Table 43 reflect direct employment in the manufacture of paper, and this industry is generally regarded as a poor provider of jobs. The strength of the pulp and paper industry, in terms of employment creation, lies in its strong linkage effect, up-stream as well as down-stream, on associated industrial activities (see Chapter 3). If this impact could be measured, the capacity expansion derived by the analysis would undoubtedly give a much more favourable indication of employment creation.

An expansion of the ASEAN pulp and paper industry would, as outlined above, not make much impact on national earnings but could make a modest contribution to foreign exchange savings and assist in job creation. The suggested development programme could therefore have political appeal and the reaction by the Economic Ministers to the proposal, as described in Chapter 17, indicates that it may be given a priority rating in the development programmes of the ASEAN countries.

18.4 Availability of Expertise and Equipment Manufacturing Capacity

The planned programme of development, as envisaged here, requires continuous intensive feasibility studies to verify the viability of the investments and to ensure the creation of efficient production units. In each planning period as many as thirty-five[4] feasibility studies for individual mills may be required.

A large number of consultant firms are offering services for feasibility studies in the field of pulp and paper throughout the world and a large number of such studies have been carried out annually in recent years. The expansion of study capacity which would be required for the ASEAN programme does not seem difficult to achieve in light of these recent activities.

Only limited investment has been made into new pulp and paper mills during the past five years, and even while investment activities were high in the world paper economy (prior to 1973) the number of new units coming into operation each year was small. It is, therefore, conceivable that world capacity for producing the required manufacturing equipment, together with the availability of skilled and experienced staff for installing and start-up of the envisaged new mills, could constitute the most serious bottle-neck in the implementation of the suggested programme.

Given firm commitments, by investors, to the ASEAN pulp and paper development programme, it is probable that obstacles relating to the supply of equipment could be resolved. The build-up of a sufficiently large cadre of skilled staff, especially for start-up and training at each new mill could, on the other hand, prove to be an insurmountable problem and should be given special attention before commitment to definite investment plans are made.

[4] Assuming installation of mills no larger than what is regarded as maximum mill capacity (see Chapter 13).

19 Further Studies

The comparison between the 1977 results and those of the 1978—79 analysis presented in Chapter 16 indicates the impact that changes in policy and data input can have on analysis results. Data are bound to change over the years under the influence of various price movements and as a result of government and industrial action. Policies will similarly change as development targets are fulfilled and new aspirations of the ASEAN member countries move into the foreground.

It is also clear that a study covering such a wide range of site specific data, as used in the analysis, cannot be expected to be free of errors. Furthermore, in order to avoid costly field studies, a large amount of subjective judgements had to be used in determining a portion of the input data. Though every effort was made to have these judgements founded on best experience available and to check them, they still constitute a serious source of uncertainty with regard to the validity of some of the inputs.

What is said above indicates that analysis results for the nearest five-year period need to be verified by special studies and what is derived for the remaining years of the total planning period should be regarded as broad indications only. This in turn means that the data files need to be up-dated continuously and that the analysis need to be redone periodically, so as to ensure that the best possible foundation is used in the rolling plan development by ASEAN as a community as well as by the individual member countries.

In the up-dating efforts the feasibility studies initiated by the Association, through their request for FAO assistance, will provide an excellent source of data, promising a far better data base than the Pulp and Paper Industries Development Programme could achieve within the limited fund and personnel resources available.

ASEAN has, through the Experts' Group, requested that the econometric model should be installed in Jakarta so that the ASEAN Secretariat can have direct access to it. This appears to indicate that there is an intention to attempt re-analysis.

The transfer of the model should not prove difficult as IBM computers, compatible with the one at FAO computer center, are available in Jakarta, with government institutions as well as with private firms. In addition, anticipating the need to make the analytical tools more easily accessible to ASEAN planners, a forest officer/system analyst from the Directorate-General of Forests of Indonesia was trained to use and manipulate the World Bank Model during the 1978—79 analysis.

Thus, there appears to be a full understanding in ASEAN for the need to up-date the input information and periodically re-evaluate the pulp and paper industry development prospects of the region. All necessary technical steps have been taken to accomplish this.

The plan as presented in Technical Report 1 should not be regarded as "the final product of the planning process; it is an interim report" (72).

