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REPORT OF THE INDONESIAN INSTITUTE OF SCIENCES (LIPI) AND DENVER RESEARCH INSTITUTE (DRI)

WORKSHOP ON TECHNO-ECONOMIC FEASIBILITY STUDIES

Convened at the Sahid Jaya Hotel
Jakarta
23 June - 2 July 1980
and
3 July - 12 July 1980

Workshop Leaders :
Achie S. Luhulima, LIPI
Ronald P. Black, DRI

The workshop received support from the Government of Indonesia and the U.S. Agency for International Development.

INTRODUCTION

What is a techno-economic feasibility study ?

When are techno-economic feasibility studies conducted ?

What is the importance of the market to feasibility studies ?

What is a product or service life cycle and how does it relate to feasibility studies and the work of an R & D institution ?

What is market research and how does one conduct it ?

What is meant by the "time value" of money and why is this of importance to projects ?

What does the technological innovation process consist of, what are the factors important to it, and how do techno-economic studies relate ?

What is a financial analysis ?

How do taxes affect feasibility studies ?

How do you deal with risk and uncertainty in techno-economic feasibility studies ?

How do you design and organize feasibility studies ?

How do techno-economic feasibility studies relate to project selection in an R & D organization ?

When is technological forecasting of importance to feasibility studies and what are the techniques for making such forecasts ?

What are feasibility considerations in selecting appropriate technology projects ?

How do development project feasibility studies differ from such studies for private entrepreneurs ?

What is an economic analysis ?

What is shadow pricing and how it is used in feasibility studies ?

What are the management factors that should be examined in a feasibility study ?

How does the techno-economic function fit into an R & D institution ?

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APPENDIXES.

1. Agenda for Workshop on Techno-Economic Feasibility Studies.
2. List of Participants
   Workshop : 23 June - 2 July 1980
   Workshop : 3 July - 12 July 1980
3. Workshop Faculty.
4. Steering and Organizing Committee.
5. List of reading materials and exercises.

WORKSHOP OPENING AND INTRODUCTION

Mrs. Luhulima opened the workshop by describing the Indonesian national R & D management development program being conducted by LIPI. This consists of :

- o The development of an indigenious R & D management training capability.
- o Strengthening Indonesian R & D management skills through training programs such as the current workshop.
- o Conducting research on R & D management in Indonesia.
- o Providing consultative services to Indonesian organizations concerned with research and development.

Dr. Black then provided an introduction to the workshop, briefly describing feasibility studies and emphasizing that they were conducted to assist management and policy makers in their decision making process. It was noted that the areas to be covered in the workshop were industrial, agricultural, and development project feasibility studies including their precursory research and development. The workshop topics were noted with a description of their relationships.

With the focus and scope enunciated, the objectives of the workshop were described as being :

- o To provide an understanding of principles, concepts and methodologies underlying feasibility studies that will be applied by participants in their management positions.
- o To develop capabilities that participants will use in making significant contributions to techno-economic feasibility studies conducted under able management.
- o To provide enough knowledge, understanding, and background material that many participants will through further self-study develop their capabilities to the level that they will be able to design, manage, and conduct major techno-economic feasibility studies.

Finally, it was noted that there were basically two purposes for holding a techno-economic feasibility study workshop for staff and management of research institutes.

These were that (1) elements of techno-economic analyses would be helpful to participants in selecting their own R & D projects, and (2) conducting techno-economic feasibility studies is a skill that they could market to potential clients.

To explore these and related questions, the Indonesian Institute of Sciences (LIPI) and the Denver Research Institute (DRI) convened two workshop for managers from Indonesian R & D organizations. The workshops were held between 23 June and 2 July and 3 and 12 July 1980. There were slight variations in the two workshops and this report reflects a composite of the two.

During the cource of the workshop different training tehniques were employed to encourage maximum participation and contribution from all participants. These included case studies, participatory lectures, group discussion periods,

The agenda and lists of workshop participants, faculty members, and steering and organizing committees are given at the end of this report.

INTRODUCTION TO FEASIBILITY STUDIES AND PANEL DISCUSSION

This session opened with a presentation by Dr. Taylor on his view of the essential elements and role of techno-economic feasibility studies. A typical techno-economic project is seen as involving a specific technology(eg. steel alloy development) as well as some more general aspects of technology (eg. steel manufacturing and testing). The technologies are influenced by the economic environment, eg. through economics of scale, pricing decisions, taxes, and government regulations. Finally, there must be a market for the product (eg. steel used for structural purposes) and there are competing products (eg. other structural materials) in the marketplace, which may also be influenced by institutional factors (eg. construction codes). This philosophy was illustrated by a case study of a weathering steels development project in Brazil.

In addition, the role of feasibility studies as an aid to decision-making was discussed. It was pointed out that different types of techno-economic feasibility studies could be required at different stages in a project's development, from conceptualization to engineering.

Dr. Black illustrated this by describing a techno-economic study conducted by the Pakistan Council of Scientific and Industrial Research to determine the commercial feasibility of the production of chemicals from bittern and a similar "pre-feasibility" study conducted by the Applied Scientific Research Corporation of Thailand at a different stage in a project's development. Other examples were given such as a study of the technical feasibility of scaling up a laboratory process in Thailand for producing an oil base for paints from rubber seed oil. The workshop participants joined in the discussion noting examples of feasibility studies in Indonesia such as a recent one concerned with the utilization of nuclear power generators as an alternative energy source.

FUNDAMENTALS OF MARKETING

Dr. Taylor introduced the basic marketing concept that marketing is directed towards satisfying human needs and that marketing "adds value". The activities involved in marketing - market research, product development, promotion, pricing, and distribution decisions were outlined ; and marketing was distinguished from selling. The distinction between consumer and industrial products (or services) was introduced, and it was shown that demand for industrial goods is derived from that for consumer-goods.

The volatile nature of the demand for capital goods (i.e. the equipment used to make other products) was explained, and the special characteristics of industrial products (eg. few buyers) were mentioned.

The concept of the product life cycle - introduction, growth, maturity, and decline - was introduced, and the characteristics associated with each phase were explained. The stages involved in new product introduction were outlined, and some data provided on the attrition that occur between initial concepts and successful products.

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THE TIME VALUE OF MONEY AND DISCOUNTING

The lecture was presented by Mr. Salim Siagian. A very basic concept in economics is that money has a time value, a given sum of money now is normally worth more than a equal sum at some future date. The long time lag between outlays of investment and the inflow of revenue, necessarily implies that we are dealing with different values of money because of the different timing aspect. This difference between the value (price) of earlier rather than later availability of resources is called the interest rate, i. (usually expressed as a percent per unit time). The interest rate i is very often called " the cost of capital ".

