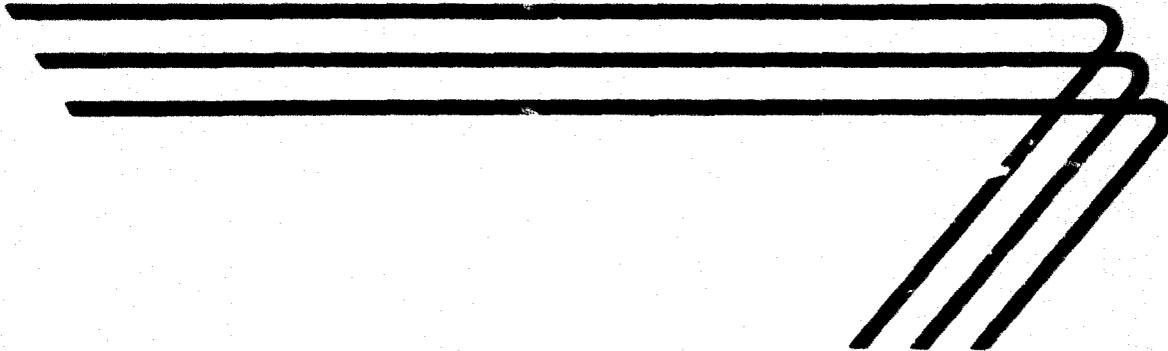


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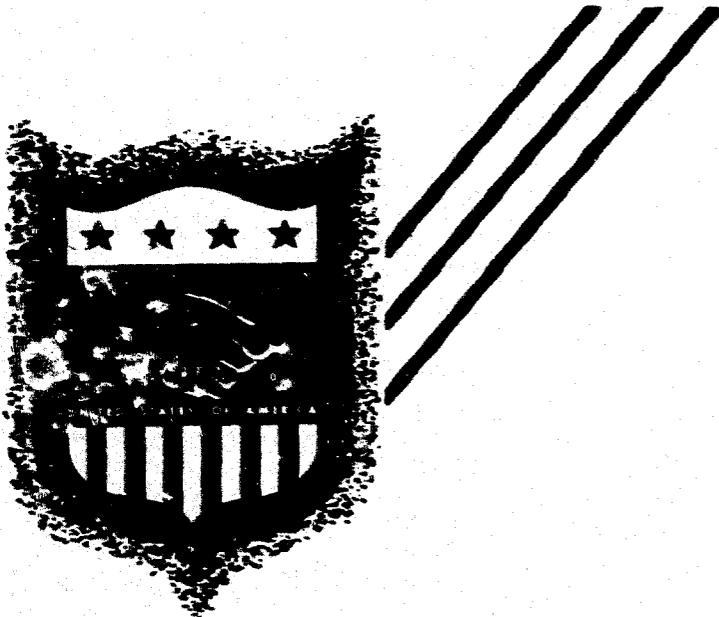
99

PLANT REQUIREMENTS FOR MANUFACTURE OF READY-MIXED CONCRETE



**DEPARTMENT OF STATE
AGENCY FOR INTERNATIONAL DEVELOPMENT
COMMUNICATIONS RESOURCES DIVISION**

Washington 25, D. C.



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FOREWORD

This brochure is one of a series of reports resulting from overseas technical inquiries on factory or commercial establishments, operation, management, and engineering. The report is designed to provide only a general picture of the factors that must be considered in establishing and operating a factory of this type. In most cases, plans for actual installations will require expert engineering and financial advice in order to meet specific local conditions.

Mention of the name of any firm, product, or process in this report is not to be considered a recommendation or an endorsement by the Agency for International Development, but merely a citation that is typical in its field.

This report was prepared by the George H. Andrews Engineering Associates, Inc., 411 Southern Building, Washington 5, D. C., in March 1961 for the technical aids program through the facilities of the Office of Technical Services, U. S. Department of Commerce.