20 Views on the Actual Planning Procedure

20.1 Introduction

The experience which was gained, with regard to directly integrating various fields of specific knowledge into a working relationship, in the combined political/economic/technical planning attempt, described in the foregoing will, no doubt, be valued differently depending from which position it is viewed. There is no doubt that this author will look at it with a heavy bias toward the economic planning side and treat lightly the problems faced by the political or technical participants in the exercise. The following should therefore be regarded as the one-sided opinion of the planning economist and any, from the point of view of other participants, unfair criticism should not cause alarm, though it should be taken into consideration.

In the planning attempt for the ASEAN pulp and paper sector the planner/analyst needed the close cooperation of (i) five governments of countries with different development priorities, resource situation and level of economic development, (ii) a not very coherent industry with widely differing technical experience, (iii) technical expertise on pulp and paper represented by consultant firms and the Pulp and Paper Branch of FAO, (iv) technical expertise on fibre resources embodied in the forestry and agricultural departments of the member countries of ASEAN and finally, (v) UNDP and FAO for the supply of funds and manpower. In addition, the analysis was further complicated by introducing, for forestry, a relatively novel concept of planning and an advanced technique of analysis. Given this planning environment it would be surprising if friction would not develop from time to time and if serious, though not intentional, obstacles would not be created by any one of the participants.

The following is not meant to pinpoint the blame for any failures on any one or to distribute praises, but to record, for the benefit of future endeavour of this kind, the problems encountered and the apparent problems which dissolved themselves.

The following discussion will be divided into four major parts dealing with analytical technique, technical inputs with regard to pulp and paper production, technical assistance from the field and political guidance. The presentation is made brief and no attempt has been made to analyse the underlying causes of success or failure.

20.2 Analytical Technique

The analysis used a linear programming technique to determine the optimal distribution, geographically and over time, of pulp and paper industry investment. In the start it was believed that the application of the analytical technique to forestry and forest industries without the continuous and direct assistance of these members of the World Bank team who had developed the specific model used in the analysis, would be impossible. However, this problem did not prove to be a problem. The linear programming technique for allocation of activities in time and space are widely used and the mathematical concept is standard and need no specific branch knowledge, only a clear problem statement. In this specific case the application was eased through the help of the model designer and the ability and wholehearted dedication of the systems analyst of the FAO Computer Center. Both of these gentlemen took part in the 1977 analysis in Bologna[1] and the FAO systems

[1] The designer, Lic. H. Bergendorff, also assisted in an initial adaptation of the model to the ASEAN environment in 1976 at the World Bank.

analyst supervised the adaptation of the model for use in the IBM computer at FAO Headquarters.

20.3 Input of Technical Expertise

It has been mentioned earlier that the application of linear programming techniques in forestry and forest industries are not new (see Chapter 6) but have so far not become a common feature.

Some of the consultant firms who participated in the assembling of the data base had experience of the use of linear programming and their officers, though not all of them familiar with the concept as such, were used to collect and adapt data for the use in analysis applying this technique.

It is inevitable that, when introducing a new planning procedure paired with a strange analytical technique, criticism with regard to the accuracy and validity of the plan development will arise. The problem lies in the change from the traditional way of applying judgement first and then make an analysis, to carrying out the analysis and then apply judgement for selecting the most appropriate alternative. This proved to be a dominating obstacle in gaining acceptance to the methodology by the Forestry Department of FAO. Only at the very end of the 1978—79 analysis had FAO gained enough confidence in the technique to fully appreciate its merits.

The ASEAN Experts' Group on Pulp and Paper, at the briefing in September 1977, developed an instant understanding of the planning procedure and analytical technique and endorsed their application in the planning of the ASEAN Pulp and Paper Sector and was offering their full support and cooperation.

20.4 Technical Input from the Field

The expert teams who travelled throughout the ASEAN region to collect data and other input information were met with full cooperation from government officials as well as from representatives of the private industry. The field contacts which were established during these visits also assisted in checking of data and collecting complimentary data.