When P (present amount), the time period = n , the interest rate = i , are known, and looking for F (future amount), we get : $F = P (1 + i)^n$. This is compound interest. Compounding factor = $(1 + i)^n$.

Discounting involves the conversion of future income into present value or present worth. This, looking for P (present value), we get : $P = \frac{F}{(1+i)^n} = F \times \frac{1}{(1+1)^n}$, Discount factor = $\frac{1}{(1+i)^n}$.

In time evaluation, beside P (present value) and F (future-amount), there is also annuity or uniform series i.e. when the future income flows are constant for all time periods (usually years), these flows are called annuities (= A). Present worth (value) of an annuity factor, is looking for P, when A, i, and n are known, we get :

$$P = A \frac{(1 + i)^n - 1}{i(1 + i)^n} \longrightarrow \boxed{\frac{(1 + i)^n - 1}{i(1 + i)^n}}$$

MARKET RESEARCH METHODS

The basic methods of obtaining information were described by Dr. Taylor. These include : asking questions, observation, and the use of secondary data sources. The usefulness of each method, under various circumstances, was explained. Some of the techniques that can be used to encourage accurate and complete answers to questions were explained and questionnaire design was discussed, with the aid of two examples. Ideas for conducting interviews were also given.

A number of methods that can be used to project market size and other characteristics were explained, together with examples of their use. The importance of cross-checking data and classifying definitions and units was stressed.

What is the role of market research for research institutions ? (1) For the commercialization of research results - determining required features and optimum marketing methods ; (2) Defines research needs ; (3) Helping industrial firms determining market potential for (new) products ; (4) Doing surveys of social and economic conditions (for government) ; (5) Helping government with planning (e.g. determine needs for major investments in basic industries and infrastructure ; (6) Finding and dispersing information.

The participants were then devided into groups and given a simple marketing case study to analyze. The case involved defining market research needs and approaches for an innovative industrial product.

THE INNOVATION PROCESS

Dr. Black initiated the session by exploring with the participants which word in Indonesian most closely approximates, in meaning, the English word "innovation". There was agreement that the Indonesian equivalent is "inovasi".

Technological innovation was described as being a process of the application of technology which includes the conceptionalization of a new product or process through its successful introduction into practical use. It was noted that there were many definitions and models of technological innovation. Several of these were examined in the session as to their applicability to six agricultural equipment innovations coming out of a program of the International Rice Research Institute (IRRI) in the Philippines, and a system adapted and commercialized in Tunisia by a private entrepreneur for converting automobils such that they could run on liquified petroleum gas (LPG).

The IRRI and Tunisian cases were then analyzed from the vantage of identifying factors of importance to these cases of innovation. A list of factors commonly found to be of importance to the innovation process was used for the analysis. Factors of importance in both the agricultural equipment and LPG system innovations were : recognition of the need, technical entrepreneur, prior demonstration of feasibility, and technology interest group. Factors of importance to at least one of these innovations included : recognition of a technical opportunity, internal R & D management, management venture decision, in house colleagues, technological gatekeeper, availability of funding, competitive pressures, and general economic factors. While of little importance in the IRRI and Tunisian cases, the workshop participants suggested that the following additional factors would often be of importance for innovations occurring in developing economies : formal market analysis, political factors, social factors, external direction to R & D personnel, and health and environmental factors.

Additional evidence from research in a number of countries was presented which strongly implied that the most important factor leading to successful innovation was the identification of a market or user need prior to the initiation of an R & D program.

For the six successful IRRI innovations and the LPG example, it was shown that the period from first conception to first practical utilization varied from less than one year to eight years. The average duration was found to be 3.2 years.

Finally, the importance of basic research, applied research, development, and non-technical factors (eg. economic factors) to the IRRI and Tunisian cases was examined. Basic research contributed to none of the innovations, applied research contributed to several of the IRRI examples, development activities and non-technical factors were found to be important for the LPG innovation and most of the IRRI examples. It was hypothesized that this would be a common pattern for innovations in developing economics.

INTRODUCTION TO THE FINANCIAL ANALYSIS OF PROJECTS

Dr. Taylor's presentation, which was oriented towards the industrial as opposed to the sociental viewpoint, commenced by explaining what is meant by fixed capital, working capital, operating costs, and revenue. The roles of depreciation and overheads were explained : and the distinction between project analysis (cash flow) and accounting analysis was explained. The need for an annual (or shorter) evaluation of a firm's performance to provide data to management and shareholders was compared with the need to look at the entire life of an investment project because of the presence of periods (eg. during construction and start-up) in which profits would not be anticipated. In addition, training and start-up costs, income tax and the treatment of R & D costs were mentioned, together with the distinction between the use of constant and current monetry units.

It was suggested that although an accounting-type cost evaluation, relating to a normal year of operation might be adequate for a " pre-feasibility " study or to determine the breakeven quantity, use of a project cash flow type of analysis would normally be needed for a full feasibility study.

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FINANCIAL ANALYSIS OF AN INDUSTRIAL PROJECT

Time value of money and cash flow are the basic concepts embodied in many of the investment appraisal technique. The lecture presented and the exercises conducted by Mrs. Sri Sundari, emphasized on the concept of cash flow and various methods used in the financial analysis of projects.

Cash Flow (CF) measures the actual flow of funds into or out of a specific project. Net Cash Flow (NCF) per unit time will be the excess of inflow over outlays for operating costs and capital expenditures.

The cash flow for any unit of time differs from the accounting net profit for that period in two items - depreciation and depletion allowances. These two items must be added to the cash flow because they are book cost, they are only bookkeeping adjustments for capital expenditure and depletable resources and are used for calculation of taxes.

The Discounted Cash Flow (DCF) method is a vast spreading technique for evaluating investment projects. Sometimes called also " Internal Rate of Return " or " Yield ", it incorporates both concepts of time value of money and cash flows. However, instead of using a predetermined interest rate, the analyst is looking for that interest rate i that makes the present value of the aggregate cash inflows equal to the present value of the combined investment outlays.