* * * * *

For further information and assistance, contact should be made with the local Productivity Center, Industrial Institute, Servicio, or United States AID Mission.

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TABLE OF CONTENTS

	<u>Page</u>
Introduction	i
General Assumptions	2
Manufacturing Unit	3
Production Capacity	3
Product Specifications	3
Manufacturing Operations	4
Direct Materials	5
Supplies	5
Direct Labor	6
Indirect Labor	6
Production Tools and Equipment	7
Other Tools and Equipment	7
Furniture and Fixtures	8
Plant Layout	8
Plant Site	8
Building	9
Power	9
Water	9
Fuel	10
Truck	10
Depreciation	11
Manufacturing Overhead	11
Manufacturing Costs	12
Fixed Assets	12
Working Capital	13

	<u>Page</u>
Capital Requirements	13
Sales Revenue	14
Recapitulation of Costs, Sales and Profits	14
Budget Control	15
Budget Control Accounts	15
Purchase Requisition	16
Voucher Check	17
Engineers	18
Training	19
Safety	20
Other Considerations	21
Materials and Supplies	21
Market Factors	21
Export Markets	22
Marketing Problems	22
Economic Factors	23
Personnel	23
Laws and Regulations	23
Financial Factors	24
Financial Requirements of the Project	24
Short Term Bank Credits	24
Financial Plan	24
Bibliography	25
Plant Layout and Workflow	26

READY - MIXED CONCRETE

INTRODUCTION

The purpose of this report is to present basic information for establishing a manufacturing plant in a foreign country to produce dry ready-mixed concrete in paper bags.

Dry ready-mixed concrete is made of various mixtures of cement and aggregates and these mixtures are called by various names such as "dry mix cement," "Ready mixed concrete" and "ready mixed cement." Some of the names used are trade names, such as "homecrete" and "sackcrete." Some of these may include additives or admixtures that are intended to produce certain desirable qualities in the final product. For the purposes of this report the product is called ready-mixed concrete.

This product is made up of cement, sand and gravel, without any special additives. This ready-mixed concrete is intended for use by homeowners and others who need only a small amount of concrete at any one time and who cannot, therefore, buy the cement, the sand and the gravel separately, to their advantage. The ready-mixed concrete is kept on hand in retail hardware stores, paint stores, lumber yards, and building supply places. Thus it always will be convenient for any homeowner or other possible user who may wish to purchase small quantities for immediate use.

GENERAL ASSUMPTIONS

In order to make realistic estimates in this manual, certain assumptions are made. These are:

1. The costs of the building and general facilities are based on United States Prices.
2. Material costs are based on sizes and specifications of materials used in the United States.
3. Labor costs are based on the average for the industry as recently published by the United States Bureau of Labor Statistics.
4. Adequate power and water are available at the plant site.
5. Adequate transportation facilities are available at the plant site.
6. The plant operates eight hours a day, five days a week, and fifty weeks per year.
7. No special provision is made for the training of new personnel. It is assumed that learner's rates are paid in such cases.
8. The following items cannot be estimated realistically:
 - A. Land value.
 - B. Distribution and selling costs.
 - C. In-freight and out-freight.
 - D. Administrative costs.
 - E. Taxes.

While general estimates will be made of each of these items, for the purpose of completing cost estimates, adjustment should be made in accordance with actual local costs.

In fact, all cost estimates contained in this report should be adjusted to conform to local conditions.

9. Columns are provided in the tables included in this report to facilitate the conversion of cost figures to conform with local costs.

MANUFACTURING UNIT

The manufacturing unit for ready-mixed concrete is one ton.

PRODUCTION CAPACITY

The plant is designed to produce 300 tons of dry ready-mixed cement per month. The estimates are based on bagging the entire output for the year in 90,000 bags weighing 80 pounds each. The annual production is 3,600 tons or 7,200,000 pounds per year.

