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Interregional Seminar on the
Industrial Processing of Rice

SUMMARY

INVESTMENT AND MANAGEMENT CONSIDERATIONS FOR THE MODERNIZATION OF TRADITIONAL RICE MILLS AND FOR THE ESTABLISHMENT OF MODERN INTEGRATED RICE PROCESSING SYSTEMS 1/

by

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1. Rice processing is acknowledged to be the largest, most widespread agro-based industry in Asia, processing more value of product than any other industry. While many other industries have received the attention of local and foreign investors and have benefitted from extensive modernization in recent years, the rice processing industries of most of the developing countries of Asia have been left largely untouched to perpetuate their traditional ways.

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2. During the past few years, increasing government and private investor interest has begun to focus on the means for accelerating introduction of modern industrial-scale methods of rice processing.

3. The lessons learned from evaluation of the few pilot modern rice processing centres established in developing Asian countries to date have provided encouraging evidence of the advantages possible. A broad range of technological advances in rice processing methodology has been tested and represents a changing, yet well-established state-of-the-art ready to be adopted.

4. The primary benefits from accelerating the spread of modern methods of rice processing are an increase in the total food availability in rice producing countries and a more efficient (and profitable) major industrial potential.

5. This paper is concerned with an examination of the detailed requirements, considerations, and methods for complete planning either of an entirely new industrial-scale modern rice processing unit or of the modernization of an existing traditional rice mill.

Its intention is to serve as a practical guide for potential investors, governments, design engineers, economists, and planners who may all be concerned with various phases of planning rice mill industrial projects. The paper includes discussion of the primary criteria for modernization of rice processing industries which should be considered by any planners or potential investors concerned with this industry. Detailed check-lists of specific planning questions, formats for analyses required, and planning methodology are included.

The importance, magnitude, and characteristics of this long-overlooked major industry are analyzed and the present pressures for change are reviewed. A conclusion is reached that the rice processing industries of much of the developing world appear to be just on the verge of a period of rapid change today, having been largely overlooked by governments and investors in the past and facing pressures building up to a critical point from many sides.

The paper begins by analyzing six of the most important motivations for modernization, important for understanding as the basis of pre-investment project planning:

Through the leverage of increased efficiency and higher yield, the paper shows how gains in total rice output ranging up to 6 per cent compared with yields of traditional huller mills can have significant impact both on the total food

availability in a nation and on the profitability of any individual enterprise. The potential economic benefits of by-product utilisation from modern rice processing centres are also discussed.

The possible economic consequences of the quality improvement which can be obtained from modern rice processing techniques is discussed, particularly from the point of view of the additional profit value of improved quality and of the necessity of quality improvement for an export market strategy.

The "Green Revolution" is having increasing impact in a number of countries making a switch to modern rice processing techniques nearly imperative. This sometimes occurs from the strict capacity question of how to handle the sheer volume of paddy increases following from introduction of new high-yielding varieties.

Another important impact occurs when backward rural areas, traditionally producing paddy for their own home consumption, reach a surplus position and become cash market traders for the first time.

Also, a number of the new high-yielding varieties have markedly different milling characteristics than the traditional paddy varieties, sometimes offering advantage for modern mills.

Where the increases in high-yielding variety paddy production coincide with monsoon harvesting periods, modern drying and storage facilities can sometimes provide the only feasible solution to problems of crisis dimensions. Where export objectives are set for individual mills or as national policies, flexibility as to quality and specifications becomes of paramount importance, and the operational and economic advantages of the modern processing methods are conclusive. Governments, looking at local problems of farm income, employment, food supplies etc., can benefit substantially from the introduction of modern rice processing facilities if this occurs in a properly planned manner.

Potential investors considering establishment of modern rice processing industries need to give careful consideration to the pre-investment planning of their project. This concerns not only the design of the buildings and machinery specifications for the industry, but, more importantly, of the proper scope, magnitude, purpose, type of project, optimum technological process, marketing strategy, paddy procurement strategy, etc.

Pre-investment planning of an industrial project can be compared with finding one's way through a complicated maze to reach a desired objective - there are literally hundreds of critical forks in the road which decisions to go this way or that must be taken before the project becomes ready to turn over to the design and installation engineers.

The most important basic industrial project planning requirements applicable for modern rice processing industries are grouped under the following four general planning steps, which are discussed in detail in the paper:

1. The Preliminary Project Planning Appraisal
2. The Basic Project Planning Strategy
3. The Project Design Specifications
4. The Economic Feasibility Analysis

The Preliminary Project Planning Appraisal is the starting point in the planning process, and covers the needs for making surveys of the environmental conditions in which the proposed mill will operate. The paper discusses a detailed Check-List of considerations in the following areas:

1. Local investment climate
2. Government regulations affecting rice processing operations
3. Local paddy production practices
4. Local paddy marketing and mill procurement practices
5. Local paddy drying and storage practices
6. Local rice milling practices
7. Market surveys
8. Survey of other resources available

The second principal planning step is concerned with determination of a Basic Project Planning Strategy. Before the engineering designs are made, one needs to analyse and define answers to a host of strategic considerations which can have a major impact on the type of facilities required and on the ultimate profitability of the investment

The paper discusses strategic planning questions applicable for modern rice industry planning in the following categories:

1. General project objectives
2. Location
3. Mill size and capacity
4. General strategy for operation
5. Alternative mill technologies
6. General strategy for paddy procurement
7. Rice marketing strategy
8. By-product marketing strategy
9. Ownership, financing, and management strategy
10. Alternative additional uses of assets and related investments

The Project Design and Specification can only be started once the basic parameters of the project have been defined in the Strategy. It is a job for well-experienced technical consultants, including a design engineer experienced in all phases of rice processing design, a civil engineer for designing and costing the buildings, structures, foundations, etc., and an economic analyst for making the economic feasibility analysis which follows.

The project design and specification should include at least the following principal steps, which are discussed in detail in the paper:

1. A statement of basic project specifications
2. A processing flow diagram
3. A plot lay-out plan
4. Equipment lay-out drawings
5. A list of detailed machinery and equipment specifications
6. Basic civil engineering designs and specifications
7. A time schedule
8. A site survey

The Economic Feasibility Analysis is the heart of the pre-investment planning process. All preceding this point has supplied the necessary pre-requisites for this analysis. The Economic Feasibility Report is important to budget the amount of capital required for the project, to predict whether the proposed plan can be economically feasible, to analyze potential profit returns, to determine an optimum financing plan for the industry, to predict the timing of cash flow requirements, and to establish detailed operating plans for later implementation.

The paper includes, as an Appendix, a Standard Format for Rice Processing Industry Economic Feasibility Reports. This format is intended to be helpful as a guide to prospective investors and planning analysts in the preparation of a detailed economic feasibility analysis for this specific type of industry. The paper follows the outline of the standard format, and provides explanatory comments on the methodology for completing such an analysis.

The primary parts of the economic feasibility analysis which are discussed include:

1. Estimated cost of the project (capital cost budget)
2. Proposed capitalization and sources of financing
3. Forecast profit and loss statements with statement of operating assumptions
4. Financial ratio analysis
5. Forecast balance sheets
6. Proposed loan repayment schedule
7. Cash flow statement.

The last chapter of the paper contains a discussion of some of the other implications of modernization of rice processing industries. Beyond the questions of the profitability of an individual enterprise in this field, many broader related social and economic questions should be of major present concern to the governments, aid-giving agencies, regional authorities, etc., as well as to the investors themselves.

Some of the potential changes in the capitalization and ownership patterns in this basic industry of Asia are discussed, including the potential assets and liabilities of a shift in the character of the industry from being primarily a field for the "small" entrepreneur, to that of large-scale industry often owned by outside investors of substantial means.

The complex management requirements of planning and operating a modern rice processing industry are discussed, since this can be one of the most important and potentially limiting aspects of planning for an expansion of this industry.

One vital consideration must be the employment implications of a shift to modern rice processing techniques. Not only are modern rice mills likely to require a reduced total number of workers per unit of capacity than is the case with traditional mills, but the character of their employment requirements will

change. Fewer unskilled labourers will be required at the same time that opportunities for technically trained machine operators and supervisors will increase. The potential social and economic consequences of such changes are considered in the paper.

Lastly, other general social concerns which should be given higher priority attention now by government and aid-giving organization planners are outlined, including the potential ways of motivating the channeling of investment in this spreading industry toward desirable general economic and social ends.

An industrial-scale modern rice processing center is a far different undertaking than a traditional "husking" mill or a government food storage programme. Any individual or organization considering investing the large amount of capital which most projects of this type require cannot afford not to safeguard and optimize his investment by adequate pre-investment planning. Likewise, governments in most Asian countries with economies primarily linked to rice production must give high priority attention not only to the potential advantages which can be achieved through providing incentives and guidelines for a spread of modern rice processing industries, but also to the leverage which changes in this field can potentially have on a host of related vital issues of national concern such as farming, employment, food availability, foreign exchange balances, and national income.

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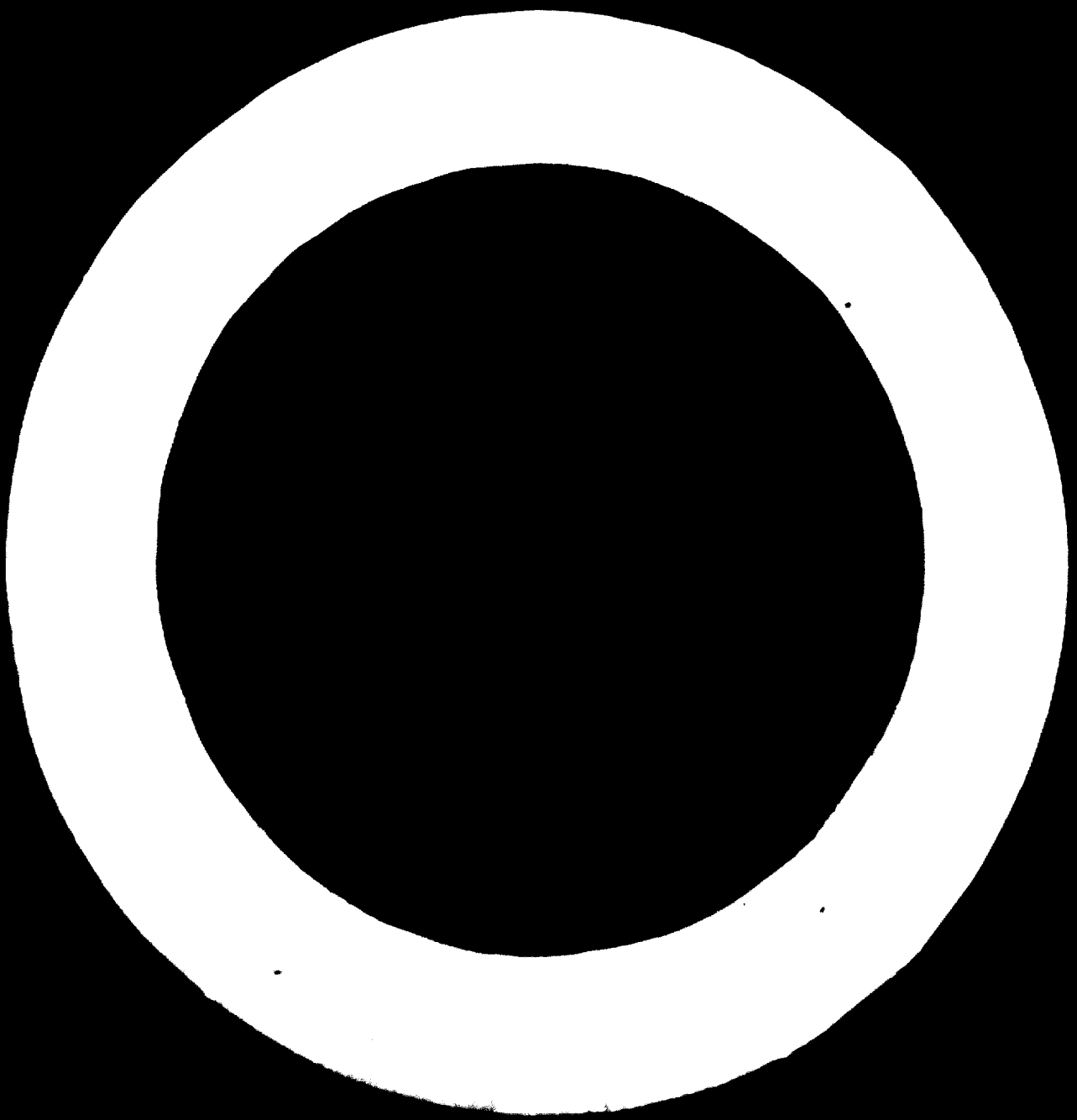