TAXATION AS IT AFFECTS INDUSTRIAL PROJECT IN INDONESIA

In his presentation, Mr. Sikuan Sutanto put to the fore that in any feasibility study one should also take into consideration the taxes imposed on development projects or any project, such as taxes on profit, on land, etc. He further explained the kinds of taxes which affect industrial project in Indonesia, such as ; taxes on import and export, royalties, corporate taxes, taxes on profit, etc.

METHODS FOR DEALING WITH RISK AND UNCERTAINTY

Risk was defined, by Dr. Taylor, as being the possible adverse outcome (measured primarily in economic terms) arising from uncertainties in the assumptions or data used in conducting a feasibility study.

Six methods were considered, ranging from those that simply change a single key parameter (eg. contingency allowances) to highly sophisticated approaches that involve extensive calculations (eg. Monte Carlo simulation).

The six methods considered were :

- o Use of contingency allowances.
- o Adjusment of the required discounted cash flow rate of return (DCFROR) to reflect the perceived degree of risk.
- o Use of multiple or supplementary evaluation criteria instead of using a single criteria (eg. payback period as a supplement to DCFROR).
- o Analysis of the sensitivity of results to changes in major data assumptions (eg. to costs and market size).
- o Decision analysis (involving specifying various outcomes and associated probabilities).
- o Monte Carlo simulation (in which all major parameters are specified as probability distributions, leading to a probability distribution for the financial results).

The uses, singly and in combination, of the various methods were discussed. The discussion focussed on management decision making and on problems associated with generating the necessary data.

The session included a decision analysis exercise designed to illustrate the potential value of obtaining additional information. Risk aversion was also discussed.

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SUMMARY ON INDUSTRIAL PROJECT SELECTION, AND DESIGN AND ORGANIZATION OF FEASIBILITY STUDIES

In this integrated session, Dr. Taylor, classified the basic objectives and methods used for conducting feasibility studies. First, some of the categories of studies (eg. resource surveys, market studies, industry wide planning, and industrial "pre-feasibility" and feasibility studies) were explained.

The need for different evaluation techniques to suit the type of study was stressed, and it was noted that in many cases the objectives and emphasis of the study will be refined during its conduct. In setting objectives, the need to define boundaries, and to negotiate and refine the terms of referance of study ("Do the right study") by consultation with the sponsor was stressed.

Methods of organizing manpower for the efficient conduct of studies were discussed, together with scheduling and reporting needs. Finally, the importance of presenting results in terms that are understood by decision-makers was stressed, along with the importance of providing all the information that the decision-makers need. This underscored the basic role of virtually all feasibility studies,i.e. the provision of appropriate information to permit a decision to be made.

R & D PROJECT SELECTION

The session commenced with Dr. Black describing some of the common problems encountered in R & D project selection. These included quantifying the probability of success (eg. technical success probability and utilization success probability), the sequential nature of decision-making, determination of selection criteria and relative weights (eg. social benefit, economic rate of return, and balanced portfolio), data availability, knowledge (or lack thereof) of competitor efforts, constraints (eg. budget, facilities, and skills), and the diffuse and hierarchical nature of the decision making process.

Models representative of these broad categories were described. These were the Mottley Newman method which is representative of a class based on the judgement of experts, the Disman method which is representative of models requiring an economic analysis, and the Hess method which is representative of a class of highly sophisticated mathematical approaches requiring large amounts of data and the use of a computer.

Finally, some general criticisms of R & D project selection models by R & D project managers was noted. These included :

- o Very few of the published methods have actually been tested.
- o Fewer are in practical use.
- o Hence, there is no clear demonstration that formal project selection methods are advantageous.
- o Subjective judgements result in hidden biases in the models.
- o Models do not conform to reality.

TECHNOLOGICAL FORECASTING

In this session Dr. Taylor provided an overview of several categories of technological forecasting techniques, together with examples. The techniques considered were :

- o Use of expert opinion (e.g. the Delphi technique).
- o Trend extrapolation methods (e.g. single parameter, compound parameter, envelope curves, substitution theory, analogies and leading indicators, and correlation [regression] analysis).
- o Normative (goal oriented) forecasting, including the use of morphological analysis and relevance rees.
- o Dynamic modeling (as used in The Limits to Growth).
- o Monitoring (for signs of the adoption of new technologies).
- o The use of cross-impact analysis and scenarios.

The role of technological forecasting techniques as an aid to conducting feasibility studies was discussed. This dealt not only with the technologies of direct use in the study but also with the effects of changing technologies in one sector or the markets for products of another sector.

The session included an exercise on trend extrapolation applied the size of oil tankers. After making an initial projection based on historic data, factors that could limit the size of tankers were considered, causing changes in estimates. This exercise provided an example of the importance of fully evaluating the "environment" in which a forecast is made.

CONSIDERATIONS IN THE SELECTION OF APPROPRIATE TECHNOLOGY PROJECTS

The session was opened by Dr. Black with a demonstration of the impreciseness of the term "appropriate technology". A "modestly firm" definition of appropriate technology, based on criteria set by "wise" development strategists who also understand technology, was suggested. This was : good engineering applied in accordance with wise development criteria. It was then suggested that wise development planners in developing countries would agree on certain development principles or criteria. Then, by taking a cuople of these, the need to encourage linkages between advanced and lower-level technologies, and the need to move toward integration into the world economy, it was shown how such factors had effects in five developing country case studies. Another characteristic demonstrated by the cases was the complexities associated with what is "appropriate". This led to the conclusion that anything less than a holistic approach to appropriate technology development is likely to lead to a result somewhat less than optimum.

While recognizing that it is possible to examine existing environments and identify instances where hardware development can aid the poor in developing countries, it was noted that this placed oneself at the mercy of the environment and events beyond one's control. On the other hand, it was suggested, that if one takes a holistic approach to what is appropriate technology, it would be possible to move from a reactive mode to one that shapes national development in a much more significant and "appropriate" fashion. It was recommended that this should be a consideration of research organizations in the project selection process.

BASIC ECONOMIC CONCEPTS FOR DEVELOPMENT STUDIES AND AN ASSOCIATED PARTICIPANT ANALYSIS

First, the main categories of development project objectives, i.e. economic growth, income redistribution, employment creation, self-reliance (eg. reducing dependency on strategic imports), and social needs (eg. health and education), were reviewed by Dr. Taylor. The extent to which fulfillment of these objectives can be evaluated using economic criteria, as opposed to requiring non-economic criteria, was discussed.

The use of cost-benefit analysis as the basis of development project evaluation was outlined. This was followed by an explanation of some of the techniques that can be used for valuating effects for which there is either no market, or an imperfect market, leading to the concept of shadow prices. In addition, the need to correct the process for subsidies and taxes, in economic analysis, was explained.