Thus, the contacts in the field provided no obstacles, if the frustrating slowness which characterizes exchange of information by mail between Southeast Asia and Italy is disregarded. The main problem encountered in the collection of field data was that relevant information was not available and when it was available, the accuracy was often doubtful. This shortcoming constitutes probably the most serious weakness in the analysis and originates from the fact that there has previously not been any need for collecting and compiling the type of data required for the intended analysis. There had not been any reason to invest in resource appraisal of high accuracy as industry was far from full utilization of the resource; the existing industry did not require a transport net work geared to heavy traffic of high intensity so there had not been any reason to investigate the cost of establishing such a transport infrastructure; small dimension wood had not been used by the industry so there was no need to determine the cost of logging and extracting such dimensions; etc.

The only way open in a situation as described above, if time and funds do not allow the carrying out of special studies, is to use guesses or estimates based on experience gained in other areas in comparable conditions. This transfer of data is a serious source of errors and has to be applied in such a manner that any errors in the data are making the analysis fail in a safe manner.

20.5 Political Guidance

The political guidance to the analysis and plan development was assumed to come from the ASEAN Ministers, through the Experts' Group on Pulp and Paper, general policy statement or direct through consultation.

If the political guidance in sector analysis and sector planning is to be efficient, the analyst/planner needs to have access to guiding authorities continuously. This does not mean that he needs to have access to top level political decision-makers all the time. He need to have assistance in screening development alternatives, selecting policies and judge the social/economic competitiveness of plan proposals. In the early stages this assistance can be obtained at lower levels of the political decision hierarchy; only crucial and final decisions have to be tested at ministerial levels.

However, the important point is not at what level in the political structure the guidance is obtained but that it has to be available continuously.

The analysis was carried out in Italy and the political guidance was to be obtained in Bangkok, Kuala Lumpur, Singapore, Jakarta and Manila. The time difference between Rome and the ASEAN capitals made telephone consultations impractical and exchange of results and advices through mail was very slow and cumbersome. This meant that the analysis and plan development had to be done with infrequent political checks only and relying, to a great extent, on indications derived from public statements by political leaders of ASEAN conveyed through news media and professional publications.

The fact that the Economic Ministers at their meeting in Manila in September 1979 concluded that the analysis had reached a stage when next phase of the plan development should be initiated—that of feasibility studies—should not be interpreted as if they regarded the plan indication of the draft report as politically acceptable. It may very well be that they concluded that further analysis without close political guidance would be futile. The request for the model to be installed in Jakarta, where it would be easier to monitor and guide further analysis, gives strength to this assumption.

The absence or infrequency of political guidance may not, in the case of the 1977 or 1978—79 analyses, have been critical as the analysis and plan development are still at a preliminary stage in which economic indications are sought as confirmation to intended policy decisions or as basis for reformulating policies or develop new ones. However, the experience gained during the analysis clearly points to the need to locate the analytical activities geographically, so that continuous political guidance is possible. Such a location would of course also go a long way in simplifying data verification and in obtaining new technical information from the field.

Sammanfattning

Utvecklingspotentialen i massa- och pappersindustrisektorn inom det s.k. ASEAN-området (ASEAN = Association of South Asian Nations, se karta s. 8) analyserades av FAO's Pulp and Paper Industries Development Programme i två omgångar: en indikativ studie utförd under år 1977 och en mera inträngande analys under åren 1978—79. Den senare analysen resulterade i ett beslut av ekonomiministrarna i ASEAN att verkställa nästa utredningsfas, s.k. lämplighets- (feasibility) studier av enskilda projekt.

Ansatsen i analysen med anslutande strategiska utvecklingsplan var teknisk/politisk. Detta förutsatte att politiska aspirationer och prioriteringar av medlemsländerna i ASEAN och i organisationen beaktades vid utformningen av de scenarier som blev föremål för utvärdering samt att det slutliga valet av strategi var grundat på politiska överväganden.

Analysen utfördes med en datoriserad linjär heltalsmodell, utformad att optimalt allokera utbyggnaden inom massa- och pappersektorn såväl geografiskt som tidsmässigt. Allokeringen berörde utnyttjande av skogsresurser, industrilokalisering, typ och storlek av industri, val av tillverkningsprocesser och produktkvaliteter, handel med andra länder än ASEAN-gruppen samt produktflöde inom ASEAN-gruppen.