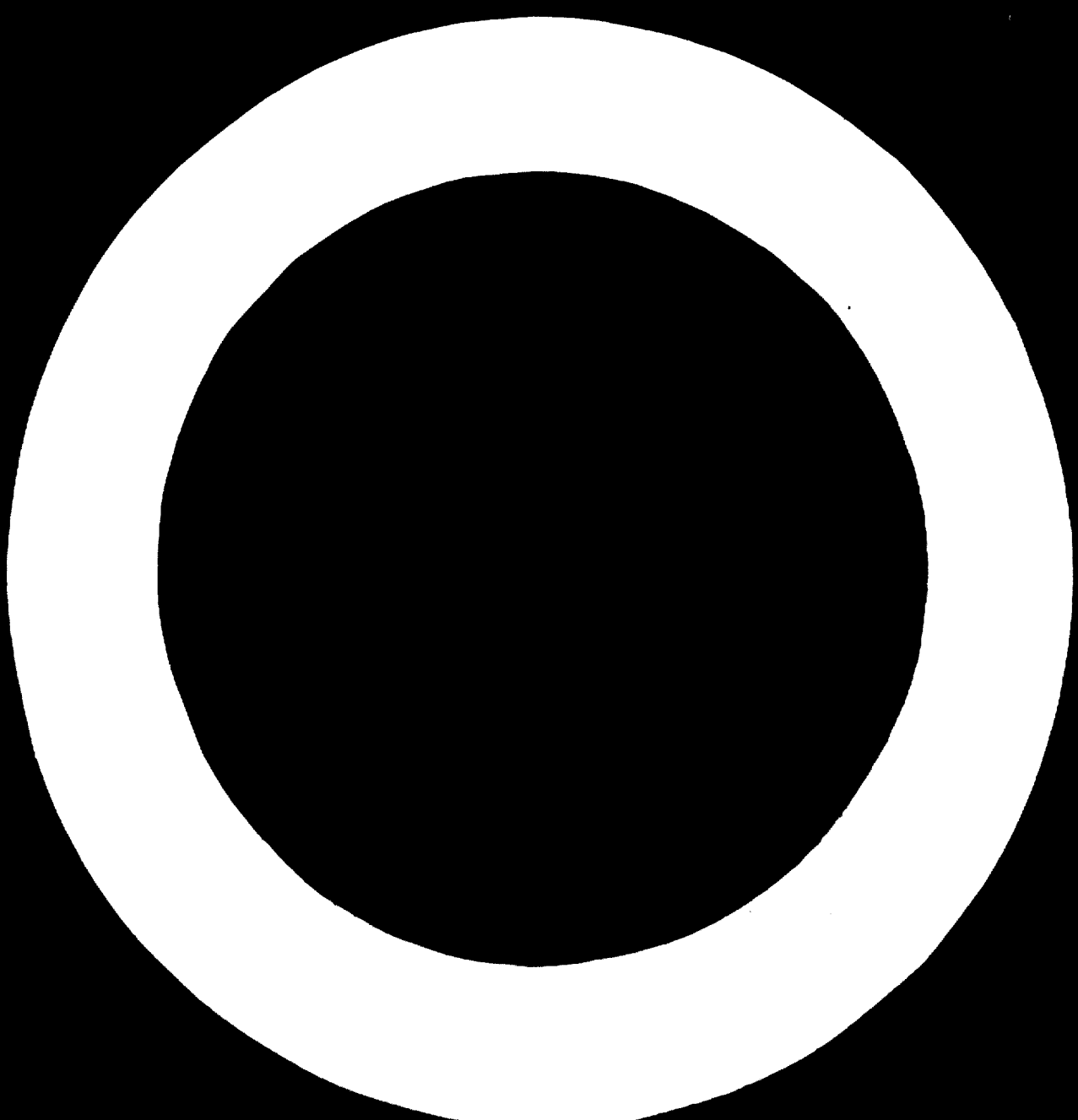

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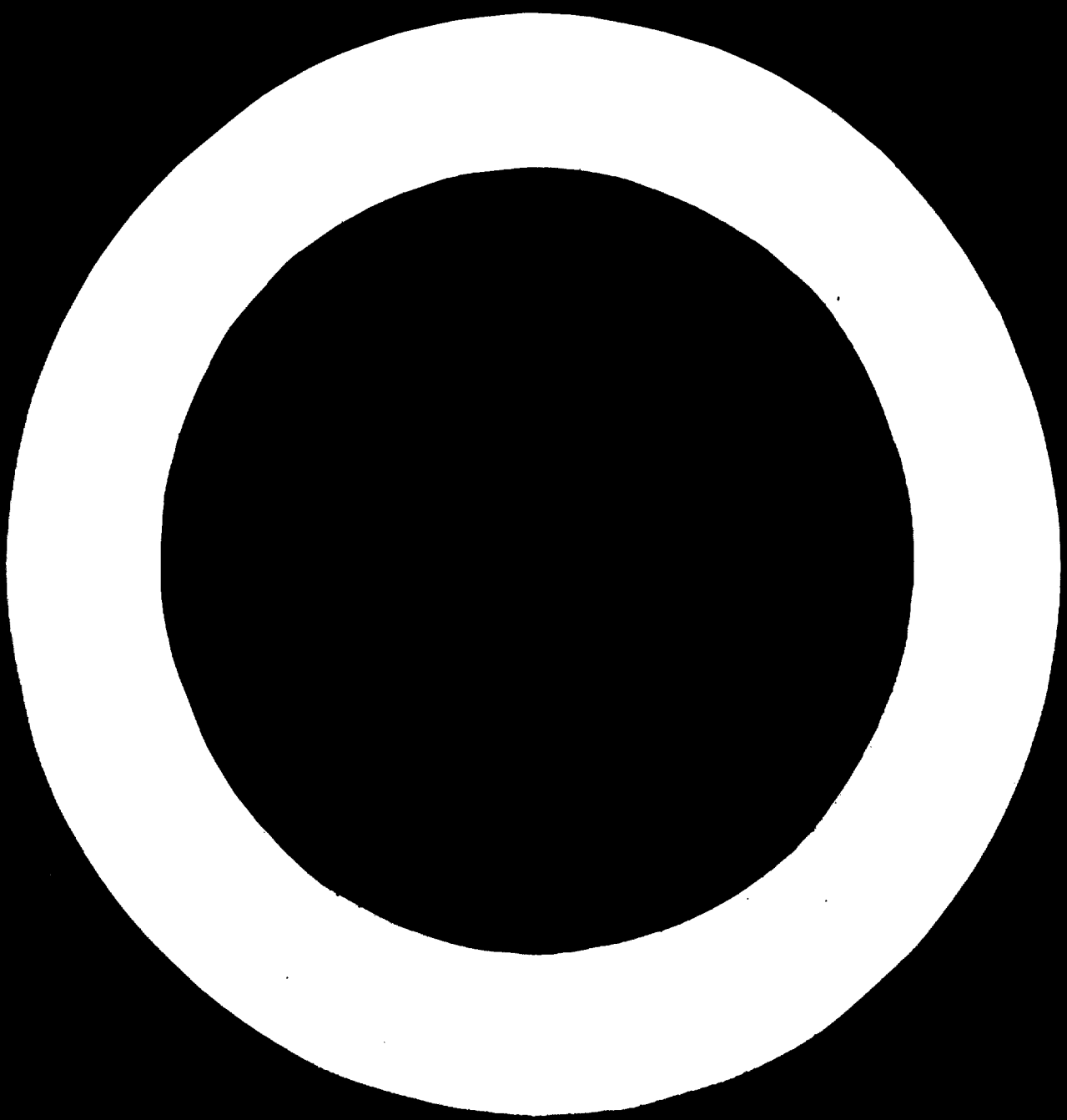

I

INTRODUCTION

1. Increasing government and private investor interest in many of the major rice-producing countries of Asia has been focusing upon the means for accelerating the introduction of "modern" industrial-scale methods of rice processing. New pilot modern rice mills have been established in a number of countries during the past few years. Mistakes have been made; lessons have been learned; successes have been recorded. A broad array of technological advances in modern rice processing methodology has been tested and represents a changing, yet well established state-of-the-art.

2. Yet the few examples of modern rice processing industries which have been established to date in a number of the developing countries in Asia demonstrate all too clearly the critical importance of careful pre-investment planning of the location, type of unit, operational strategy, financing, equipment specification, economic feasibility, etc., which together combine to yield a successful industrial project.

3. This paper is concerned with an examination of the requirements, considerations, and methods for complete planning either of an entirely new industrial-scale modern rice processing unit or of the modernization of an existing traditional rice mill.

4. Its intention is to serve as a practical guide for potential investors, governments, design engineers, economists, and planners who may all be concerned with various phases of rice mill project planning or policy determination. Its approach is that of the study of modern rice processing as a business investment, although consideration is also given to other non-business motivations which governments may sometimes have for encouraging the spread of this industry.

5. The paper uses the generalized terms, "modern" and "traditional" rice mill, which can cover a broad range of actual sizes and types of rice processing installations.

6. In general, by "modern" mill, I am referring to an integrated complete paddy processing center employing machinery of late design, generally automatic in operation, employing mechanical handling equipment between processing stages, using milling machinery normally based around rubber-roll husking machines, operating on an industrial scale with mill-purchased paddy, producing polished (not brown, or "cargo") rice, and generally incorporating most of the following principal processing stages:

Paddy Procurement
Paddy Receiving, Inspection, Weighing
Paddy Cleaning
Paddy Mechanical Drying and Tempering
Paddy Storage, Aeration, and Fumigation
Parboiling and Drying (optional)
Rice Milling
Rice and By-products Packaging and Storage
Rice and By-products Marketing
Husk Utilization

7. By "traditional" mill, I am referring to a more limited older-style unit, generally smaller in capacity, generally employing machinery based around huller or disc sheller type husking machines, usually employing sun-drying and (where practiced) older slow soaking and steaming methods of parboiling, usually without a substantial by-products utilization or marketing system, and often operating on a servicing (toll) rather than a commercial basis.

8. The industrial planning procedures outlined should be applicable for consideration of a modern (or modernized) rice processing industry in any part of the world. The primary focus of the comments and considerations discussed, however, is intended to be on the needs of the "developing" rice-producing countries (primarily in South-East Asia and the Indo-Pak subcontinent), where "traditional" mills now predominate, where capital is frequently shy, where labor rates are low and unemployment is a problem, and where transportation, marketing, grading, and other logistical supports are usually quite limited.

9. "Modern" machinery and methods for rice processing may be established either in a completely new industry or may be progressively added to an existing traditional rice mill to effect partial (and later complete) modernization of the older unit. The basic planning considerations are essentially similar in either case, except that a complete planning exercise, with open options for most criteria, is required for a new industry, whereas many of the criteria are already given with an existing rice mill and the scope and detail of planning required may be reduced.

10. Industrial planning is a skilled profession in which the average businessman, government servant, or rice miller would find his capabilities severely taxed. With the amount of investment typically required for an industrial-scale modern rice mill, one can ill-afford the trial-and-error mistakes which may come from a lack of adequate anticipation of and planning for the multitude of problems which may arise.

11. While this paper is intended both to point out the potentials of investment in modern rice processing industries and to guide prospective investors toward an understanding of the planning considerations required, the use of experienced professional consultants is advised in the actual execution of a complete pre-investment project plan.

II

THE MOTIVATIONS AND GOALS OF MODERNIZATION OF RICE PROCESSING INDUSTRIES

12. Rice processing is acknowledged to be the largest, most wide-spread agro-based industry in Asia, processing more value of product than any other industry. Yet while many of the developing nations have benefitted from both local and foreign investments in numerous other manufacturing industries employing modern technologies, this traditional rice processing industry has been left largely untouched to perpetuate its traditional ways.

13. The interest in exploring the technical and economic means of modernising rice processing on an industrial scale appears to have intensified both because of the growing awareness of the wasteful and inefficient characteristics of the present "traditional" rice processing methods and because of the growing pressures to add capacity for handling larger paddy volume in a number of countries which are experiencing dramatic rice crop production increases.