Next, the question of what effets to include as a part of the project was discussed. Spillovers (such as down stream effects and pollution) that should be included in an evaluation, were distinguished from secondary or "multiplier type" effects which are generally not considered to be admissable as project benefits. However, the importance of multiplier effects on a regional economy was demonstrated.

Finally, economic evaluation criteria, such as the benefit-cost ratio and net present worth were discussed, and the possibility of choosing a "social" rate of discount (lower than the private rate) was mentioned.

The use of these principles was demonstrated by a group analysis of case studies taken from a land reclamation project in Thailand. These case studies were minor projects associated with the main reclamation project, and were used to demonstrate both the financial and economic analysis methods that could be used to evaluate such projects. The participants considered the appropriateness of the methods used, and also identified factors not considered in the original study that might be significant.

SHADOW PRICES AND THEIR APPLICATION IN INDONESIA

The lecture was presented in the first workshop by Mr. Salim Siagian, and in the second workshop by Mr. Djarot Siwijatmo, both of the Management Institute, University of Indonesia.

Shadow prices are the corrected value of the market prices ' are the certain production factors or a certain product or service. In the shadow price are included the social opportunity costs of the said product or service. Shadow pricing are usually applied in the economic analysis of big or government projects, to know the real value of the project for society or the national economy.

Examples of the use of shadow pricing in the calculation of capital investment, the rate of wages of unskilled labor and foreign exchange were presented.

IMPLICATIONS OF MANAGEMENT FOR PROJECT FEASIBILITY STUDIES

Dr. Black opened the session by noting that comprehensive feasibility studies would include a section that examined the proposed management for a project. Key functional areas that should be covered include planning, organization, control, and evaluation.

Does, the project need a continuing planning activity ? How does the project planning function fit into the overall project management structure and within this arrangement can it logically achieve the results desired of the function ?.

When examining a potential project's organization some key questions which should be asked include the following. Is the organizational structure defined ?. Is the span of control reasonable ? Does, one person have overall project responsibility and corresponding authority ? Do the management procedures allow for delegation of authority ? Are the functions of the organization's positions defined ? Is the project management's relationship with authorities higher in the organization defined ? Have fiscal policies and procedures been established ? Have personnel policies and procedures, including recruitment methods, been yet ? Have technical procedures been defined ? Have bidding and contracting procedures for resource procurement and allocation been determined ? Have procedures for interagency coordination been yet ? Have procedures for project handover been established ? Has the management information system linking the project to higher authorities been described.

Some key questions noted for examining the design for a project's control system included the following. Do project control instruments such as PERT and CPM exist ? Have information requirements been determined ? Have sources of needed information been identified ? Have procedures for collecting, storing, and retrieving data been established ? Has the overall management information system been described ? Does the project organization have the flexability and authority to bring the project back under control should deviations from the plan occur ?

Questions which should be asked when examining the design for a projects evaluation were listed as including the following. Are project objectives stated in measurable terms ? Has an evaluation plan been prepared for both formative and summative evaluations ? Has the data collection mechanism for collecting needed evaluative data been described ?.

After discussing these management design related questions, the participants were asked to analyze the management aspects of a case study of an Indonesian transmigration project. The participants offered many constructive suggestions as to how the original project management design could have been improved.

DEVELOPMENT PROJECT FEASIBILITY STUDY IN INDONESIA : The Case of the Nucleus Estate and Smallholder (NES) Project

Dr. Rachmat Subiapradja put to the fore that the Nucleus Estate and Smallholder (NES) Project is a synthesis between smallholders estates and state estates which will benefit each other. The objective of the project are twofold : (1) from the economic point : to develop the estates, and (2) from the socio-economic point: the strong should help the weak. To each smallholder is allotted 2 ha of land, which should be planted with estate crops, 1 ha for foodcrops and 1/4 ha for a house and other plants. The management of the project, the production, processing and marketing of the estate crops are the responsibilities of the nucleus estate (= the state estate), whereas the supply of labour come from the smallholders. During the first three years credits are given to the smallholders by the nucleus estate, to build their houses and the planting of food and estate crops. For rubber for instance, the time is 20 years, with a grace period of 6 - 7 years, and a rate of interest of 10 %.

The smallholders return their credits in the form of supplying the nucleus estate with 10-20 % of their crops. The rest are sold to the nucleus estate, which become an income for the smallholders. The nucleus estate is obliged to buy the crops with the highest market price.

It is emphasized that the NES Project is an investment project which is expected to give returns. Therefore economic and financial analysis are applied in the feasibility study of the project. Result of a study in South Kalimantan, 10.000 ha of nucleus estate and 5.000 smallholders shows that economic rate of return is 14.1 % and IROR is 12.9 % for the smallholder, and 10.7 % for the nucleus estate.

THE TECHNO-ECONOMIC FUNCTION IN RESEARCH INSTITUTE

The panel discussion was initiated with Dr. Taylor reviewing a paper on the techno-economic function as an integrating mechanism in research institute by J. Gordon Milliken of DRI. In the paper, it was noted that the key function of a techno-economic unit within a research institute was to facilitate the transfer of technology. Sub-functions, to facilitate this transfer, were described as including market analysis; new technology promotional efforts; strengthening relationships between industry and research; planning and evaluation of research programs; providing consultancy services to industry in the areas of production, inventory, personnel, finance, and marketing; and establishing a documentation center to provide data to entrepreneurs.

Dr. Black provided examples of how a techno-economic division grew and developed within the Thailand Institute of Scientific and Technological Research noting the evolving nature of the functions served by the division as it capabilities and the market evolved.

The participants joined in the discussion noting how the techno-economic function could relate to research institutes in Indonesia.