The production can be increased by adding personnel, by working overtime or by working more shifts without increasing the fixed capital investment for additional plant facilities.

It is possible to bag the product in smaller sizes of bags, or in a variety of sizes. The production of special sizes, special proportions of mix and special materials differing from the specifications used in this report may affect the production capacity.

PRODUCT SPECIFICATIONS

All information and figures contained in this report are based on the production of a dry mixture of one part of portland cement, two parts of sand and four parts of gravel.

The cement, sand and gravel, as separate items, and the mixture of cement, sand and gravel conform in all respects to the specifications of the American Society for Testing Materials.

MANUFACTURING OPERATIONS

The direct materials - cement, sand and gravel are purchased in carload lots, or in other large bulk quantities. The rates at which the purchases are made do not conform to the rates at which the material is used. Accordingly, it is necessary to have storage facilities for these direct materials. The cement is purchased in bulk, in carload lots. It is unloaded at a track hopper and transferred to a cement silo. The sand and gravel are taken from the unloading area or storage passed by conveyor through the dryer to bin storage. The cement, sand and gravel are conveyed to and dropped through batching equipment to the bagger by gravity.

The bagging equipment controls the speed of operation. The bagging is done at the rate of 10 bags per minute.

The filled bags are conveyed to the sewing machine, closed and stacked on pallets. As soon as a pallet is filled it is replaced by an empty pallet. The loaded pallets are moved into storage. It is not intended to have a large storage nor to keep the mixed materials for a long time in storage.

If the bagging machine were to work continuously it would fill 200 bags per hour, or the year's output could be bagged in 500 machine hours. This will release the machine operator for other work about six hours per day. Most of this other work is trucking into storage or from storage to shipping.

DIRECT MATERIALS

The annual direct materials requirements for the maintenance of ready-mixed concrete and the annual cost of materials are shown below:

<u>Item</u>	<u>Unit</u>	<u>No. of Units</u>	<u>Unit Cost</u>	<u>Annual Cost</u>	
				<u>Estimated</u>	<u>Annual</u>
Portland cement	ton	510	\$ 24.00	\$ 12,240	_____
Sand	ton	1,030	2.00	2,060	_____
Gravel	ton	2,060	1.50	3,090	_____
Bags	1,000	90	41.70	<u>3,753</u>	_____
TOTAL				\$ 21,143	_____

SUPPLIES

<u>Item</u>	<u>Annual Cost</u>	
	<u>Estimated</u>	<u>Actual</u>
Lubrication and hand tools	\$ 100	_____
Maintenance and spare parts	1,150	_____
Office supplies	100	_____
Truck, gas, oil and maintenance	<u>150</u>	_____
TOTAL	\$ 1,500	_____

DIRECT LABOR

<u>Job Classification</u>	<u>Number Needed</u>	<u>Hourly Rate</u>	<u>Annual Cost</u>	
			<u>Estimated</u>	<u>Actual</u>
Skilled workers	1	\$2.00	\$ 4,000	_____
Semi-skilled workers	1	1.75	3,500	_____
Unskilled workers	<u>2</u>	1.50	<u>6,000</u>	_____
TOTAL	4		\$ 13,500	_____

INDIRECT LABOR

<u>Job Classification</u>	<u>Number Needed</u>	<u>Hourly Rate</u>	<u>Annual Cost</u>	
			<u>Estimated</u>	<u>Actual</u>
Manager	1		\$ 8,000	_____
Driver, maintenance	<u>1</u>	\$2.00	<u>4,000</u>	_____
TOTAL	2		\$ 12,000	_____

* * * * *

PRODUCTION TOOLS AND EQUIPMENT

<u>Item</u>	<u>Cost</u>	
	<u>Estimated</u>	<u>Actual</u>
Conveyors	\$ 4,000	_____
Elevators	3,000	_____
Heater	2,000	_____
Batcher (hopper and mixer)	3,500	_____
Bag batcher and scales	2,500	_____
Bagging machine	<u>5,000</u>	_____
TOTAL	\$ 20,000	_____