14. The rice processing industry appears to be just on the verge of a period of rapid change today. It has clearly been largely overlooked by governments and investors; pressures necessitating change are building up to a critical point from many sides; the "green revolution" is acting in many areas as the primary catalyst to create second-generation impact needs for change in grain processing and marketing methods and facilities; the economic advantages of modernization are clear-cut and are substantial; pilot projects set up in the last two to four years in several countries are demonstrating locally visible proof of the advantages of the modern technology and industrial scale of this industry.

15. The following discussion analyzes the main areas of motivation which are presently producing the pressures for change in this field and on which the success of any specific new project could be determined:

A. The Increased Efficiency of Modern Rice Processing

16. The straightforward efficiency advantages offered by modern rice processing machinery compared with traditional mills have been documented by comparative studies, particularly in India. Gains in total rice output ranging from 4 to 6 percent in the case of raw paddy and 1 to 2 percent in the case of parboiled paddy, compared with yields of "traditional" huller mills, have been shown to be reasonable expectations.

17. Whereas typical huller mills deliver about 63 to 65 percent (or less) of the weight of paddy processed as total rice (including brokens), most modern mills can give around 69-72 percent total yield. The differences in range depend, of course, on the variety, cleanliness, condition and moisture content of the paddy being processed, on the harvesting, parboiling, and drying methods used, and on the efficiency with which the rice mills are operated.

18. Increased efficiency may be an important planning goal from two viewpoints:

* Financial gain from sale of extra rice product, important as a profit incentive to potential industrial investors.

* Increased total food grain availability, important to governments in food-deficit or food-importing areas.

19. From the first viewpoint, each 1% increase in total rice yield means approximately 1.5% increase in sales revenues from the same raw material cost.

20. For example, if 100 tons of paddy yields 67 instead of 66 tons of rice, the extra 1% of paddy weight is an increase of 1/66 = 1.5% in the amount of rice available for sale. For comparison, at least this much is lost to birds and rodents alone in most traditional rice mills.

21. At an assumed rice value of $150 per ton and with an average yield increase of 5% over that of traditional mills, this means

an average 7.5% increase in total revenue, valued at $90,000 per year for a 2 ton/hr. mill, with no increase in raw material cost. A businessman could invest $900,000 more than he would in a traditional rice mill just to produce this extra income, yet the entire capital cost of the complete modern mill facilities needed to give this higher yield should be well under half this amount.

22. From the second viewpoint of the efficiency advantages of modern rice processing, the increase in the total food supply which more modern rice processing methods offer can influence markedly some of the most pressing economic, political, and social problems plaguing a number of developing countries -- continuing food deficits necessitating imports, acceptance of aid loan terms, or below-subsistence levels of local food consumption; or loss of a potential major source of foreign exchange earning capability through increased exports.

23. India, for example, still importing 487,000 tons (1969) of rice worth more than $50 million at world rice trade values, could be self-sufficient with an increase in local rice availability of only 1.2% over her present (1969) production level. More than this could come from accelerated adoption of more efficient milling technology. Pakistan, traditionally always food-deficit and facing critical foreign exchange shortages, could reach complete rice self-sufficiency from the gains of modern milling alone. Further modest yield increases could turn rice into the country's second-largest source of foreign exchange earning. Only a 3% yield increase through shift to modern milling in the Philippines could potentially generate more than $10 million in foreign exchange export earnings.

24. In short, the leverage of only a few percent increase in total mill rice outturn is so great both for most national economic policies and as a profit incentive for large-scale investment that the potential advantages of modernization cannot be overlooked.

B. The Quality Improvement of Modern Rice Processing

25. One of the major advantages of modern rice milling techniques is that the rice and by-products produced by modern mills are of a much higher quality than the output of traditional mills. "Quality" may be defined in terms of (a) percent of brokens (head yield), (b) percent of unhusked paddy, red rice, damaged grains, etc., (c) degree of uniformity of bran removal and polish, (d) cleanliness and presence of dust, trash, and other admixtures, (e) control of uniformity of moisture content, (f) physical appearance, (g) and nutritional characteristics.

26. Each of these criteria of rice quality are influenced by a number of variables, some external to the rice milling process (i.e. variety of paddy, condition of paddy, time of harvest, moisture content, method of threshing used, method and speed of drying used, etc.).

27. At the point of receipt, a modern mill can adopt paddy procurement grading standards which will provide incentives for delivery of better quality paddy and will prevent acceptance of varieties and qualities of paddy which are below minimum specifications set. Through use of a simple paddy grading laboratory at the point of procurement combined with objective schedules of price premiums and reductions for variations from several measurements of paddy condition and quality, the mill can encourage farmers to deliver improved paddy and can be compensated for the potential losses from sub-standard deliveries.

28. From the point of receipt onward, the type of facilities which are used in all phases of a rice processing industry can have a significant effect on the ultimate quality of the output. For example, evaluation tests of the first modern rice mills in India showed that only one measure of quality, head yield, increased an average of 15.1% over traditional huller mills with raw paddy (4.5% increase average with parboiled paddy).

29. For each 1% increase in head yield (reduction in percentage of brokens), 22 extra pounds of premium-priced whole grain rice

are available for sale from every ton of paddy milled, in place of 22 pounds of lower priced brokens. If, for example, brokens sell at half the price of whole grain rice in local markets, and if rice is valued at $150 per ton, this would mean additional revenue of $\frac{22}{2200} \times \frac{150}{2} = \$0.75$ per ton of paddy processed for each 1% higher head yield than a traditional mill outturn. If a 2 ton/hr. modern rice mill can yield 15% higher head yield than a traditional mill, the extra annual profit coming from increased head yield alone could be worth $135,000, with no increase in raw material cost.

30. Also, the rice from the modern mill will be of higher general quality (in addition to broken count) than that of traditional mills. As such, it should bring a higher premium price than the rice output of traditional mills, again with no increase in raw material price. This is particularly true in countries with free private-trade rice markets, with above-subsistence level consumption, and/or with export rice trade. Rice of higher milling quality may bring a price premium of up to 25% in world trade markets compared with inferior-milled rice of the same variety.

C. "Second Generation" Effects of the "Green Revolution"

31. The so-called "green revolution" -- the dramatic increases in crop production resulting from use of the new high-yielding seed varieties combined with the application of fertilisers, pesticides, and irrigation water-- has benefitted some countries, some regions, some groups of farmers, some parts of the economy much more than others.

32. It has also brought about a host of "second generation" problems in these areas concerned with supply of related agriculture inputs and equipment; processing, transporting, storing, and marketing the increased production in rural areas; changes in credit needs; changes in rural employment patterns; etc.

33. Three important impacts of these "green revolution" changes which can have a major impact on the need for modern rice mill investment are noted below:

34. First, the sheer increase in paddy quantity in areas affected by the "green revolution" can overtax traditional methods and facilities for rice milling and for related paddy drying, storage, transportation, and marketing.

35. As an example, in the Sind region of West Pakistan, the introduction of IR-8 (and later IR-6) varieties nearly doubled paddy production from 664,000 to 1,155,000 tons annually in a period of only two years from 1967-68 to 1969-70. No modern mills are located in the area, although several hundred traditional huller mills have leisurely handled the single annual crop of the region in past years, typically operating less than half the year following the harvest season.

36. Now these same mills are bursting at the seams, milling round-the-clock. Unmilled paddy is seen piled outside in dozens of 1000-ton (or larger) open stacks around each mill town. Bagged milled rice overflows the railway station sheds waiting for wagons for shipment. Present predictions of the potential for further paddy production increases in the next few years have called attention to an impending crisis of abundance, wherein substantial increases in milling capacity are required merely to cope with the increased grain quantities needing milling.

37. Second, in most rural areas in Asian rice producing countries, the majority of the rice produced is consumed "at home", either literally by the farmer's extended family or within his local village area. When an essentially subsistence-agriculture area, often lacking good transportation and communication links, suddenly finds itself with a sizeable net local surplus through adoption of the new rice technologies, the local farmers are faced with being traders for the first time; the economy shifts to a cash-crop basis.

38. The farmers not only have surplus paddy they need to sell rather than consume, but they need cash to pay for unaccustomed costs of fertilizers, pesticides, etc. Since the farmers are typically inexperienced in their new commercial role and since

grain marketing mechanisms seldom work perfectly or efficiently in the developing countries, what often happens is that shrewd outside traders take advantage of the farmers' helplessness and urgency to sell, and the local price of paddy drops, discouraging the farmers and thereby softening their motivation to expand the adoption of the new agricultural techniques.

39. In situations such as these, commercial rice processing facilities are needed where they were not before, and the advantages which the extra investment in modern, rather than more traditional facilities can offer are substantial.

40. Third, the new high-yielding varieties which form the backbone of the "green revolution" in some cases have markedly different milling characteristics than the traditional local paddy varieties they replace. For example, IR-8, the first principal high-yielding variety introduced, has a chalky characteristic which breaks very easily in milling, particularly when dried excessively rapidly or when it is subjected to excessive friction (as occurs in huller mills). Numerous mills processing IR-8 in raw (white) rice form have been observed breaking more than 50% of the grains.

41. Since one of the main advantages of the modern rubber-roll sheller is its ability to reduce breakage, it is possible that a modern mill may be able to be in a unique position to accept and process some of the new varieties with high-breakage characteristics economically, where this might not be possible with traditional huller mills.

D. By-Product Utilisation

42. Another significant motivation for investing in modern rice processing facilities is the potential economic benefit which is attainable from utilisation of the by-products of the modern mill.

43. Most traditional huller mills produce only one by-product besides rice and rice brokens: a "powder" mixture of ground-up husk, bran, dust, dirt, polish, and finely ground rice particles.

This powder has little economic value in most locations except for sale as an animal feed or for fuel.

44. Modern mills, on the other hand, produce separated by-products in a form which can generate substantial additional mill revenue. First, nearly all fine brokens are saved and collected and can be sold as consumable brokens or for brewery use, or can be ground into rice flour.

45. Bran is the most valuable by-product and is produced in a quantity equivalent to 4 to 8 percent of the weight of the incoming paddy, depending on degree of polish milled. Bran has a number of economic uses such as sale as a poultry feed ingredient. The use of highest economic value, however, has proven to be that of solvent oil extraction for production of either edible or inedible oil.

46. Husk is the other remaining by-product of any consequence. Husk is available in such abundant quantity at most mills (at least 20% of the weight of the paddy) that it can pay to burn it to produce steam for mill use even if it is a relatively inefficient heat source simply because it is free in comparison with a raw material cost for any other purchased fuels. Also, it often costs money just to dispose of it if not burned.

47. Husk-generated steam can be used for parboiling, for driving a steam engine or electric generator for mill motive power, and/or for the heat source for a mechanical dryer through use of a steam heat exchanger in the dryer input air duct. Many older traditional rice mills, particularly in areas where parboiling is practiced, have used husk or husk/bran burning boilers for many years.

48. Some mills which have tried to maximise their use of husk-generated steam have found they have been able to generate enough steam from their husk output to accomplish both all of their parboiling plus generate all of their mill horsepower, or a combination of parboiling plus mechanical drying requirements. Since no external fuel source is needed with such installations, the cost savings can be significant.

E. Preservation and Storage of Monsoon-Harvested Crops

49. In some parts of the developing countries of Asia, the seasonal timing of the crops in which the largest production gains are being realized from introduction of high-yielding varieties coincides with rainy, high-humidity, or monsoon weather conditions. Monsoon-harvested paddy is, of course, very difficult to dry and preserve by traditional sun-dependent methods and consequently is often primarily consumed immediately where grown or marketed at depressed prices. If kept or transported to distant markets, there is danger of spoilage or sprouting.

50. This challenge, where it exists, can be a very strong motivation for installation of modern rice processing equipment, particularly mechanical drying and bulk storage facilities. Not only can more efficient use be made of the food potential of these crops, but the profit potential of modern mills offering such facilities can be very substantial, since their mechanical dryers can turn this sacrifice-price wet paddy into full-value normal dry paddy.

51. As an example, 60 LSU-type mechanical dryers were installed in Tanjore District, India, alone in 1967-68 for drying of a greatly increased crop of monsoon-harvested paddy. In the Rangunia Thana of Chittagong District in East Pakistan, production of the "Boro" paddy crop which is harvested just before the onset of the heavy monsoon rains increased 36-fold between 1966 and 1968, creating a substantial marketable surplus for the first time. Since no mechanical drying facilities were available for this and the following "Aus" crop harvested in mid-monsoon, paddy prices became markedly depressed. A preliminary study of the potential for a modern drying and storage complex for the area shows that gains far in excess of costs can be expected from establishment of the new facilities.