AGENDA FOR WORKSHOP
ON
TECHNO-ECONOMIC FEASIBILITY STUDIES
Jakarta, 23 June - 2 July 1980

Monday, 23 June

09.00 - 10.00	Opening and introduction to workshop and its objectives, overview of topics to be covered and their interrelationships.	Luhulima/Black/ Taylor
10.00 - 12.00	Introduction of the participants.	
12.00 - 13.00	L u n c h.	
13.00 - 14.30	Fundamentals of marketing.	Taylor
14.30 - 15.30	Panel discussion on marketing of research institute's services and results	Darobroto/ Gatoet Soedomo/ Black/Taylor
15.30 - 16.00	B r e a k	
16.00 - 17.30	Market research methods.	Taylor

Tuesday, 24 June

08.30 - 10.30	The concept of the time-value of money and discounting.	Salim Siagian
10.30 - 11.00	B r e a k	
11.00 - 13.00	Discounting exercise	Salim Siagian
13.00 - 14.00	L u n c h	
14.00 - 15.30	Market research methods (continued)	Taylor
15.30 - 16.00	B r e a k	
16.00 - 17.30	Estimation of market size and structure	Taylor

Wednesday, 25 June

08.30 - 10.30	Marketing exercise	Taylor
10.30 - 11.00	B r e a k	
11.00 - 13.00	The innovation process	Black
13.00 - 14.00	L u n c h	
14.00 - 15.00	The innovation process (continued)	Black

15.00 - 15.30	Introduction to project feasibility studies	Taylor
15.30 - 16.00	B r e a k	
16.00 - 17.30	Introduction to project feasibility studies (continued)	Taylor

Thursday, 26 June

08.30 - 09.30	Industrial project feasibility studies	Sri Sundari
09.30 - 10.30	Science and technology in Indonesia	Chairman of LIPI
10.30 - 11.00	B r e a k	
11.00 - 13.00	Industrial project feasibility studies	Sri Sundari
13.00 - 14.00	L u n c h	
14.00 - 15.30	Taxation as it affects industrial projects in Indonesia	Sikuan Sutanto
15.30 - 16.00	B r e a k	
16.00 - 17.30	Industrial project feasibility study exercise	Sri Sundari

Friday, 27 June

08.30 - 10.00	Industrial project feasibility study exercise (continued)	Sri Sundari
10.00 - 11.30	Methods used for dealing with risk and uncertainty	Taylor
11.30 - 13.00	Free Period	
13.00 - 14.00	L u n c h	
14.00 - 15.00	Methods used for dealing with risk and uncertainty (cntinued)	Taylor
15.00 - 15.30	B r e a k	
15.30 - 17.00	Risk and uncertainty exercise	Taylor

Saturday, 28 June

08.30 - 09.30	Summary on industrial project selection	Taylor
09.30 - 10.30	Design & organization of feasibility studies	Taylor
10.30 - 11.00	B r e a k	
11.00 - 13.00	R & D project selection.	Black

13.00 - 14.00	L u n c h	
14.00 - 15.30	R & D project selection exercise	Black
15.30 - 16.00	B r e a k	
16.00 - 17.30	Technological forecasting	Taylor

Monday, 30 June

08.30 - 10.30	Technological forecasting exercise	Taylor
10.30 - 11.00	B r e a k	
11.00 - 13.00	Consideration in selection of appropriate technology projects	Black
13.00 - 14.00	L u n c h	
14.00 - 15.30	Basic economic concepts for development project feasibility studies	Taylor
15.30 - 16.00	B r e a k	
16.00 - 17.30	Shadow prices and their application in Indonesia	Salim Siagian

Tuesday, 1 July

08.30 - 10.30	Implications of management for project feasibility	Black
10.30 - 11.00	B r e a k	
11.00 - 13.00	Implications of management for project feasibility studies (continued)	Black
13.00 - 14.00	L u n c h	
14.00 - 15.30	Group analysis of a development project feasibility study	Taylor
15.30 - 16.00	B r e a k	
16.00 - 17.30	Group analysis of a development project feasibility study (continued)	Taylor

Wednesday, 2 July

08.30 - 10.30	The techno-economic function in research institutes	Taylor/Black
10.30 - 11.00	B r e a k	
11.00 - 13.00	Evaluation session and closing	Black/Luhulima
13.00 - 14.00	L u n c h	

AGENDA FOR WORKSHOP
ON
TECHNO-ECONOMIC FEASIBILITY STUDIES
Jakarta, 3 July - 12 July 1980

Thursday, 3 July

09.00 - 10.00	Opening and introduction to workshop and its objectives, overview of topics to be covered and their interrelationships.	Luhulima/Black/ Taylor
10.00 - 12.00	Introduction of the participants	
12.00 - 13.00	L u n c h	
13.00 - 14.30	Fundamentals of marketing	Taylor
14.30 - 15.30	Panel discussion on marketing of research institute's services and results .	Roestamsjah/ Gatoet Soedomo/ Black/Taylor
15.30 - 16.00	B r e a k	
16.00 - 17.30	Market research methods	Taylor

Friday, 4 July

08.30 - 10.30	The concept of the time-value of money and discounting.	Salim Siagian
10.30 - 11.30	Discounting exercise	Salim Siagian
11.30 - 13.00	F r e e P e r i o d	
13.00 - 14.00	L u n c h	
14.00 - 15.00	Discounting exercise (confinued)	Salim Siagian
15.00 - 15.30	B r e a k	
15.30 - 17.30	Market research methods (continued)	Taylor

Saturday, 5 July

08.30 - 10.30	Estimation of market size structure	Taylor
10.30 - 11.00	B r e a k	
11.00 - 12.30	Marketing exercise	Taylor
12.30 - 13.30	L u n c h	
13.30 - 15.00	The innovation process	Black
15.00 - 15.30	B r e a k	

15.30 - 17.30	The innovation process (continued)	Black

Monday, 7 July

08.30 - 10.30	Introduction to financial analysis of project	Taylor
10.30 - 11.00	B r e a k	
11.00 - 13.00	Financial analysis of industrial project	Sri Sundari
13.00 - 14.00	L u n c h	
14.00 - 15.30	Financial analysis of industrial project (continued)	Sri Sundari
15.30 - 16.00	B r e a k	
16.00 - 17.30	Taxation as it affects industrial project in Indonesia	Sikuan Sutanto

Tuesday, 8 July

08.30 - 10.30	Financial analysis exercises	Sri Sundari
10.30 - 11.00	B r e a k	
11.00 - 13.00	Financial analysis exercises	Sri Sundari
13.00 - 14.00	L u n c h	
14.00 - 15.30	Methods used for dealing with risk and uncertainty	Taylor
15.30 - 16.00	B r e a k	
16.00 - 17.30	Risk and uncertainty exercises	Taylor

Wednesday, 9 July

08.30 - 09.30	Summary on industrial project selection	Taylor
09.30 - 10.30	Design & organization of feasibility studies	Taylor
10.30 - 11.00	B r e a k	
11.00 - 13.00	R & D project selection	Black
13.00 - 14.00	L u n c h	