OTHER TOOLS AND EQUIPMENT

<u>Item</u>	<u>Units Needed</u>	<u>Unit Cost</u>	<u>Cost</u>	
			<u>Estimated</u>	<u>Actual</u>
Platform lift trucks	4	\$ 400	\$ 1,600	_____
Pallets	500	32	16,000	_____
Maintenance tools			650	_____
Electric repair tools			400	_____
Testing equipment			1,000	_____
Delivery truck			<u>2,500</u>	_____
TOTAL			\$ 22,150	_____

FURNITURE AND FIXTURES

<u>Description</u>	<u>Number Required</u>	<u>Unit Cost</u>	<u>Cost</u>	
			<u>Estimated</u>	<u>Actual</u>
Desk and chair	1	\$ 125	\$ 125	_____
File cabinet	1	75	75	_____
Typewriter	1	150	150	_____
Adding machine	1	150	<u>150</u>	_____
TOTAL			\$ 500	_____

PLANT LAYOUT

A plant layout and schematic diagram of the flow of work is shown on page 26.

PLANT SITE

In order to provide for future expansion and to provide storage for sand and gravel a plant site of 1/2 acre, or 20,000 square feet, will be required. The plant site should be as advantageously located as possible with respect to transportation, power, water, fuel, sources of labor and markets.

The estimated cost of the plant site is \$1,000.

BUILDING

A one story building, 50 feet by 80 feet, or 4,000 square feet, is required for the manufacture, bagging and storage of dry ready-mixed concrete. The total cost of this building, including cement silo, track hopper, heating, wiring and plumbing is \$30,000. The floor of the building is above the roadway (at tail gate level). The floor must be well built, of concrete, to withstand the heavy trucking of the bagged dry ready-mixed concrete from the bagging machine to all parts of the storage warehouse. No basement is required. The roof is low and nearly flat. Local materials may be used in the construction of the building.

POWER

The connected load requirements amount to 50 horsepower. The estimated annual cost of power is \$200. The equipment such as mixers, conveyors, batchers and bagging machine operates relatively only a small part of the time.

WATER

Water is used only for drinking water, the boiler, for sanitation and fire protection. No cooling pond nor recirculation of used water is involved. The annual cost of water is estimated at \$100.

FUEL

Fuel is used for drying the sand and gravel before mixing them with the cement. This requires an estimated 8,000 cubic feet of gas per year. The estimated cost of this fuel is \$900. Other forms of fuel could be used if appropriate equipment were provided. The cost estimates would not be greatly modified.

TRUCK

A pickup truck will be required for occasional use for miscellaneous purposes including some special local delivery. The shipment of the ready-mixed concrete to various destinations is, however, a separate business. It has been found that tractors and trailers are most satisfactory for this purpose since most of the customers are not located on the railroad. Such equipment and its operation are not included in this estimate since they are not part of the process of making ready-mixed concrete. Delivery is usually by contract with a trucking company.

The estimated cost of the pickup truck is \$2,500, which is included as an item in Other Tools and Equipment. The cost of the gasoline and lubrication is included with Supplies. The cost of the driver is included in Indirect Labor.

DEPRECIATION

<u>Description</u>	<u>Estimated Cost</u>	<u>Years Life</u>	<u>Annual Cost</u>	
			<u>Estimated</u>	<u>Actual</u>
Building	\$ 30,000	20	\$ 1,500	_____
Production tools and equipment	20,000	10	2,000	_____
Other tools and equipment	22,150	10	2,215	_____
Furniture and fixtures	500	10	50	_____
Truck	2,500	4	625	_____
TOTAL			\$ 6,390	_____