F. Export Objectives

52. Another motivational factor which can be very important in

considering investment in modern rice processing facilities is the potential role which rice exports may play in the marketing strategy for the mill. World rice markets have become considerably more quality-conscious in recent years, as world production has increased and as average world rice trade prices have declined. Much of the rice produced in traditional mills in the developing countries of Asia is of a quality below that of the lowest grade moving in world trade.

53. If rice export is now carried out or planned for the future, the ability to produce high quality, clean, uniformly milled rice and to be able to vary specifications according to customer order is becoming of paramount importance. Modern rice milling facilities are mandatory to achieve either of these objectives efficiently.

G. Government Incentives and Policies

54. Many aspects of the rice economy in a number of Asian countries is controlled or influenced by government policies. These range from controls over acreage, seed, fertilizer, pesticide, and water distribution control, restrictions on free paddy movement and marketing, government paddy and rice procurement programs (either mandatory or voluntary), rationing systems, price support programs, government export controls, government licensing and regulation of private rice mill operations, inspection, certification, grading, government-operated rice mills, and direct government involvement in transportation, storage, and rice marketing.

55. In some cases, these government policies can provide substantial incentives to rice growers and millers, such as has been the case in Japan in recent years. On the other hand, government policies can sometimes achieve warped effects. As an example, in one major rice producing country, whole-grain rice of an export quality until recently was required to be sold to the government for export, while millers were free to sell brokens in private markets. The local demand was such that the price of so-called "brokens" rose higher than the government procurement price for whole grain rice.

and it paid millers to break as much rice as possible. In another Asian rice growing area surveyed by the author, one of the highest costs of operation in local rice mills was for the bribes necessary to pay local government food inspectors.

56. Government policies must, of course, take into account a broad range of divergent considerations including overall national food supply, export and import controls, and general socio-economic goals of economic development, rural development, employment, etc. Most governments could not, for example, permit wholesale forced closure of many small rural, high-employment rice mills by the competitive effects of a few mechanized large-scale monopolistic modern mills.

57. It is clear, however, that the "rice economy" is the dominant economic force in most Asian countries and that the government policies affecting it can have a significant influence on the growth and efficiency of the rice producing industries, on the national food supply, and on the general rate of economic development

III

PRE-INVESTMENT PLANNING FOR MODERN RICE PROCESSING INDUSTRIES

58. There are certain standard basic planning steps which should be taken by any potential industrial investor before making a final decision on a new project. Careful pre-investment planning is necessary to define the proper scope, magnitude, purpose, and type of project; to specify the optimum technological process, equipment, and other facilities; to study the market and plan a workable marketing strategy; to determine the technical and economic feasibility and return on investment of the project; to examine the political and competitive environment in order to identify dangers and constraints.

59. Pre-investment planning of an industrial project can be compared with finding one's way through a complicated maze to reach a desired objective -- there are literally hundreds of critical forks in the road at which decisions to go this way or that must be taken before the project becomes ready to turn over to the construction and installation engineers. The decisions taken at these planning crossroad points can have a major influence on the final viability of the result.

60. In short, planning aims at solving as many questions as possible **before** making the financial and physical commitment to a new project. The objective is to end up with an enterprise which is planned in the detail necessary for physical implementation; which conserves investment to a practical minimum; which will operate as nearly as possible to optimum efficiency and profitability; and which can avoid as many costly trial-and-error mistakes as possible.

61. The most important of these basic industrial project planning pre-requirements which are unique to rice processing industry pre-investment analyses may be grouped under the following four general planning steps, which are discussed in detail in the following chapters:

1. The Preliminary Project Planning Appraisal
2. The Basic Project Planning Strategy
3. The Project Design and Specification
4. The Economic Feasibility Analysis

62. An industrial-scale modern rice processing center is a far different undertaking than a traditional huller mill or a government food storage program. Any individual or organisation considering investment of the large amount which most projects of this type require cannot afford not to safeguard and optimise his investment by adequate pre-investment planning. The use of professional industrial planning consultants at this stage can pay handsome rewards throughout the life of the project.

IV

THE PRELIMINARY PROJECT PLANNING APPRAISAL

63. The starting point in the process of planning for either a new modern rice mill investment or for further investment in modernization of a traditional rice mill should be an appraisal of the basic environment in which the proposed mill will operate.

64. The Preliminary Project Planning Appraisal should include consideration of relevant points in the following major categories:

1. Local Investment Climate
2. Government Regulations Affecting Rice Processing Operations
3. Local Paddy Production Practices
4. Local Paddy Marketing and Mill Procurement Practices
5. Local Paddy Drying and Storage Practices
6. Local Rice Milling Practices
7. Market Survey
8. Survey of Other Resources Available

65. The extent of study appropriate may depend both upon the previous experience and knowledge of the investor in the local rice processing economy and upon the size and complexity of the proposed new rice mill. In the case of a small mill or for partial modernisation of an existing mill, it may prove sufficient to make a brief informal review of the outstanding questions in the categories above which might influence the success of the investment.

66. On the other hand, in the case of a larger complete modern paddy processing center, a more detailed study of the influencing factors concerned may be appropriate, leading to written conclusions about the likelihood of success of the proposed project, the constraints under which it must operate, and the appropriate best strategy for its operation.

67. As a guide for prospective investors making a Preliminary Project Planning Appraisal for modern rice processing industry investments, a check-list for planning and study is outlined in Appendix - "A". While not intended to be all-inclusive, it is representative of the kinds of specific considerations which shoul be studied before a detailed project plan is developed.

68. The important point for consideration as each of these appraisal questions is studied is, "What may be the likely potential influence of this factor on the proposed rice mill?". Many formal and informal methods of study exist. Since many of the considerations are subjective in nature one simple method of evaluating the types of questions raised in the check-list is to rate each factor in terms of its potential impact on the success of the proposed new mill, as:

1 - strongly favorable influence
2 - favorable influence
3 - neutral influence
4 - unfavorable influence
5 - strongly unfavorable influence

V

THE BASIC PROJECT PLANNING STRATEGY

69. Having completed a preliminary appraisal of the environmental constraints and opportunities in which the proposed rice mill must operate, the next step in the planning process is to define the appropriate optimum strategy for the the project. Out of this strategy can later come the specific detailed specifications and designs and cost budgets on which the project can approved and implemented.

70. Strategic planning is concerned with defining the basic parameters of the proposed project. It is a consideration of fundamental alternatives where there are important choices to be made.

71. At this stage one needs to think through and define answers to the following types of strategic considerations which can have a major impact on the type of facilities required and on the ultimate profitability of the investment:

A. General Project Objectives

72. The determination of a basic project planning strategy should start with a definition of the principal objectives which the proposed rice mill is intended to accomplish.

73. For example, objectives such as the following may be considered as of major or minor importance for many rice mills, particularly when established by governments or cooperative groups:

* to increase the food output of the region (through increased mill yield)
* to handle a surplus of paddy which cannot be processed physically or efficiently in other ways
* to increase the quality of food output
* to produce rice of export quality for foreign exchange earning
* to prevent spoilage of monsoon-harvested crops
* to provide local employment
* to help raise or lower paddy and/or rice prices
* to earn a maximum possible return on investment

B. Location

74. The location of a rice mill industry may have numerous important impacts on the ultimate success of the project. It is unfortunate that illogical or inefficient location has been one of the primary mistakes made in establishment of a number of rice mill projects in Asian countries during the past few years.

75. The first decision for an outside investor will, of course, be on the country and state or region within that country. The results of the environmental studies in the Preliminary Project Planning Appraisal should help to narrow down logical possibilities quickly. For a local investor, the general locale may already be determined and all that remains is finding a good site within the area and seeing if the project will be feasible at that site.

76. The primary determining factor on location is, of course, paddy availability -- the quantity available, the seasonality of supply, the trend of production, the methods by which that supply is presently being transported, marketed, processed, and sold. A second consideration is the extent and type of other rice processing capacity already installed or proposed for the area.

77. Ideally, the mill should be located as centrally as possible, with the area which will be supplying the paddy located radially around it, so that the distance from the field to the mill is as short as possible.

78. Within that general objective, the next consideration will be the availability of roads, rivers, railways, and other means of transportation and of power supply. When acquiring a specific industrial site, it is usually desirable to acquire additional land at the same time to allow for future expansion.

C. Mill Size and Capacity

79. Two (or in some areas, one) tons paddy per hour is generally considered about the minimum economic scale for a modern rice mill industry. Even at this minimum economic level of operation, substantial logistical, operational, and working capital problems

must be solved, since, based on at least 20 hours operation per day, approximately 40 tons of paddy, 28 tons of rice, and 2½ tons of bran must be moved in and out of the mill every day.

80. Above this basic capacity, modern rice mills will become somewhat more efficient and profitable with larger installed capacity providing they have the assured paddy supply, rice markets, working capital, and management ability to be able to use the larger capacity efficiently.

81. At the upper end of the scale, experience has shown that few modern rice mills in developing countries are built with capacities higher than ten to fifteen tons paddy per hour, since the investment required beyond this point may generally exceed ten million dollars, and the paddy procurement logistical problems usually become too great to manage. Rice mills in the U.S.A., Japan, and a few other "developed" rice producing countries are, however, usually of even larger scale (20-100 tons per hour).

82. Somewhere inbetween say 2 to 15 tons per hour an appropriate capacity for the proposed unit must be selected. This decision may be governed by such considerations as the survey of amount of paddy available, the seasonal characteristics of supply, the limitations on investment capital available, the local interest rate, the extent of development of roads, railways, and other grain transport facilities, etc.

83. Another basic point to be weighed seriously in determining the strategy for capacity is the realistic efficiency with which the industry can be expected to operate. Modern rice mills are designed to operate essentially round-the-clock on a year-round basis, and should presumably be most economic the more they approach this target. Many industrial-scale rice mills find, in fact, that their break-even point is at more than one-shift operation.

84. However, few industries ever operate at perfect efficiency, and the experience in many of the developing Asian countries where the need for modernisation of rice milling processes is greatest

ie, practically, that few industries are able to operate at even half of their rated capacity.

85. While 24 hour per day - 360 days per year - is the theoretical maximum installed capacity of any mill, something around 70% of this (representing the equivalent of operation 20 hours per day, 300 days per year) usually represents a more realistic "effective installed capacity" target.

D. General Strategy for Operation

86. There are several different basic methods in which rice mills of industrial scale can operate, and the decision taken on these methods again can affect substantially the type of facilities required and the projected profitability of the unit:

87. The first question concerns whether the mill is to operate on its own account by buying and stocking paddy and selling rice, or whether it will operate on a toll, or servicing basis, charging a fixed fee per weight unit for milling paddy owned by outside traders or by government departments.

88. In the first case, major storage and drying facilities may be required, and the financial plan for the industry must include a huge amount of working capital (and the interest thereon) which will be tied up in paddy stocks purchased. Also, a mill operating in this "normal" manner may be able to profit more from speculation on seasonal price changes than from the margin in milling itself. However, the risk of loss is also proportionately greater.

89. The servicing type of operation may be described as safe and sure, but generally offers considerably lower profit returns, since the miller is not able to capitalise on most of the advantages which his more modern machinery offers. Some modern mills have found this system workable, however, since it greatly reduces working capital requirements.

90. The second operational question concerns whether it is expected that paddy will be procured already dried in a form

suitable for storage and/or milling or will require drying due either to procurement being during monsoon conditions or being chiefly of freshly harvested paddy.

91. The proposed paddy procurement schedule should be reviewed from the point of view of the moisture content which can be expected in the paddy received each month. From this, the quantity which must be dried and the degree of drying required can be calculated. This will be important later in specifying the capital and operating costs required for drying.

92. The third question to be examined is whether parboiling facilities will be required. This is largely governed by local habits; in the areas of India, East Pakistan, Ceylon, and a few other countries where parboiled rice is primarily consumed, most mills have to have equipment for this process because this is what the market demands. In some other areas such as the Sind in West Pakistan, parboiling is practiced primarily because the climate is so hot and dry that most of the rice breaks when milled unless it is parboiled first.

93. Parboiling is an expensive process, both in capital equipment and in the operational cost necessary to soak, steam, and dry the paddy. In world rice markets, instead of adding value, this extra step in the processing usually decreases the value of the product over what it would be without parboiling. However, it is the habit in some areas and does slightly improve the nutritional qualities of the rice.