Resultaten av analysen visar att ASEAN-området har konkurrensfördelar som medger länderna tillverkning och försörjning med upp till 90 % av deras beräknade behov av viktigare sortiment av emballage- och tryckpapper i konkurrens på världsmarknaden och utan fiskalt skydd för industrin. Alla medlemsländer utom Singapore, som har begränsade egna skogsresurser, deltar i områdets försörjning med papper.

Ett försök görs att kritiskt värdera ansats och tillämpbarhet i fråga om utvecklingsstrategi.

Acknowledgement

Technical and political contribution by individuals and organizations to the ASEAN Pulp and Paper Analysis have been acknowledged in the several reports on the subject from the Pulp and Paper Industries Development Programme. The list is long and will not be repeated here. This should however not be interpreted as diminished appreciation on my part for their contribution; I remain greatly indebted to all of them.

I want to express here my thanks to those who have directly made the compilation of this document possible.

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Appendix I: A Brief Description of the Economic Model

Methodology

The model was originally compiled by the Development Research Center of the World Bank. It is specifically designed for forest sector analysis and uses a combination of linear and integer programming techniques to determine those locations and scales of operation for various forest industries, using a given set of economic, resource and market data inputs within a framework of specified constraints, which optimizes cost of supplying the market requirement of forest products.

In the ASEAN analysis, emphasis was placed on the pulp and paper industry. However, in order to determine the extent and type of fibre available for this industry, it was first necessary to examine the existing mechanical wood-based industries and their capacity for expansion relative to projected domestic and international market demand and resource availability throughout the 20-year planning period which is covered by the analysis.

The forest resource was examined in terms of its distribution, sustainable productive capacity, quality and cost of supplying wood to existing and potential new industry. The annually available wood quantities[1] were specified for hardwoods and softwoods and were classified into three timber grades so as to guarantee their proper use by the model. This classification implies, for instance, that only wood designated as pulpwood, together with residues from plywood and sawnwood manufacturing can be used for the manufacture of pulp and paper, and only in those mixtures of hardwoods and softwoods specified for the various paper grades. Thus the solutions obtained for the pulp and paper industries do not conflict with the requirements of the mechanical wood-based industries, but are supplementary to them.

The model can consider several possible regimes of forest harvesting. In the ASEAN analysis six management options for each forest area were incorporated in the data base. The model selects that option for each resource area which minimizes the production of excess logs whilst supplying the forecasted product mix requirement to domestic market, through internal production supplemented, where necessary, by import, and meeting the export market as far as that is economically advantageous.

The location, type and production capacity of existing wood-based industries are incorporated in the data base together with potential new industry locations and the cost of developing these new locations. The input data contain also information on cost of production at each industrial location and the investment requirements for expansion of existing industries and the establishment of new industries.

The model determines the most economic geographic allocation of industrial activities considering the location, quality and quantity of the resource, the location and requirement of markets and all costs involved in resource harvesting, transport and manufacturing.

When optimizing the cost of forest products supply, the model maximizes the use of low cost wood residues from mechanical forest industries and hence favours those pulp and paper mill locations with minimal cost for wood residue transport. In this respect the model searches for a pattern

[1] As derived from projections by each forest service and from information obtained from established industry.

of integration between chemical and mechanical wood-based industries.

Once the location, cost and type of fibre suitable for pulping is determined,[2] the analysis as presented in this report concentrates solely on determining a solution for the pulp and paper sector. Note should, however, be taken of the fact that in the process of determining raw material availability, the model has derived optimal solutions also for the mechanical forest industry sector. The model is thus a highly versatile tool for assisting in the formulation of forest sector development strategy through the integration of forest management with the most effective utilization of the resource flow relative to market demand and investment potential for all types of forest products.

The model is limited with regard to the size of problem which can be solved in one single computer run. Even when the total number of options can technically be accommodated in the model, considerable time and cost can be saved by reducing the number of options per run as the time taken by the computer increases very sharply with increasing number of theoretical solutions.