14.00 - 15.30	R & D project selection exercise	Black
15.30 - 16.00	B r e a k	
16.00 - 17.30	Technological forecasting	Taylor

Thursday, 10 July

08.30 - 10.30	Technological forecasting exercise	Taylor
10.30 - 11.00	B r e a k	
11.00 - 13.00	Considerations selection of appropriate technology projects	Black
13.00 - 14.00	L u n c h	
14.00 - 15.30	Basic economic concepts for development project feasibility studies	Taylor
15.30 - 16.00	B r e a k	
16.00 - 17.30	Shadow prices and their application in Indonesia	Djarot Siwijatmo

Friday, 11 July

08.30 - 10.00	Implications of management for project feasibility Studies	Black
10.00 - 11.30	Development project feasibility studies in Indonesia	Rachmat Subiapradja
11.30 - 13.00	F r e e P e r i o d	
13.00 - 14.00	L u n c h	
14.00 - 15.30	Group analysis of a development project feasibility study	Taylor
15.30 - 16.00	B r e a k	
16.00 - 17.30	Group analysis of a development project feasibility study (continued)	Taylor

Saturday, 12 July

08.30 - 10.30	The techno-economic function in research institutes	Taylor/Black
10.30 - 11.00	B r e a k	
11.00 - 13.00	Evaluation session and closing	Black/Luhulima
13.00 - 14.00	L u n c h	

Peserta Widyakarya-Penataran Pengelolaan Penelitian dan Pengembangan :
Studi Kelayakan Teknoo-Ekonomi I
Participants of Workshop on Techno-Economic Feasibility Studies I

J a k a r t a, 23 Juni - 2 Juli 1980

No.	Nama/Name	Bidang/Field	Jabatan/Position Alamat/Address
1	2	3	4
	DEPARTEMEN PERINDUSTRIAN Department of Industry		
1.	Anton Hadiono, Drs.	Political Science, International Relations.	Kepala Sub Bagian Evaluasi Sosial Ekonomi Badan Penelitian dan Pengembangan Industri Departemen Perindustrian. Chief, Section of Social Economic Evaluation, Industrial Research and Development Agency, Department of Industry. Jl. Proklamasi 56, Jakarta.
2.	S. Abbas Ras	Production Management Analyst; Regional Industrial Development Analyst, Income Distribution and Employment Analyst.	Kepala Sub Bagian Pengumpulan dan Pengolahan Data, Badan Penelitian dan Pengembangan Industri, Departemen Perindustrian. Chief, Data Collection and Analysis Section, Industrial Research and Development Agency, Department of Industry. Jl. Proklamasi 56, Jakarta.
3.	Idi Soebroto, Ir.	Textile Engineering, Spinning & Weaving.	Staf Badan Penelitian dan Pengembangan Industri, Departemen Perindustrian. Staff Industrial Research and Development Agency, Department of Industry. Jl. Proklamasi 56, Jakarta.
4.	Victor K. Senobua, Drs.	Political Science, International Relations.	Peneliti, Badan Penelitian dan Pengembangan Industri, Departemen Perindustrian. Research worker, Industrial Research and Development Agency, Department of Industry. Jl. Proklamasi 56, Jakarta.

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1	2	3	4
5.	Sutjipto, B.Sc.	Leather Technology	Kasie Pengadaan/Gudang, Balai Penelitian Kulit, Departemen Perindustrian. Leather Research Institute, Department of Industry. Jl. Sokonandi 3, Yogyakarta.
6.	Haman Abdul Rochman, Ir.	Metallurgy	Kepala Seksi Pengendalian Mutu dan Normalisasi, Balai Besar Pengembangan Industri Logam dan Mesin, Departemen Perindustrian. Quality Control & Standardization Manager, Metal Industries Development Centre, Department of Industry. Jl. Sangkuriang 12, Bandung.
	DEPARTEMEN PERTANIAN Department of Agriculture		
7.	Hilmi Ridwan, Ir.	Agro Economy	Sekretaris Proyek Penelitian Hortikultura Lembang, Departemen Pertanian. Secretary, Horticulture Research Project Lembang, Department of Agriculture. Lembang, Bandung.
8.	Suparno, M.Sc.	Fish Technology Chemical Analysis (Fish Processing)	Staf Peneliti, Lembaga Penelitian Teknologi Perikanan, Departemen Pertanian. Research Staff, Research Institute for Fish Technology, Department of Agriculture. Jl. K.S. Tubun, Palmerah, Jakarta.
9.	R.M. Napitupulu, Drs.	Economics	Biro Penanaman Modal. Bureau of Investment Section of Interprize Development, Department of Agriculture. Jl. Imam Bonjol 29, Jakarta.
	DEPARTEMEN PERTAMBANGAN DAN ENERGI Department of Mines & Energy		

10. Kartiwa Sumadi .....

1	2	3	4
10.	Kartiwa Sumadi	Analytical Chemistry	Kepala Subsi Laboratorium dan Fisika, Pusat Pengembangan Teknologi Mineral, Departemen Pertambangan dan Energi. Chief, Sub Division of the Chemical and Physical Laboratory, Mineral Technology Development Centre, Department of Mines and Energy. Jl. Jend. Sudirman 623 - Bandung.
11.	Hirwan Effendi, Drs.	Techno Economic of Petroleum	Staf Peneliti Tekno Ekonomi, Pusat Pengembangan Teknologi Minyak dan Gas Bumi "LEMIGAS", Departemen Pertambangan dan Energi. Research Staff Techno Economic Group, Oil & Gas Technology Development Centre "LEMIGAS", Department of Mines and Energy. Cipulir, Kebayoran Lama - Jakarta.
	DEPARTEMEN H A N K A M Department of Defence and Security.		
12.	M. Hartun Sunjata	Operation Research (cost analysis)	Puslitbang HANKAM, Departemen HANKAM. Defence Research Centre, Department of Defence and Security. Pondok Labu, Jakarta.
	BADAN TENAGA ATOM NASIONAL National Atomic Energy Agency		
13.	Haryono Arumbinang, M.Sc.	Radiation Chemistry	Direktur Pusat Pengembangan Bahan Material dan Instrumentasi, Badan Tenaga Atom Nasional. Director, Research Centre for Nuclear Materials and Instrumentation, National Atomic Energy Agency at Yogyakarta. Jl. Babarsari P.O. Box 8, Yogyakarta.