B. Alternative Mill Technologies

94. All rice mills of industrial scale generally employ milling machinery based around one of three types of husk-removing machines: hullers, disc shellers, or rubber rollers.

95. Most plans for new so-called "modern" rice mills call for use of the latest, most modern types of milling machinery, generally incorporating rubber (or plastic) roll huskers, improved type paddy separators, friction, abrasive, or improved design

cone polishers, latest types of grading machinery, and complete use of mechanical handling equipment. Machines of these types are made today by several manufacturers, principally in Japan and Germany, and also, in lesser volume, in Italy, Spain, India, and a few other countries. Any potential rice mill investor will usually obtain quotations and design details from each of these major rice mill machinery suppliers.

96. In areas where there are no major restrictions on obtaining foreign exchange for imported machinery, where import duties are reasonably low, and where rice markets demand high quality milling, there should generally be no other choice except a decision between the closely-similar types of modern machines offered by these principal international suppliers.

97. However, in some developing countries, different conditions may argue for giving serious consideration to intermediate-technology compromises in order to reduce capital cost to a minimum, conserve foreign exchange, support local suppliers, and achieve highest return on capital investment.

98. The old hullers are clearly too inefficient in terms of reduced total rice outturn, increased breakage, and lack of separation of bran and other by-products to consider for incorporation in new industrial-scale rice mills.

99. However, locally-made machinery of intermediate-technology design (generally copies of older European disc sheller-based rice mills) may offer advantages worthy of consideration in some unique developing country circumstances. Such complete "automatic" mills are made today in a few of the developing countries in small local machinery factories.

100. In the Punjab rice producing areas of West Pakistan, for example, four manufacturers of the type described above have built and installed over 100 "automatic" rice mills during the last four years. Each mill is generally of a standardised 1½ ton paddy per hour capacity and incorporates a cleaner, two disc shellers, a paddy separator, 3 cone polishers, a grading machine,

husk and bran aspiration equipment, and complete mechanical handling equipment.

101. Another point which should be weighed as part of the basic project planning strategy concerns which machinery and equipment should be imported and which should be fabricated locally. In most cases, it will be decided to import at least the basic milling machines from one of the major manufacturers of world repute.

102. Beyond this, however, accessory equipment such as storage silos, tempering bins, mechanical dryers, mechanical handling equipment, cleaners, receiving equipment, etc. can often be fabricated or constructed locally at lower cost than if imported.

F. General Strategy for Paddy Procurement

103. The success of a modern rice processing industry may well depend more than anything else on the effectiveness and efficiency with which the paddy procurement program is planned and executed.

104. Practices vary widely from country to country and within regions in each country. A study should be made not only of the present paddy production, trading, transporting, and marketing practices in the area from which the mill will draw raw material, but also of potential practical changes in these present systems which might be possible if the new mill were operating.

105. The starting point is a survey of the quality and quantity and characteristics of paddy production and local consumption in concentric circles of ever-larger radius around the proposed mill site. The farther the paddy must come from, the higher the transportation cost and the greater the potential difficulties in making sure the paddy can be procured.

106. Basic points which may be considered in a survey of local paddy availability include:

* Present paddy marketing patterns
* Quantities and milling and marketing characteristics of different paddy varieties available
* Expected impact of future introduction of new high-yielding varieties, increased use of fertilisers and pesticides, increased irrigation facilities.

* Seed requirements and methods in which these are being met; effect on paddy availability
* Loyalties and obligations of farmers and traders
* Credit policies (present and possible)
* Weighing practices and methods
* Times of the year when paddy prices are lowest
* Expected effects of the proposed new mill on the local paddy markets and prices
* Estimated percentage of paddy production in 5, 10, 25 mile radius from proposed mill site needed to meet proposed mill requirements; Is this attainable?

107. The next question to be examined is the optimum logistical system for procuring and transporting the paddy. Will there be a few major suppliers or a multitude of small farmers who must be dealt with? Will all supply be in bags, or can it be bulked at some point in the procurement system? Will the mill procure at the mill site only, or will it be necessary or advantageous for the mill to arrange transportation facilities for delivery of paddy from other areas? Can a single receiving station handle the quantity expected, allowing time and facilities for proper inspection, weighing, dumping, payment, etc., or will multiple facilities be required? Would a number of satellite procurement-drying-storage centers offer advantage?

108. The guiding principles of a procurement system are that it should:

* Assure without fail supply of the quantity of paddy needed to run the mill year-round on an efficient basis.
* Procure the paddy at as low a delivered cost as possible.
* Include a paddy grading and inspection system.
* Have the paddy delivered to the actual mill site in as large unit quantities, spaced as evenly spread out as possible.

109. The result of the above analysis should be a proposed Paddy Procurement Schedule. This should show, month by month,

the following information, estimated as closely as it can be possible:

* Expected paddy procurement quantity each month (tons)
* Expected paddy procurement price each month
* Expected moisture content of paddy procured each month
* Expected quantity of paddy to be milled each month
* Remaining quantity of paddy stocks which must be stored each month

G. Rice Marketing Strategy

110. The next basic planning question concerns determination of the optimum rice marketing strategy for the proposed mill.

111. The first task is to decide and define the primary market objective. Depending on the market objective selected, the types of machinery required may be quite different.

112. Examples of representative Primary Market Objectives which some industrial-scale rice mills have found profitable include:

* Supplying mainly domestic coarse-rice commercial markets
* Supplying government rice procurement programs
* Focusing on specialty premium quality markets
* Supplying mainly export markets

113. The next consideration is to decide on the principal geographic area in which the rice can best be marketed and on the primary markets, customers, methods of sale which will be preferable in this area.

114. Other related marketing considerations which affect the type and size of facilities required include: How much credit will have to be extended to customers? How large inventories of milled rice will need to be held at the mill before sale and shipment? Will the rice be sold ex-mill or be delivered to point of sale? What type of transportation facilities will be used for transporting the milled rice? What type of bagging or packaging will be used?

H. By-Product Marketing Strategy

115. The pre-investment planning for any modern industrial-scale rice mill should include careful consideration of the methods of maximising revenue from sale of milling by-products. The answers to these questions will substantially affect the estimated profit calculations in the economic feasibility analysis which follows.

116. Bran can be an extremely valuable by-product, comprising 4 to 8% of the weight of the paddy, and often selling for a price ranging from $\frac{1}{2}$ to $\frac{1}{4}$ of the price of rice. Some modern mills reportedly account for a majority of their net profit from bran sales alone.

117. In much of the developing world, husk can probably be utilised most efficiently by burning at the mill site as a heat source for drying, parboiling, and/or steam power. This not only solves the potentially costly problem of disposal of the husk economically, but reduces the mill operating cost requirements for fuels and electricity. If, however, husk burning equipment is to be used, this must be planned from the start, since the required boilers and other equipment can be quite costly and will require physical space in the plan.

I. Ownership, Financing, and Management Strategy

118. Ownership may generally be either a sole proprietorship, partnership, or limited company business or a government-owned or cooperative-owned enterprise. In some cases it may be a combination, such as a government-private joint venture.

119. The financing plan, including preliminary assessment of the limits of equity and loan financing which may be available for the project, should also be defined early in the planning process. If the owner (investor) does not intend to use his own equity funds for 100% of both the fixed capital and working capital investment requirements, what amounts and terms of loan facilities can be counted on to supplement his resources?

120. For example, the same investment which could finance entirely a 2 ton/hr mill could, alternatively, stretch through debt leverage to permit installation of a mill of about 6 tons capacity if this would prove more highly profitable.

121. The technical and business management manpower resources which will be available to run the mill should also be considered in strategic planning. If this important issue may present constraints or limitations on the size, location, degree of complexity, etc. of the mill, this should be faced up to and considered as a governing criteria from the start.

122. This is particularly true in developing countries where there is little if any expertise either in modern mill management or in operating a procurement, plant operation, and marketing program as large, complex, and efficient as that of a modern mill.

123. If government servants are to run the mill, it may not be possible to pay sufficiently high salaries or to offer incentive rewards sufficient to attract the type of individuals capable of and motivated toward efficient, business-like operation.

VI

THE PROJECT DESIGN AND SPECIFICATION

124. The next step in the pre-investment planning necessary for establishment of a modern rice mill project is preparation of the detailed designs and specifications for the industry. This will be necessary for being able to budget accurately the capital costs for land, buildings, machinery and equipment, etc. and for being able to obtain specific quotations for these requirements. The design plans later become the basis of physical implementation of the project.

125. Technical consultants may probably be required at this stage: First, a design engineer experienced in all phases of rice processing design will be needed to take the basic criteria spelled out in the Project Planning Strategy and turn this into an efficient set of detailed design engineering plans and machinery specifications. Second, a civil engineer will normally be required who can design and cost the buildings, structures, foundations, etc. required for the mill.

126. The principal requirements for a rice mill industry engineering design are as follows:

A. A statement of Basic Project Specifications: Each section in the complete proposed rice processing center should be defined in terms of the basic type of equipment to be included and the capacity required.

B. A Processing Flow Diagram, showing an elevation drawing of each item of equipment in each sequential processing step in the proposed rice mill and the interconnections between them.

C. A Plot Layout Plan, showing the size and shape of the plot of land and the physical size and general positioning of all buildings, structures, and equipment required for the mill.

D. Equipment Layout Drawings, showing the physical size,

shape, and detailed installation positioning of each item of equipment. These drawings will normally include both a top view and an elevation.

E. A List of Detailed Machinery and Equipment Specifications for the entire plant, suitable for obtaining quotations and placing orders for the exact items of machinery required.

F. Basic Civil Engineering Designs and Specifications: These will include designs and costs for all buildings, foundations, roads, water supply systems, and other structures required to be built.

G. A Time Schedule for completion of all required phases of project planning and approval, ordering and shipment of equipment, acquisition of land, construction of buildings and other structures, erection of machinery and equipment, hiring of staff, start of paddy procurement program, start of trial production operation, etc.

H. A Site Survey, including physical survey and soil tests for required major foundations.

VII

THE ECONOMIC FEASIBILITY ANALYSIS

127. Most of the planning which has preceded this point has been a necessary prerequisite for preparation of the Economic Feasibili Analysis. The Economic Feasibility Analysis is useful for five primary purposes:

* To budget the total amount of capital which will be required to set up and operate the proposed mill.
* To predict whether the proposed plan should be economically feasible and, if so, what profit returns can be expected based on the most likely set of operating assumptions.
* To determine an optimum financing plan for the industry and to document the applications necessary for any loan financing required.
* To predict the cash flow, or expected timing at which different amounts of capital will be required to be invested in the industry.
* To establish the detailed operating plans which later can be implemented, such as list of staff required, fuel requirements, etc.

128. Different banks and financing institutions may require the economic feasibility report to be in a number of different organisational formats and in varying degrees of detailed documentation. Some investors, likewise, may be satisfied with a broad-brush estimate of the predicted profitability of the industry, while others may want to carry out quite detailed cost analysis, trying to predict operating plans and costs in as much detail as possible. Care and precision in this critical planning stage can help ensure against forgetting vital costs, can make estimates as accurate as possible, and can help work out ahead of time the optimum methods of operation for the mill. The result can be avoidance of possible costly "trial and error" experiments, delays, and inefficiencies which could have been foreseen.

129. An Economic Feasibility Analysis for any proposed new or expanded industry generally includes the following primary parts:

A. Estimated Cost of the Project (Capital Cost Budget)
   * Fixed Investment
   * Working Capital

B. Proposed Capitalisation and Sources of Financing

C. Forecast Profit and Loss Statements
   * Statement of Operating Assumptions

D. Financial Ratio Analysis

E. Forecast Balance Sheets

F. Proposed Loan Repayment Schedule

G. Cash Flow Forecast

130. As a tool for planners making economic feasibility studies for new modern rice mill projects, a detailed Standard Format for Rice Processing Industry Feasibility Reports is attached to this paper as Appendix - "B". The Format follows the outline of the seven basic parts of the Economic Feasibility Analysis shown above, and includes notes on methodology helpful to planners in completing the analysis. This Format has proved useful to the author in his analyses of a number of modern rice mill projects, and may serve as a helpful guide to others facing this complex task for the first time. No form, however, can cover all situations, and users should feel free to adapt the detailed breakdown of the suggested standard form to specific project requirements and conditions.

with this type of equipment.