Since ASEAN, as a sub-region, contains an extremely wide range of potential development options, it was necessary, and advantageous, to adopt a step by step approach to the determination of its pulp and paper potential. In the initial steps data were processed by individual countries for each of the four 5-year periods. Subjective judgement was then applied to eliminate those mill sites which obviously lacked the potential for viable investment and to aggregate those resource and market areas which had no apparent impact on the solution. Those mill sites identified in this manner and those resource and market areas thus determined were then entered into the ASEAN analysis.

The analysis of ASEAN as a whole was then approached in a similar step by step manner until no more obvious reduction of options were possible. At that point, the ASEAN analysis was run sequentially for periods 2, 3 and 4 to derive the optimal industrial growth path from 1985 up to the year 2000.

The process of elimination and aggregation inevitably involves some simplification of the problem due to subjective judgements by the analyst. This could be a source of error and lead to biased solutions. However, every precaution was taken to ensure that the analysis was not affected by external bias through adopting a series of careful checks and cross-checks.

The standard IBM programme as used in this analysis, the MPSX, can derive optimal linear programming as well as mixed integer programming solutions.[3] The linear programming technique requires significantly less computer time and memory capacity than the mixed integer programming but assumes that industry capacity can be expanded gradually and not, as in real life, by machine units; mixed integer programming, on the other hand, assumes that only complete machine units can be installed.

In order to minimize computer time and cost, the linear programming technique was used to derive approximate solutions and to study the implications of changes in assumptions and data and to derive and test eliminations and aggregations in the model. The mixed integer programming techniques were applied only in the final refinement of the analysis.

Operational Detail

Data used in the analysis are essentially the same in character as those used for prefeasibility studies. However, the tremendously broad scope of the ASEAN study, to-

[2] Fibre data are based on known patterns of land-use and includes an assessment of the various fibres such as straw, bagasse and bamboo together with rubber wood, which are likely to be available during each five-year planning period. Residues available from the planned conversion of forest to agriculture are also taken into account.

[3] Refer to Figure 5 which illustrates the derivation of linear programming as well as mixed integer programming solutions.

gether with the constraints of time and finance, precluded pre-feasibility precision in several data fields. The study is, therefore, presented as an indicative analysis, the results of which must be interpreted within the limitations of the data and of the assumptions which are used.

The data which are quantified and used in the analysis are specified below:

a) The location, nature and productive potential of existing and accessible fibrous raw materials suitable for the manufacture of mechanical forest products and of the desired pulps,
b) the location of potential new resources, their extent, the type of fibre and the cost of establishing these new resources,
c) the location of existing industry, its capacity, product mix and the cost of expanding this capacity for various grades and volumes of pulp and paper,
d) the identification of potential new mill sites and the cost of site development,
e) the cost of transporting fibrous raw material from existing sources and potential new sources to existing and potential new mill sites,
f) the direct costs of producing various paper grades at established mills and at potential new mills,
g) the location of consumption areas together with their requirements of the main paper grades at five-year intervals up to the year 2000,
h) the cost of transporting finished products from existing and potential new mill sites to consumption areas,
i) the cost of imported pulps at existing and projected mill sites, and
j) the cost of imported papers at the consumption areas.

The version of the World Bank Model as adapted for the evaluation of the development potential of the pulp and paper sector of ASEAN analyses the period 1980 to 2000 divided into four periods, each of five years duration.

The model considers the following raw materials, intermediates and final products:

1. Raw Materials:

Hardwood plywood logs	Softwood plywood logs
Hardwood sawlogs	Softwood sawlogs
Hardwood pulpwood	Softwood pulpwood
Wood residues from plywood mills and saw mills	Waste paper
Bagasse	Pulp and paper making chemicals
Straw	Bamboo
	Rubberwood

2. Intermediate Products:

Hardwood chips	Softwood chips
Unbleached hardwood kraft pulp	Unbleached softwood kraft pulp
Bleached hardwood kraft pulp	Bleached softwood kraft pulp
High yield hardwood kraft pulp	High yield softwood kraft pulp
NSSC pulp	Groundwood
Caustic soda	Chlorine

3. Final Products:

Sawnwood	Plywood
Fibreboard	Particleboard
Linerboard	Sack kraft
Newsprint	Printing and writing paper
Corrugating medium	Folding boxboard

For each 5-year period, the model calculates the "cost" of supplying the market (national or sub-regional) with all its requirements of the above-listed products in the following steps:

Item	*Sign in the cost summary (+ = added, − = subtracted)*
— cost of raw materials domestically produced	+
— direct cost of producing intermediates	+
— direct cost of producing final products	+

— depreciation of new investment	+
— interest on new investment	+
— cost of imported raw material	+
— cost of imported intermediates	+
— cost of imported final products	+
— revenue from exported raw materials	–
— revenue from exported intermediates	–
— revenue from exported final products	–
— cost of transporting raw materials	+
— cost of transporting intermediates	+
— cost of transporting final products	+

The total cost for each 5-year period is deflated to current values at a selected rate of interest; these are then added to give a present value of the cost of supplying wood and paper products for the entire 20-year period. This total present value represents the objective function for which the model derives a minimum value solution.

The model is designed to find that combination of domestic supply import and export which minimizes the sum of present value under a specified set of conditions. The most important of these conditions is that production must stay within the limits of raw material availability as determined by forest management principles or by estimated agricultural production; markets must also be fully supplied with the projected quantities of various finished products.

Other important considerations are the so-called "balance constraints" which, for instance, state that:

a) Mills in a certain locality cannot consume more raw material than has been delivered to the mill site,
b) transport of products from a mill site cannot exceed the volume actually produced, or
c) production at any mill site cannot be larger than the capacity, old and new, at that site.

The methodology used in the analysis enables an exhaustive computerised examination of comprehensive data inputs; this process simultaneously resolves a number of major issues such as:

— The locations most suited to the development of pulp and paper industries
— the identification of demand areas which can be supplied at lowest cost from each identified manufacturing location
— whether it is more financially advantageous to import supplies of pulp and/or paper, or to manufacture these at the selected locations
— whether pulp manufactured at any one location should be distributed to mills in other locations
— whether existing manufacturing capacity should be expanded or whether it is more financially favourable to install new capacity elsewhere
— the most favourable phasing of capacity expansion by product type at each selected location
— the source and type of fibrous raw material to be used in the fibre furnish, at each location, to best financial advantage, within the limits established for each grade of paper
— the forest cutting options which should be used to ensure the best use of the available forest resource to meet the requirements of all wood-based industries.

The results thus reflect the most favourable combination of import, export, domestic manufacture and distribution of pulps and papers which minimizes the present value of the supply of projected paper requirements to the ASEAN market.

The 20-year perspective development potential which is identified by the analysis thus results from a comprehensive evaluation of a large number of alternative de-

velopment options which, through an evaluation of the comparative advantage of each location and its manufacturing potential, arrives at the optimal solution.

The detail given above is broadly illustrative of the nature and function of the model used in the ASEAN analysis. Complete details of the structure of the model are available from the Development Research Center of the World Bank.

The forest industry model was developed by the World Bank for use in a CDC 6000 series computer together with MAGEN and Apex III software. In the 1977 study, the model was retained in its original form with only small modifications and the analysis was carried out on the CDC computer at Centro di Calcolo Inter-universitario dell'-Italia Nord-Orientale (CINECA) in Bologna.

For the 1978—79 analysis the model was modified so that it could be used in the IBM 370 computer at FAO Headquarters, Rome, together with OMNI and MPSX software.