14. Moh. Ridwan .....

1	2	3	4
14.	Moch. Ridwan, Dr	Chemistry	Direktur Pusat Aplikasi Isotop dan Radiasi Pasar Jum'at, BATAN. Director, Centre for the Application of Isotopes and Radiation, National Atomic Energy Agency. P.O. Box 2, Kebayoran Lama, Jakarta.
	LEMBAGA ILMU PENGETAHUAN INDONESIA Indonesian Institute of Sciences.		
15.	Afadlal, Drs	Political Science, East Asian Studies.	Asisten Peneliti, Lembaga Research Kebudayaan Nasional (LRKN-LIPI) Research Assistant, National Institute for Cultural Studies, Indonesian Institute of Sciences. Jl. Taman Pejambon 3 , Jakarta.
16.	Arridha Bachtiar, Dra.	Bussiness Economics	Staf Sekretariat Pimpinan LIPI, Staff of the Secretariat, Indonesian Institute of Sciences. Jl. Merdeka Selatan 11, Jakarta.
17.	Iranto, Ir.	Engineer in Charge for Diffusion and commercialization of R & D Results.	Staf Lembaga Instrumentasi Nasional (LIN-LIPI). Staff, Technical Cooperation, National Institute for Instrumentation, Indonesian Institute of Sciences. Jl. Cisitu Sangkuriang, Bandung.
18.	Hariyanto Soetjiyo, Ir.	Mining Exploration Engineering.	Kepala Laboratorium Bitumen Perminyakan Lembaga Geologi dan Pertambangan Nasional (LGPN-LIPI) Research Worker, National Institute of Geology and Mining, Indonesian Institute of Sciences. Jl. Cisitu Sangkuriang, Bandung.

19. Herminiati.....

1	2	3	4
19.	Herminiati, BA.	Documentation and Information Services on Standardization	Staf, Proyek Pengembangan Sistem Nasional Standardisasi, Lembaga Ilmu Pengetahuan Indonesia (LIPI). Head, Technical Services, Project for the Development of National Standardization System, Indonesian Institute of Sciences. Jl. Gatot Subroto, Jakarta.
20.	Kersanah, B.Sc.	Financial Management	Staf, R & D Management, Lembaga Ilmu Pengetahuan Indonesia. Staff, R & D Management, Indonesian Institute of Sciences. Jl. Gatot Subroto, Jakarta.
21.	Kreshna Amurwabumi, Drs.	Non Destructive Testing	Kepala Pusat Penelitian Tepat Guna, Lembaga Fisika Nasional - LIPI Head, Appropriate Technology Research Centre, National Institute of Sciences. Jl. Cisitu Sangkuriang - Bandung.
22.	Nazir Harjanto, Drs.	Geography, Information on S & T Potential	Kepala Bagian Koordinasi Ilmiah, Biro Koordinasi dan Kebijaksanaan Ilmiah, Lembaga Ilmu Pengetahuan Indonesia. Head, Division of Science Coordination, Bureau of Coordination and Science Policy, Indonesian Institute of Sciences. Jl. Gatot Subroto, Jakarta.
23.	Sri Rahadi, Ir.	Technical Physics	Staf, Lembaga Elektroteknika Nasional-LIPI. Staff, National Institute for Electrotechnique, Indonesian Institute of Sciences. Jl. Sawunggaling 14, Bandung.

24. Soedibyo, Drs. .....

1	2	3	4
24.	Soedibyo, Drs.	General Economic	Staf, Deputi Ketua LIPI Bidang Teknologi Lembaga Ilmu Pengetahuan Indonesia. Staff, Deputy Chairman for Technology, Indonesian Institute of Sciences. Jl. Teuku Cik Ditiro 43, Jakarta.
25.	Sumini, A.S, Dra.	Social Psychology	Staf, Deputi Ketua LIPI Bidang Teknologi Lembaga Ilmu Pengetahuan Indonesia. Staff, Deputy Chairman for Technology, Indonesian Institute of Sciences. Jl. Teuku Cik Ditiro 43, Jakarta.
26.	Yusuf, Ir.	Mineral Processing Metallurgy	Kepala Pusat Penelitian Metalurgi Ekstraktip, Lembaga Metalurgi Nasional LIPI. Head, Extractive Metallurgy Division, National Institute for Metallurgy, Indonesian Institute of Sciences. Jl. Cisitu Sangkuriang, Bandung.
	LEMBAGA PENERBANGAN DAN ANTARIKSA NASIONAL. National Institute of Aeronautics and Space.		
27.	Alfred Sitindjak	System Analysis	Pemimpin Proyek Pengkajian Perkembangan Kemajuan Dirgantara, LAPAN. Manager, Aerospace Studies Project, National Institute of Aeronautics and Space. Jl. Pemuda Persil 1, Jakarta.
28.	Sakti Sitindjak	System Analysis/Economic	Staf Peneliti Proyek Pengkajian Perkembangan Kemajuan Dirgantara, LAPAN. Research Staff, Aerospace Studies Project, National Institute of Aeronautics and Space. Jl. Pemuda Persil 1, Jakarta.

Peserta Widyakarya-Penataran Pengelolaan Penelitian dan Pengembangan :
Studi Kelayakan Tekno-Ekonomi II
Participants of Workshop on Techno-Economic Feasibility Studies II
J a k a r t a, 3 - 12 July 1980

No.	Nama/Name	Bidang/Field	Jabatan / Position Alamat / Address
1	2	3	4
	LEMBAGA ILMU PENGETAHUAN INDONESIA Indonesian Institute of Sciences.		
1.	Abdul Hakim, Drs.	- Plant Biology - Ecology	Staf Sekretariat Program MAB Indonesia Lembaga Ilmu Pengetahuan Indonesia. Staff, Secretariat of The Program Man and Biosphere (MAB) Indonesia, Indonesian Institute of Sciences. Jl. Jenderal Gatot Subroto, Jakarta.
2.	Dipo Alam, Drs.	- Organic Chemistry	Staf, Deputi Ketua LIPI Bidang Teknologi Staff, Deputy Chairman for Technology, Indonesian Institute of Sciences. Jl. Teuku Cik Ditiro 43, Jakarta.
3.	Ibrahim Ambong, Drs.	Social & Political Science	Asisten Peneliti, Lembaga Research Kebudayaan Nasional (LRKN - LIPI) Research Assistant, National Institute for Cultural Studies, Indonesian Institute of Sciences. Jl. Taman Pejambon 3, Jakarta.
4.	Muhiddin, Drs.	General Economics	Staf R & D Management, Lembaga Ilmu Pengetahuan Indonesia Staff, R & D Management, Indonesian Institute of Sciences. Jl. Gatot Subroto, Jakarta.