140. Management requirements with a modern rice processing industry far exceed the simple running of the unit. The discussion of operational alternatives contained in the preceding chapters has pointed out needs for professional management capabilities in such specialties as:

* Project Planning and Financial Analysis
* Labor Relations and Personnel Management
* Systems Programming and Critical-Path Scheduling (such as in planning a paddy procurement program)
* Production Scheduling and Control
* Inventory Planning and Control
* Cash Management and Control
* Credit Management
* Marketing, Salesmanship, and Marketing Research

141. Out of the range of skills required, the three primary management positions on which the success of the industry will most depend are worth noting in more detail:

1. A <u>General Business Manager</u> in overall charge of the day-to-day operations of the entire industry. This individual must not only be conversant with the economics of the rice industry, but must also be a well educated, broadly experienced business executive with abilities in most of the areas outlined above. In regions where government policies influence rice mill operations significantly, his contacts in key government departments may also be of importance.

2. A <u>Senior Plant Engineer</u> who will be responsible for the functioning and maintenance of all items of machinery and equipment. An industry such as rice processing which must rely on such a large turnover volume cannot afford to remain idle for long due to breakdowns or inefficient operation of the machinery. This individual will

generally be responsible for the actual production of the industry, and the shift supervisors would normally report to him.

3. A Paddy-Rice Trading Specialist, perhaps drawn from the existing trade, who is fully conversant with all the local techniques of paddy and rice marketing. He would be responsible for planning and operation of the critical paddy procurement and rice marketing programs.

C. Employment Implications

142. The manpower needs of modern rice processing centers are quite different from those of most traditional rice mills. Any visitor to most of the traditional mills of Asia, usually employing sun-drying, huller milling, and no mechanical handling apparatus, is immediately impressed by how labor-intensive this industry is.

143. Many traditional mills have been observed literally employing hundreds of minimum-wage laborers. Almost none possess any technical skill or educational training; most are used in physical labor capacity for carrying bags of paddy, raking the drying yards, and transferring rice from one machine to another.

144. Since modern rice processing centers are largely automatic (necessary both for efficiency and for physically handling the huge quantities involved), comparatively few common laborers are generally required in the operation of these industries. On the other hand, a number of new needs exist for more highly educated, technically trained machine operators and supervisors.

145. Thus, the pattern of employment in the more modern mills is different from the traditional mills and may not only require a smaller total number of persons per unit of paddy processed, but also a higher proportion of the types of technically trained workers who infrequently are found in rural locations.

146. Without sacrificing the inherent efficiency advantages of modern mills, it is certainly important for planners in most developing countries to bear in mind the critical unemployment problems faced by most of these countries in the design of such industries, and to continue using labor in place of machinery wherever the costs of the two compare nearly equally.

D. Other Social Concerns

147. In conclusion, it is most important to consider thoroughly the need for balancing social and economic ends when a major industrial change, such as the shift to modern rice processing methods, occurs. Far beyond the question of the profitability of a particular enterprise, government planners, aid-giving institutions, and local authorities need to give careful consideration to the delicate balancing of industrial profit motivations with the desirable economic and social consequences which they would like to see occur.

148. A properly planned evolution toward more efficient modern methods of rice processing could well become one of the primary stimuli contributing to the growth of a better society, higher incomes, and more well-nourished population throughout much of Asia. On the other hand, if left to develop without planning, incentives, and controls in the hands of a few monopolistic industrialists, the private control exercised over food supplies, grain prices, farmer income, and rural employment potentially could be used toward either socially desirable or undesirable ends.

149. One of the most basic concerns of most Asian countries having predominantly agricultural economies and poor rural populations is the level of farm income. If properly planned, a shift to modern rice processing should be able to guarantee a higher return to the paddy farmer than he typically obtains through present marketing methods. Larger scale mills could provide guaranteed markets, could eliminate the excessive margins often taken by unscrupulous middlemen traders, and could help to break the stranglehold often held by land owners and moneylenders.

150. A broad range of national policies could be considered to encourage objectives in this direction as a part of the sanctioning provisions for new modern rice mills established.

151. The rice economy of Asia is far too intimately connected to the daily livelihood of nearly 2,000 million people to be tinkered with without most careful consideration of the complex consequences which may result from any change in the present balance. This remains one of the most challenging areas for further research and planning and for high policy consideration by governments, aid-giving organisations, and potential investors which faces most of the developing world today.

XII

APPENDIX - "A"

App. "A"

Check-List of Environmental Factors Affecting Investment in Modern Rice Processing to be included in Preliminary Project Planning Appraisal

A. Local Investment Climate:

1. Economy growing, stagnant, or declining?
2. Political situation stable?
3. Local capital resources available?
4. Strong interest or activity by other investors in this or similar industries?
5. Reasonable local return-on-investment standards?

B. Government Regulations Affecting Rice Processing Operations:

1. Paddy and/or rice price support policies?
2. Mandatory or voluntary government paddy rice and/or procurement policies?
3. Restrictions on free marketing of rice?
4. Restrictions on free movement of paddy and/or rice?
5. Rice mills require government sanction, licensing, regulation, inspection, etc?
6. Government paddy and/or rice grading or inspection system established?
7. Price premiums paid for higher grades and qualities of rice?
8. Difficulties in obtaining sanction for new rice processing industry or for foreign exchange for importing machinery?
9. Difficulties anticipated in future in importing rubber rolls and other spare parts for modern rice mill industry?
10. Export:
    * Permitted?
    * Private trade or Govt. controlled?
    * Quality incentives established?
    * Inspection requirements?
    * Bonus for foreign exchange earning?

11. Restrictions on credit availability?

12. Taxation, licensing, etc. policies applicable?

13. Policy on public vs. private sector in rice processing industry?

14. Government investment incentives applicable?

15. Appropriation and Repatriation of Profits Guarantees (for foreign investors)?

C. Local Paddy Production Practices:

1. Local paddy production trend increasing, static, or declining?

   * Acreage changing?

   * Yields changing?

   * Varieties changing?

2. Paddy acres and tons production in radius of 5, 10, 25 miles from proposed mill site?

3. Projected potential for future local adoption of high-yielding varieties?

4. Projected future requirements and resources available for fertilizers, insecticides, irrigation, etc.?

5. Seasonal characteristics of paddy supply (and drying and storage implications thereof):

   * single or multiple paddy crop?

   * harvesting and threshing periods?

   * number of local varieties(and storage separation implications thereof)?

   * historical seasonal paddy price levels?

6. Local harvesting and drying practices (and implications on paddy quality and milling characteristics thereof):

   * typical moisture content at time of harvesting?

   * methods of pre-threshing field drying and/or storage used?

* methods of threshing used?

* methods of post-threshing paddy drying and pre-marketing paddy storage used?

7. Proportion of paddy production kept for local consumption:

* proportion milled by rural hand-pounding for local consumption (does not enter mills or paddy markets)?

* proportion milled by small local rice mills on a servicing (toll) basis for return to local consumption?

* remaining proportions of each crop and variety being marketed for cash?

B. Local Paddy Marketing and Mill Procurement Practices:

1. Estimate of total marketed paddy available in 5, 10, 25 mile radius from proposed mill site? Proportion which proposed mill might succeed in procuring?

2. Description of present general practices for movement and marketing of paddy from farm to mill?

3. Roles of local paddy markets, trading agents, middlemen with vested interests, landlords, etc?

* Extent of control exercised over supply?

* Price margins represented?

* Farmers obligated to sell paddy to creditors?

4. Present extent and/or future possibility of direct farmer supply to mill or mill procurement stations?

5. Formal or informal paddy grading standards established?

* Price or quantity dockage for high moisture content, excessive trash content, admixtures, etc?

* Any precedent of scientific analysis to determine procurement price (moisture testing, laboratory milling analysis, counting of admixtures, etc.)?

6. Paddy procurement payment and credit practices:

   * Cash payment required on delivery?

   * Established systems and/or future possibilities of delayed payment to farmers or traders?

   * Government credit system applicable?

   * Role of cooperatives in credit?

   * Payment based on delivery at mill site and/or transportation payment required?

7. Commodity futures markets functioning for paddy?

8. Government and/or private paddy storage facilities operating from which paddy could be obtained off-season? Terms?

9. Expected effects of the proposed new rice mill on local paddy markets?

   * Possible shifts, displacements, etc. from present marketing patterns?

   * Possible influence on price?

   * Possible competitive reaction of other millers?

10. Local weighment and measurement practices?

   * Techniques acceptable to local people?

   * Degree of exactness vs. expected margin for error practiced by competitors?

11. Extent of adulteration, admixture, varietal mixture, etc. in local practice?

12. Transportation facilities for bringing paddy to mill?

   * Facilities available?

   * More economic systems possible?

   * Paid for by grower; middleman; miller?

13. Identifiable losses and inefficiencies in present practices which can be improved upon?

B. Local Paddy Drying and Storage Practices:

1. Survey of local drying practices:

(a) Percent of paddy moisture reduction required (monthly)?

* Monthly local climatic data (temperature, humidity, rainfall, days of sun)?

(b) Sun drying practices employed:

* Sun drying by contractors or by millers?

* Direct cost of sun drying (direct operating or contract costs)?

* Indirect costs of sun drying (depreciation and interest and repair of drying floor, losses to birds, rodents, pilferage, damage to grains, cost of bags, rakes, etc., used; alternate-use value of land being used, etc.)?

* Shade drying practiced?

* Problems during periods of monsoon, rains, high humidity, wind storm, cloud cover, flooding, winter weather, etc.?

(c) Experience with mechanical drying:

* Experiences of existing mechanical drying units?

* Fuels used?

* Costs experienced?

* Indirect benefits derived (reduction of losses, higher milling yields, reduction of breakage, longer season operation, use of monsoon-harvested paddy, etc.)?

* Problems encountered or predicted?

2. Survey of local storage practices:

(a) Flat-storage warehouses for paddy storage in bags:

* Types of construction used?

* Costs of construction and operation?

* Depreciation cost of bags required?

* Losses encountered (rodents, infestation, heat damage, mould, pilferage, etc.)?

(b) Bulk-storage facilities:

* Experience with silos?

* Costs of construction and operation?

* Loading and unloading systems used?

* Other bulk-storage methods used? (bulk-storage warehouses, covered stacks, etc.)

(c) Fumigation, aeration, and turnover requirements and practices?

(d) Other paddy storage facilities available in the local area? Typical charges for rented storage space?

F. Local Rice Milling Practices:

1. Survey of other local rice mills in 5, 10, 25 miles radius from proposed new mill site:

* Location, type, capacity, business methods used, seasonal pattern of operation, etc.?

* Any other mills with modern machinery in area? Experience and problems encountered?

* Competitive problems anticipated?

* Any excess capacity already in area?

* Other new mills sanctioned or proposed to be set up?

2. Average total rice and head rice yields obtained in competitive local mills?

3. Optimum milling yield characteristics of local varieties (determined by laboratory analysis)?

4. Local rice mills generally operate with mill purchased paddy or on servicing (toll) basis for customers and traders?

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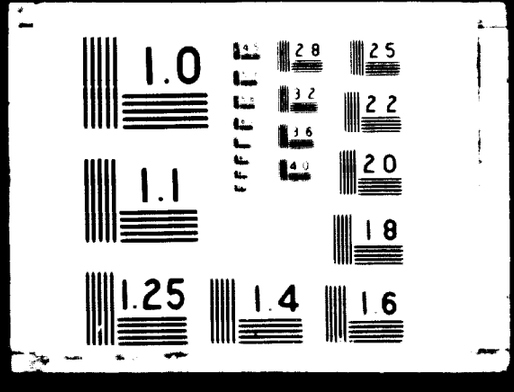


5. Local practices for parboiling, if practiced?

   * Type of parboiling systems used?

   * Reasons for parboiling? (because of market preference, government regulation, problems of excessive breakage if no parboiling, etc).

   * Price differences for parboiled rice?

   * Percentage of local market for parboiled rice?

6. Present practices and potential local user for rice mill by-products?

   * Rice bran oil extraction or other by-product utilisation industries established?

7. Government inspection of rice produced?

8. Losses and inefficiencies in present practices which can be improved upon?

C. Market Survey:

(Note: There are usually numerous localised questions which should be examined in a market survey. Care should be taken to adequately identify and study the implications of all relevant local influences on sale of the products of the proposed new industry. Some of the primary generalised categories of inquiry important for a rice mill market survey are outlined below.)

1. Domestic Markets:

   (a) Local rice consumption trends: amount, growth?

   (b) Location of primary markets?