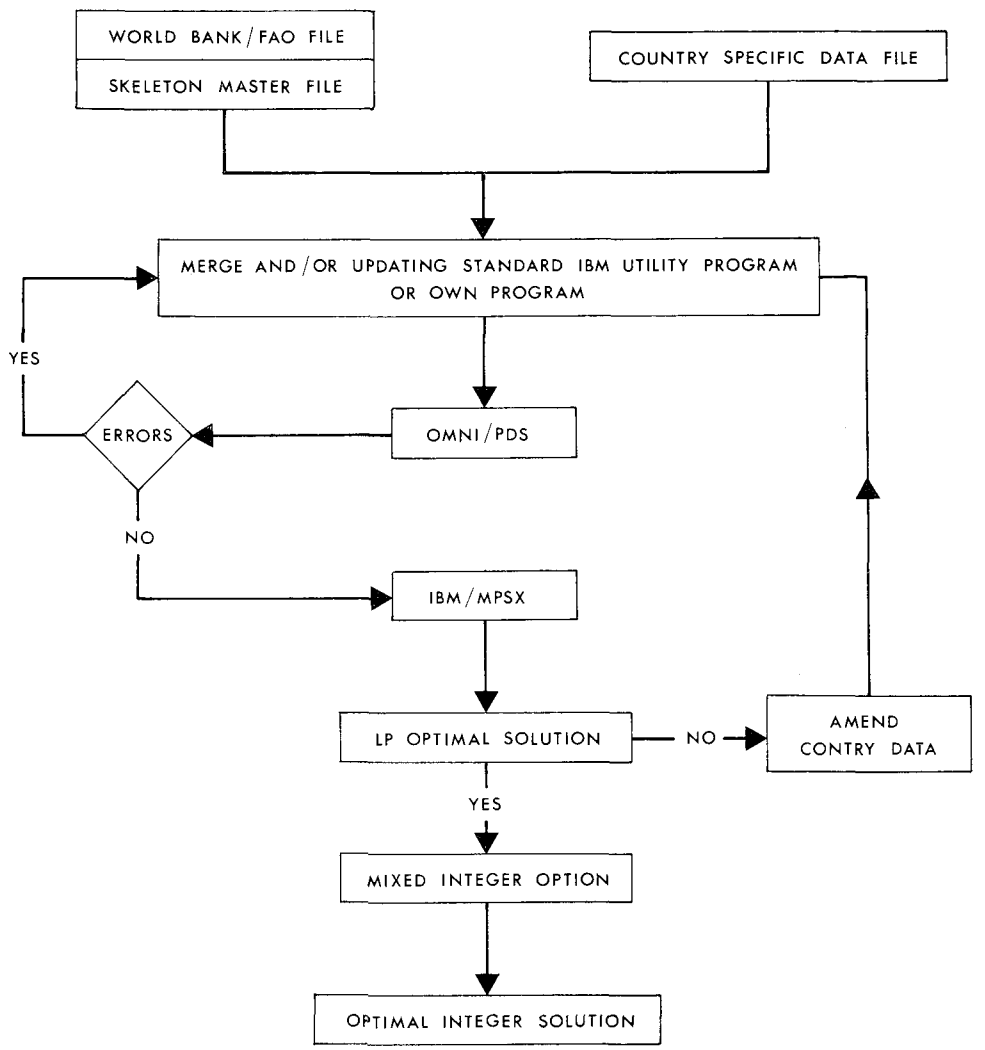

Figure 5. Simple Flow Chart of the World Bank Forestry Model.

Appendix II: Mill Sites Included and Tested in the Analysis

		Reference No. (see Map 4, p. 96)
INDONESIA:	Sumatra	1. Takengon or Lhoksukon
		2. Tebingtinggi or Pematangsiantar
		3. Kotapinang
		4. Jambi
		5. Palembang
	Java	6. Krawang
		7. Bandung
		8. Cilacap or Purwakerta
		9. Jogyakarta
		10. Malang
		11. Surabaya
		12. Banyuwangi or Leces
	Kalimantan	13. Martapura
		14. Balikpapan or Samarinda
		15. Mara
		16. Malinau
		17. Pontianak
	Sulawesi	18. Ujung Pandang (Makasar)
	Irian Jaya	19. Obome
MALAYSIA:	Peninsular Malaysia	20. Dungun
		21. Temerloh
		22. Kuantan
		23. Rompin
		24. Endau
		25. Sedili
		26. Kelang
	Sabah	27. Tawau
PHILIPPINES:	Luzon	28. Bangued
		29. Bataan
		30. Bulacan
		31. Rizal
		32. Laguna
		33. Lubuagan
	Visayas	34. Bais
		35. Tacloban

	Reference No.
Mindanao	36. Bislig
	37. Butuan
	38. Cagayan
	39. Iligan
	40. Talakag
	41. Zamboanga
	42. Cotabato
	43. Davao
SINGAPORE:	
THAILAND:	44. Yala
	45. Kanchanaburi
	46. Banpong
	47. Bangkok
	48. Bang Pain
	49. Si Sa Ket
	50. Sam Ngau
	51. Chiang Mai or Maesuai

Map 4. Potential Mill Sites Considered in the Model.