5. S. Chr. Muljono, Drs.....

1	2	3	4
5.	S. Chr. Muljono, Drs.	- Public Management - Management Techniques	Kepala Biro Keuangan, Lembaga Ilmu Pengetahuan Indonesia. Head, Bureau of Finance, Indonesian Institute of Sciences. Jl. Gatot Subroto, Jakarta.
6.	Rachmadi Ambyah, Ir.	Mining Engineering	Kepala Pusat Pertambangan, Lembaga Geologi dan Pertambangan Nasional (LGPN-LIPI). Research Worker and Chief, Mining Engineering Centre National Institute of Geology & Mining, Indonesian Institute of Sciences. Jl. Cisitu Sangkuriang, Bandung.
7.	Soefjan Tsauri, Drs.,M.Sc.	Chemistry	Asisten Direktur, Urusan Pengembangan, Lembaga Kimia Nasional (LKN-LIPI). Assitant Director for Development, National Institute for Chemistry, Indonesian Institute of Sciences. Jl. Cisitu, Sangkuriang, Bandung.
8.	Sjarief Husen, Ir.	Industrial Engineering	Asisten Peneliti, Lembaga Instrumentasi Nasional (LIN-LIPI) Staff, Technical Cooperation Division, National Institute for Instrumentation, Indonesian Institute of Sciences. Jl. Sangkuriang, Bandung.
9.	Sukarno, Dr.	Marine Biology	Asisten Direktur Urusan Ilmiah, Lembaga Oseanologi Nasional - LIPI. Assistant Director for Research, National Institute of Oceanology, Indonesian Institute of Sciences. Jl. Pasir Putih 1, Ancol Timur, Jakarta.

10. Suprapto .....

1	2	3	4
10.	Suprapto	Chemical Technology	Staf, Proyek Pengembangan Sistem Nasional Standarisasi, Lembaga Ilmu Pengetahuan Indonesia. Staff, Project for Development of National Standardization System, Indonesian Institute of Sciences. Jl. Gatot Subroto, Jakarta.
	DEPARTEMEN PERINDUSTRIAN Department of Industry		
11.	K. Bangun	Economics	Kepala Bagian Tata Usaha, Balai Besar Pengembangan Industri Logam, Departemen Perindustrian. Head, General Service Division, Metal Industries Development Centre, Department of Industry. Jl. Sangkuriang 12, Bandung.
12.	Djumarman, Ir.	Agricultural Product Technology	Kepala Bagian Dinas Penelitian dan Pengujian, Balai Penelitian Industri, Departemen Perindustrian. Chief, Division of Research and Testing, Industrial Research Institute, Department of Industry. Jl. Karanganyar 55, Jakarta.
13.	David Soegiantoro, Drs. Apth.	Pharmacist	Koordinator Pencegahan Pencemaran Industri Kulit, Balai Penelitian Kulit, Departemen Perindustrian. The Coordinator of Waste Water Treatment of Leather Industries, Leather Research Institute, Department of Industry. Jl. Sokonandi 3, Yogyakarta.
14.	Robiatun, Ir.	Technology of Annual Crops	Staf Peneliti, Balai Penelitian Industri, Departemen Perindustrian. Research Staff, Industrial Research Institute, Department of Industry. Jl. Karanganyar 55, Jakarta.

1	2	3	4
15.	Roeswan Roesli, Ir.	Electrical Engineering	Kepala Sub Bidang Evaluasi Pola dan Struk - tural Industri Dasar, Badan Penelitian dan Pengembangan Industri, Departemen Perindustrian. Section Chief of Pattern & Structure Evaluation, Industrial Research & Development Agency, Department of Industry. Jl. Proklamasi 56, Jakarta.
	DEPARTEMEN H A N K A M Department of Defence and Security.		
16.	Darwis Adnan, M.Sc.	Food Technology R & D Management	Kepala Dinas Litbang, Puslitbang HANKAM, Departemen HANKAM. Chief, R & D Division, Defence Research Centre, Department of Defence and Security. Pondok Labu, Jakarta.
	DEPARTEMEN PERHUBUNGAN Department of Communication		
17.	Maruli H. Siahaan, Drs.	Finance, Economics	Kepala Bagian Laporan dan Dokumentasi, Badan Litbang Perhubungan, Departemen Perhubungan. Head, Report and Documentation Division R & D Agency of Communications, Department of Communication. Jl. Merdeka Barat 8, Jakarta.
	DEPARTEMEN PERTANIAN Department of Agriculture		
18.	Budhoyo Sukotjo, Ir.	Agronomy	Sekretaris Bantuan Teknis, Kepala Bidang Perkebunan, Badan Litbang Pertanian, Departemen Pertanian.

Secretary .....

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1	2	3	4
			Secretary for Technical Service, Research Institute for Estate Crops, Agency for Agriculture Research and Development, Department of Agriculture. Jl. Taman Kencana 1, Bogor.
19	Khairina Noekman, Ir.	Agriculture Economics	Staf Peneliti, Pusat Penelitian Agro Ekonomi, Badan Litbang Pertanian, Departemen Pertanian, Research Staff, Centre for Agro Economics and Development, Department of Agriculture. Jl. Ir. H. Juanda 20, Bogor.
20.	Redinal Aswin, SH.	Customary Law	Kepala Sub Bagian Persiapan Perijinan, Biro Penanaman Modal, Departemen Pertanian. Head of Licences Sub Section, Bureau for Capital Investment, Department of Agriculture. Jl. Imam Bonjol 29, Jakarta.
	BADAN TENAGA ATOM NASIONAL National Atomic Energy Agency		
21.	Effentrip Agoes, Ir.	Geology and Exploration for Uranium Deposit	Direktur Pusat Eksplorasi dan Pengolahan Bahan Nuklir, Badan Tenaga Atom Nasional. Director, Centre for Exploration and Nuclear Materials Processing, National Atomic Energy Agency. Cinere, Pasar Jum'at, P.O. Box 11, Kebayoran Baru, Jakarta Selatan.
22.	Iyos Subki, Ir. M.Sc.	Nuclear Engineering	Direktur Pusat Penelitian Teknik Nuklir, Badan Tenaga Atom Nasional. Director Research Centre for Nuclear Techniques, National Atonomic Energy Agency. Jl. Tamansari 71, Bandung.

DEPARTEMEN PERTAMBANGAN.....