   (c) Rice price trends (seasonal and long-term)?

   (d) Price elasticity of demand for rice (how much sales may be reduced by price increase)?

(e) Local rice economy self-sufficient or deficit? Rice viewed as a basic subsistence food or as a speciality non-subsistence food supplement?

(f) Quality preferences of local markets? (color; degree of milling; shape of grain; cooking characteristics; cleanliness; degree of admixtures, paddy, damaged grains, red rice, etc. acceptable; etc.)

(g) Rice grading standards practiced in local markets (formalized grades or informal practices)? Scope of markets and premiums paid for higher quality rice? Types of specialized premium quality markets?

(h) Packaging preferences in local markets?

(i) Weighing systems practiced?

(j) Methods of competition practiced between millers and traders?

(k) Role of marketing middlemen, traders, etc?

(l) Need for salesmen, advertising, promotion, rebates, or other sales costs?

(m) Credit practices and demands connected with rice sale?

(n) Rice sold ex-mill or delivered to buyer?

(o) Weight sold includes weight of bag? Any separate charge possible for bag?

(p) Transportation methods and costs (if paid by mill)?

(q) Government controls on marketing or movement of rice?

(r) Special taxes on sale or movement of rice?

(s) Rationing systems, if applicable?

(t) Markets for rice mill by-products? Brokens?

2. Export Markets:

(a) Survey of primary foreign markets for quality of rice produced locally.

(b) Quality and packaging preferences; grading standards employed; price premiums for higher quality rice; cargo rice markets; broken rice markets?

(c) Price trends (seasonal and long-term)?

(d) Primary competitors?

(e) Shipping costs?

(f) Port facilities for handling exports?

(g) Transportation and handling costs to port?

(h) Export incentives, bonuses, etc. available?

(i) Government controls on exports applicable?

(j) Market intelligence and sales organization required?

(k) Practices with respect to payment, credit, barter, inspection, bonding, guarantees, etc.?

B. Survey of Other Resources Available:

1. Manpower:

(a) Availability of persons to fill senior management and technical positions for proposed mill; experience available?

(b) Training requirements for management, supervisors, and workers foreseen?

(c) Training facilities available? Reliance on on-the-job training?

(d) Technical skills available for plant installation, operation, maintenance, repair?

(e) Technical and management consultants required and available?

(f) Local labor rates, work conditions, types of skills available, working hours, union practices, etc.?

2. Finance:

(a) Amount of equity investment available from investor?

(b) Sources and amount of long-term loan finance available for fixed capital investment: government loans, bank loans, cooperative credit, foreign credits, supplier credits, etc.?

(c) Source and amount of short-term loan finance available for working capital investment: government loans, bank loans, cooperative credit, pledged stocks, credit from traders, delayed payment to farmers, etc.?

(d) Interest rate and loan terms?

(e) Tax rates applicable?

(f) Import duties applicable?

(g) Availability of foreign exchange for machinery and spare parts import?

3. Supporting Facilities:

(a) Local workshops and manufacturers which can fabricate equipment and parts for the proposed rice mills (silos, storage bins, dryers, conveying equipment, etc.)?

(b) Electric power available; capacity; cost; regularity?

(c) Other fuels available for power, drying, steam generation?

(d) Transportation facilities available locally; roads, railroads, rivers, indigenous transport, etc.?

X

APPENDIX - "B" App. "B"

STANDARD FORMAT FOR RICE PROCESSING INDUSTRY
ECONOMIC FEASIBILITY REPORTS

I. ESTIMATED COST OF THE PROJECT:

1. FIXED INVESTMENT:

A. Land (____ acres @ ____ per acre): _____

B. Land Development (leveling, filling, grading, clearing, etc.): _____

C. Buildings:

1. Rice Mill Building, ____ sft. @ ____ per sft. _____

2. Parboiling Structure & Shed, if included, ____ sft. @ ____ per sft. _____

3. Rice Warehouse Building, ____ sft. @ ____ per sft. _____

4. Paddy Warehouse Buildings, ____ sft. @ ____ per sft. _____

5. Boiler House, ____ sft. @ ____ per sft. _____

6. Chimney _____

7. Receiving Station facilities _____

8. Office/Workshop/Spare Parts/Storage/ Grading Laboratory, ____ sft. @ ____ per sft. _____

9. Sanitary Facilities _____

10. Boundary Wall, etc. _____

Total Buildings: _____

D. Other Civil Construction:

1. Water Supply Well, Pump, Watertank, etc. _____

2. Main Electric Supply (transformer, main line connections, etc.) _____

3. Road Construction (if required), to Mill Site and internal roads within mill site, or railway car siding. _____

4. Boat Dock Facilities. _____

5. Miscellaneous. _____

Total Civil Construction: _____

E. Transportation Facilities:

1. Trucks. _____

2. Grain Carts. _____

3. Tractors, Fork Lifts, etc. _____

Total Transportation Facilities: _____

F. Machinery and Equipment:
(list each item of equipment required under each section)

	Foreign Exchange Req't (CIF)	Local Currency Req't
1. Receiving, Inspection, and Weighing Section.	_____	_____
2. Cleaning, Drying, and Storage Section.	_____	_____
3. Parboiling Section.	_____	_____
4. Rice Milling Section.	_____	_____
5. Miscellaneous Equipment.	_____	_____
6. Machinery Installation Costs.	_____	_____
7. Customs Duty, Taxes, Clearance Costs, Inland Freight, etc.	_____	_____
Total Machinery and Equipment.	_____	_____

	Local Currency Req't
G. Preliminary Fixed Expenses: (to be amortized over ___ years)	
1. Surveys, Consultants, Loan Service Fees, Legal Fees, etc.	
2. Interest during period of Plant Construction (amount borrowed x interest rate x no. of months).	
3. Pre-production Start-up and Training Costs:	
Administrative Services for ___ months.	
Overhead Expenses for ___ months.	
Supervisory & Technical Labor for ___ month.	
Training Costs.	
Paddy Lost in Trial Operations.	
4. Miscellaneous.	
Total Preliminary Fixed Expenses:	
H. Contingencies:	
1. On Machinery and Equipment _____ (amount) x ___ %.	
2. On Other Fixed Investment Costs _____ (amount) x ___ %.	
Total Contingencies:	
I. TOTAL FIXED INVESTMENT:	
1. Foreign Exchange Requirement.	
2. Local Currency Requirement.	
Total	

2. WORKING CAPITAL:

A. Paddy Inventories:

Value of maximum amount of paddy which will need to be stored plus value of paddy coubalent of milled rice and by-products stored before sale plus value of paddy equivalent of no. days necessary to wait for payment of sale accounts receivable. _____

B. Other Inventories:

1. Spare Parts. _____

2. Bags, Packaging Materials. _____

3. Chemicals, Fumigants, etc. _____

C. Total Inventories: _____

D. Less Expected Bank Cash Credits against pledged inventories ___ % of inventory stocks. _____

E. Net Cash Required for Inventories: _____

F. Cash for Operations (cost of labor, overhead, administrative expense, etc., for ____ months maximum): _____

G. Other: _____

H. Net Total Working Capital Requirement at Full Effective Capacity Production: _____

I. Initial Working Capital Requirements:

First Year: ___% of Capacity Production. _____

Second Year: ___% of Capacity Production. _____

Third Year: ___% of Capacity Production. _____

Fourth Year: ___% of Capacity Production. _____

3. TOTAL ESTIMATED COST OF THE PROJECT:

A. Fixed Investment. _____

B. Working Capital. _____

Total _____

II. PROPOSED CAPITALIZATION AND SOURCES OF FINANCING

A. Fixed Investment:	Amount	Interest Rate (%)	Term (Yrs.)
1. Foreign Currency Long-Term Loan (source:_____)	_____	_____	_____
2. Local Currency Long-Term Loan (source:_____)	_____	_____	_____
3. Commercial Bank Short Term Loans, Other Borrowings (source:_____)	_____	_____	_____
4. Total Loans	_____		
5. Owner's Equity Investment	_____		
6. Other Equity Investment	_____	(source:_____)	
7. Total Investment in Fixed Assets (4 + 5 + 6)	_____		

B. Working Capital:			
1. Long-Term Loans (source:_____)	_____	_____	_____
2. Commercial Bank Short Term Loans, Overdrafts, Supplier Credits, Other Borrowings (source:_____)	_____	_____	_____
3. Total Loans	_____		
4. Owner's Equity Investment	_____		
5. Other Equity Investment	_____	(source:_____)	
6. Total Investment in Working Capital (3 + 4 + 5)	_____		

C. Proposed Capitalization:

	Fixed Investment	Working Capital	Total Investment
1. Debt	____(%)	____(%)	____(%)
2. Owner's Equity	____(%)	____(%)	____(%)
3. Total Capitalization	____(100%)	____(100%)	____(100%)

XII-A. SUMMARY FORECAST PROFIT AND LOSS STATEMENTS

	First Year	Second Year	Third Year	Fourth Year	Fifth Year
A. Gross Sales					
B. Cost of Production					
1. Raw Materials					
2. Production Labor					
3. Production Overhead					
4. Total Cost of Production					
5. Cost of Inventory Adjustments (+ or -)					
6. Cost of Sales					
C. Gross Profit					
D. Overhead & Financial Costs					
1. Administrative & Overhead Costs					
2. Sales Expense					
3. Depreciation					
4. Interest					
5. Amortization of Pre-production Expenses					
6. Total Overhead & Financial Costs					
E. Pretax Profit					
F. Taxes					
G. Net Profit					

III-B. OPERATING ASSUMPTIONS UNDERLYING FORECAST PROFIT AND LOSS STATEMENTS
(make separately for each year)

A. Assumed Operating Capacity (Annual)

1. Installed Machinery Capacity
(___ tons/hr. x 24 hrs. x 360 days) _____ tons paddy

2. Effective Installed Capacity
(___ tons/hr. x __ hrs. x ___ days) _____ tons paddy

3. Operating Capacity Planned This Year
(__% of Effective Installed Capacity) _____ tons paddy

B. Assumed Methods of Operation

1. Raw (white) Rice Processing
(__% of Production) _____ tons paddy

2. Parboiled Rice Processing
(__% of Production) _____ tons paddy

3. Processing Mill-Account Paddy
(__% of Production) _____ tons paddy

4. Processing for Others
(Servicing/Toll Basis)
(__% of Production) _____ tons paddy

C. Assumed Paddy Losses (Removal of trash, impurities, immature grains, etc., in paddy cleaner; losses in storage; losses to rodents, birds, insects pilferage, etc.)

Lc = __% of original weight of paddy procured lost in cleaning, et

D. Assumed Drying Losses (Loss of weight through moisture removal in drying paddy procured)

1. Average Annual Moisture Content of Paddy Procured ___ % moisture

2. Average Moisture Content of Dried Paddy for Storage or Milling ___ % moisture

3. % of original weight of paddy procured (after cleaning) lost in drying

$Ld = 1 - \frac{1 - \text{Original Moisture \%}}{1 - \text{Dried Moisture \%}} =$ ___ % loss

E. Assumed Paddy Procurement Requirement

1. For each ton of clean, dry paddy to be stored/milled, ____ (x) tons original field paddy must be procured:

$$x = \frac{1}{(1 - Lc)(1 - Ld)} = \text{\_\_\_\_\_}$$

2. Total annual paddy procurement requirement

= (_____ tons clean, dry paddy needed) x = _____ tons

F. Assumed Procurement/Storage/Production Schedule

Month	Tons Paddy Procured	Moisture %	Paddy Weight After Cleaning & Drying	Tons Paddy Milled	Remaining Tons Paddy in Storage
Jan.					
Feb.					
Mar.					
Apr.					
May					
Jun.					
Jul.					
Aug.					
Sep.					
Oct.					
Nov.					
Dec.					
Total					

C. Assumed Milling Yields
Note: Yield percentages are of clean dry paddy.

1. Whole Rice (____% of paddy weight) _____ tons
2. Broken Rice (____% of paddy weight) _____ tons
3. Mixed Rice with avg. ____% brokens (____% of paddy weight) _____ tons
4. Brewers/Fine Brokens/Etc. (____% of paddy weight) _____ tons
5. Bran (____% of paddy weight) _____ tons
6. Husk (____% of paddy weight) _____ tons
7. Other: _____ _____ tons

H. Assumed Average Annual Sales Prices and Gross Sales Revenues

Product	Tons Production	Price Per Ton	Gross Sales Revenue
Whole Rice			
Broken Rice			
Mixed Rice			
Brewers/Fine Brokens/Etc.			
Bran			
Husk			
Other			
Total			

I. Assumed Average Paddy Procurement Price _____ per ton

J. Assumed Total Raw Material Costs (Paddy, bags and other packaging materials, chemicals, etc.)

Raw Material	Quantity Required	Price	Annual Cost
Paddy			
Bags			
Total			

K. Assumed Production Labor Costs (Do not include managerial, administrative, sales labor here; include all fringe benefit costs in "Rate".)

Position	No.	Rate	Annual Cost
Shift Supervisors			
Mill Operators			
Dryer Operators			
Parboiling Operators			
Boiler Operators			
Paddy Procurement Staff			
Paddy Receiving Supervisor			
Paddy Grading Technician			
Mechanics/Electricians/Etc.			
Laborers			
Other			
Total			

L. Assumed Production Overhead Costs

1. Electric Power: _____ KWH @ _____ _____

2. Fuels (Oil, Gas, Gasoline, Etc.):

F u e l	Quantity	Rate	Annual Cost
Total			

3. Water _____

4. Spare Parts _____

5. Transportation Costs:

a. Transport of Paddy from Point of Procurement to Mill _____

b. Transport of Products Sold from Mill to Point of Sale _____

c. Other Transportation Costs _____

6. Repair and Maintenance:

I t e m	Value	Repair and Maintenance %	Annual Cost
Buildings			
Machinery			
Other			
Total			

7. Miscellaneous _____

8. Total Production Overhead Cost _____

M. Total Assumed Cost of Production

1. Raw Materials _____
2. Production Labor _____
3. Production Overhead _____
4. Total _____

N. Assumed Cost of Inventory Adjustments
(Deductions which must be made during the first start up years of production to account for net additions to year-end inventories)

1. Production Value This Year _____
2. Inventory Value End of Year _____
3. Inventory Value Start of Year _____
4. Inventory Change During Year _____
5. Change as % of Production Value _____
6. Cost of Production _____
7. Net Cost of Inventory Adjustment (5 x 6) _____

O. Assumed Cost of Sales

1. Cost of Production _____
2. ± Cost of Inventory Adjustment _____
3. Cost of Sales _____

P. Assumed Administrative and Overhead Costs

1. Administrative Labor:

Position	No.	Rate	Annual Cost
Plant Manager			
Chief Engineer			
Salesmen			
Accountants			
Cashiers			
Storekeepers			
Office Staff			
Guards			
Miscellaneous			
Total			

2. Overhead Costs

a. Stationery, Printing, Office Supplies _____

b. Postage, Telegram, Telephone _____

c. Travel _____

d. Rent, Rates, Taxes _____

e. Legal, Auditing, etc. _____

f. Entertainment _____

g. Donations _____

h. Staff Welfare _____

i. Insurance _____

Total _____

Q. Assumed Sales Expenses

1. Gross Sales _____

2. Sales Expense (___%) _____

R. Assumed Financial Costs

1. Depreciation (reserves for replacement capital equipment)

a. On Buildings, other Civil Construction:

_____(value) x ___% _____

b. On Silos:

_____(value) x ___% _____

c. On Machinery and Equipment:

_____(value) x ___% _____

d. On Vehicles:

_____(value) x ___% _____

e. On Furniture & Fixtures:

_____(value) x ___% _____

f. Other:

_____(value) x ___% _____

Total Depreciation _____

2. Interest (Refer to Part II, Proposed Capitalization and Sources of Financing, for Debt Structure)

Loan Amount	Days Outstanding	Interest Rate	Annual Interest Cost
Total			

S. Amortization of Pre production Expenses
(Refer to Part I, Item 1-G)

1. Total Pre-production Fixed Expenses _____

2. No. Years to be Charged _____

3. Annual Charge _____

T. Total Overhead and Financial Costs

(P + Q + R + S) _____

U. Assumed Taxes
(Describe Assumed Tax Rates, Tax Holidays, etc., and Calculate Amount.)

_____

_____

_____

_____

_____ _____

IV. FINANCIAL RATIO ANALYSIS

A. Debt/Equity Ratio:

$$\frac{\text{Long Term Debt}}{\text{Equity}} = \frac{\qquad}{\qquad} = \qquad\%$$

B. Debt/Capitalization Ratio:

$$\frac{\text{Long Term Debt}}{\text{Total Capitalization}} = \frac{\qquad}{\qquad} = \qquad\%$$

C. Fixed Asset Coverage:

$$\frac{\text{Fixed Assets}}{\text{Long Term Debt}} = \frac{\qquad}{\qquad} = \qquad\%$$

D. Debt Coverage Ratio:

$$\frac{\begin{array}{l}\text{Net Profit} \qquad\qquad\qquad\qquad \\ \text{Add Interest} \qquad\qquad\qquad\qquad \\ \text{Net Profit After Taxes and Before Interest} = \qquad\end{array}}{\begin{array}{l}\text{Principal Payment} \qquad\qquad \\ \text{Interest Payment} \qquad\qquad \\ \text{Total Payment} = \qquad\end{array}} = \qquad \text{times}$$

E. Return on Sales:

1. Before Taxes:

$$\frac{\text{Profit Before Taxes}}{\text{Sales}} = \frac{\qquad}{\qquad} = \qquad\%$$

2. After Taxes:

$$\frac{\text{Profit After Taxes}}{\text{Sales}} \qquad\qquad = \qquad\%$$

F. Return on Equity:

1. Before Taxes:

$$\frac{\text{Profit Before Taxes}}{\text{Equity + Reserves}} = \_\_\_\_\_ = \_\_\_\_\%$$

2. After Taxes:

$$\frac{\text{Profit After Taxes}}{\text{Equity + Reserves}} = \_\_\_\_\_ = \_\_\_\_\%$$

G. Return on Capitalization:

1. Before Taxes:

$$\frac{\text{Profit Before Taxes + Interest}}{\text{Total Capitalization (Equity + L.T. Debt)}} = \_\_\_\_\_ = \_\_\_\_\%$$

2. After Taxes:

$$\frac{\text{Profit After Taxes + Interest}}{\text{Total Capitalization (Equity + L.T. Debt)}} = \_\_\_\_\_ = \_\_\_\_\%$$

H. Return on Assets:

1. Before Taxes:

$$\frac{\text{Profit Before Taxes}}{\text{Total Assets (After Depreciation)}} = \_\_\_\_\_ = \_\_\_\_\%$$

2. After Taxes:

$$\frac{\text{Profit After Taxes}}{\text{Total Assets (After Depreciation)}} = \_\_\_\_\_ = \_\_\_\_\%$$

V. FORECAST BALANCE SHEETS

(Assumed Date _____)

(Note: Make Forecast Balance Sheets for Beginning of Project and End of Each of First Five Years Operations)

Assets:

Current Assets:

Cash	
Accounts Receivable	
Inventory	
Advances, Deposits, etc.	
Other	

Fixed Assets:

Land	
Buildings	
Machinery & Equipment	
Other	
Less Accumulated Depreciation	
Total Assets:	

Liabilities:

Current Liabilities Payable:

Short-Term Loans	
Accounts Payable	
Expenses Payable	
Taxes Payable	
Other	

Long-Term Liabilities:

Bank Loans	
Other	
Total Liabilities:	

Owners Equity:

Paid in Capital	
Surplus (Retained Earnings)	
Total Owners Equity:	
Total Liabilities and Owners Equity =	

VI. PROPOSED LOAN REPAYMENT SCHEDULE

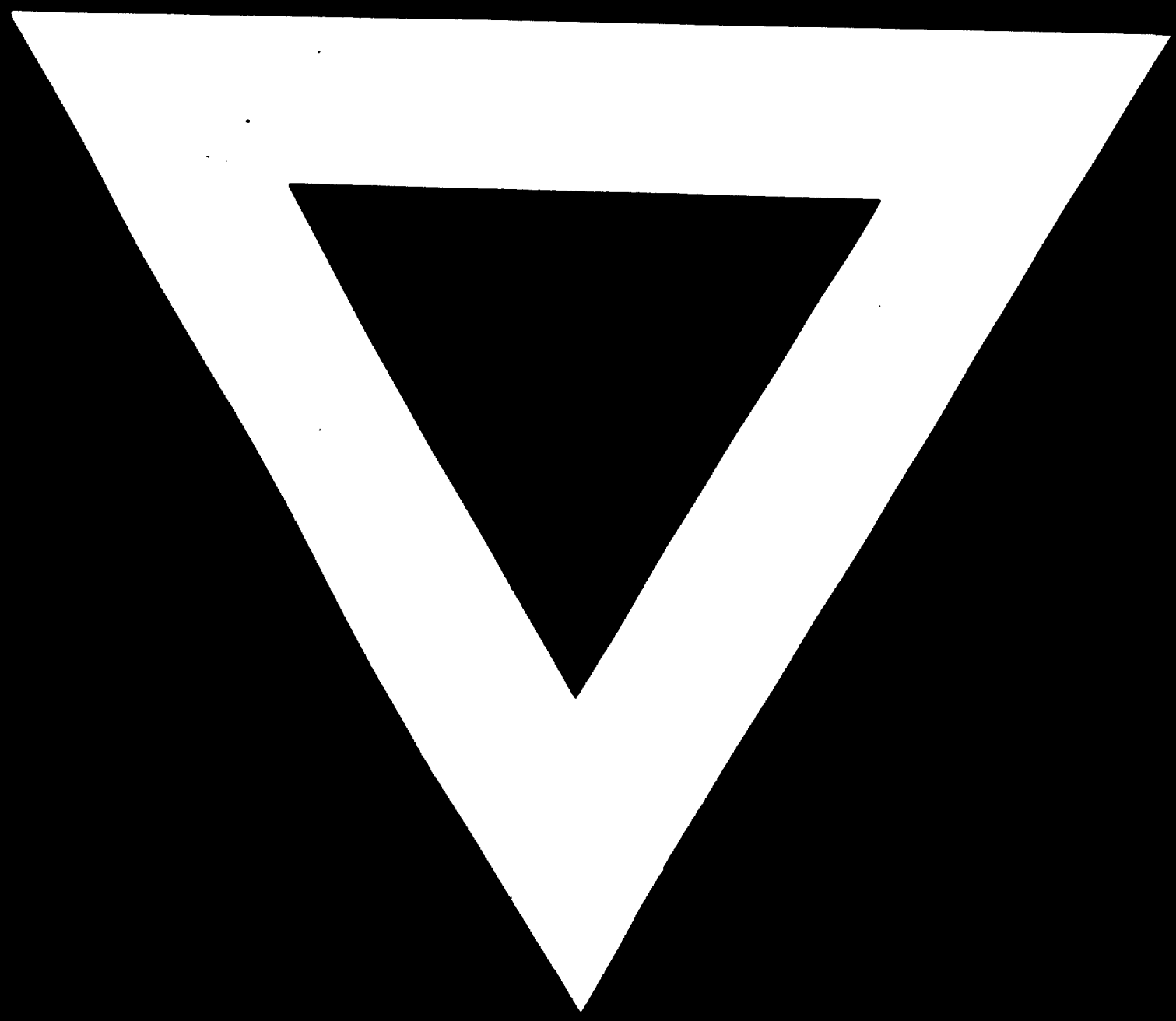
(Loan Principal Repayment Obligations, First 5 Years,
Assumed Beginning Date _____)

QUARTER	Loan A (term ____yrs) (interest ___%) (source _____)	Loan B (term ____yrs) (interest ___%) (source _____)	Loan C (term ____yrs) (interest ___%) (source _____)	Total Loan Repayments
1st				
2nd				
3rd				
4th				
5th				
6th				
7th				
8th				
9th				
10th				
11th				
12th				
13th				
14th				
15th				
16th				
17th				
18th				
19th				
20th				

VII. CASH FLOW FORECAST

(Assumed Beginning Date _____)

	QUARTER							
A. Sources of Funds:	1st	2nd	3rd	4th	5th	6th	7th	8th
Stock Subscription								
Cash Fund								
Cash From Sales								
Borrowings								
Equity								
Net Profit								
Depreciation								
Other								
Total Cash Available								
B. Utilization of Funds:								
Purchase of Fixed Assets								
Pre-production Expenses								
Cash Expenditures								
Loan Principal Repayments								
Interest Payments								
Divident Payments								
Tax Payments								
Other								
Total Cash Requirements								
C. Ending Cash Position Carried forward:								



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