MANUFACTURING OVERHEAD

<u>Item</u>	<u>Annual Cost</u>	
	<u>Estimated</u>	<u>Actual</u>
Depreciation	\$ 6,390	_____
Indirect labor	12,000	_____
Power	200	_____
Water	100	_____
Fuel	900	_____
Supplies	1,500	_____
TOTAL	\$ 21,090	_____

MANUFACTURING COSTS

<u>Item</u>	<u>Annual Cost</u>	
	<u>Estimated</u>	<u>Actual</u>
Direct materials	\$ 21,143	_____
Direct labor	13,500	_____
Manufacturing overhead	<u>21,090</u>	_____
TOTAL	\$ 55,733	_____

FIXED ASSETS

<u>Item</u>	<u>Cost</u>	
	<u>Estimated</u>	<u>Actual</u>
Land	\$ 1,000	_____
Buildings	30,000	_____
Production tools and equipment	20,000	_____
Other tools and equipment	22,150	_____
Furniture and fixtures	500	_____
Truck	<u>2,500</u>	_____
TOTAL	\$ 76,150	_____

WORKING CAPITAL

<u>Item</u>		Cost	
		<u>Estimated</u>	<u>Actual</u>
Direct materials	30 days	\$ 1,700	_____
Direct labor	30 days	1,130	_____
Manufacturing overhead	30 days	1,700	_____
Reserve for sales collections	30 days	<u>7,500</u>	_____
TOTAL		\$ 12,130	_____

CAPITAL REQUIREMENTS

<u>Item</u>	Cost	
	<u>Estimated</u>	<u>Actual</u>
Fixed assets	\$ 77,150	_____
Working capital	<u>12,130</u>	_____
TOTAL	\$ 89,280	_____

SALES REVENUE

The estimates in this report are based on the production of 300 tons of dry ready-mixed concrete per month or 7,200,000 pounds per year. Although various sizes of bags of dry ready-mixed concrete may be sold, it is assumed that all are marketed in 80 pound bags, of which there are 90,000.

90,000 bags of dry ready-mixed concrete at \$1.00 per bag amount to \$90,000 total annual gross sales.

RECAPITULATION OF COSTS, SALES AND PROFITS

<u>Item</u>	<u>Estimated Cost</u>	<u>Actual Cost</u>
Direct materials	\$ 21,143	_____
Direct labor	13,500	_____
Manufacturing overhead	<u>21,090</u>	_____
Total manufacturing cost		\$55,733
Interest on loans	2,500	_____
Insurance	250	_____
Legal	300	_____
Auditing	600	_____
Unforeseen expense	<u>2,617</u>	_____
Total administrative costs		\$ 6,267
Sales commissions		6,000
Travel, bad debts, discounts and allowances, freight-out		2,000
Profit before taxes		<u>20,000</u>
TOTAL ANNUAL GROSS SALES		\$90,000

BUDGET CONTROL

A requisition form designed to provide accurate records of procurement and indicate the purpose of procurement with the least amount of time and effort is shown on the following page.

This form has an account number for each type of the various expenditures which the manager will review in detail, monthly or oftener, in order to control his expenses. Some items, such as power and water, are usually under contract and are easily checked by reference to monthly bills. For simplification, items (marked with an asterisk below) are omitted from the purchase requisitions. Variations in the labor costs are easily reviewed by examination of the payroll vouchers. The simplified type of control thus provided makes certain that the manager can control expenditures promptly.

Following the requisition form, a sample voucher check is shown. Voucher checks should be used for the payment of all expenditures and the appropriate book account number placed on each voucher.

At the end of each month the manager will receive a statement of all expenditures broken down by budget accounts. If the expenditures exceed the budgeted monthly allowances of any of the accounts, the bookkeeper will furnish the manager with a break-down of all expenditures relative to the budgeted accounts exceeded. All these supporting data can be secured by reference to the purchase requisitions and the check vouchers. This reference will enable the manager to determine what caused the over-expenditure and take corrective action.

If at any time during the month it becomes apparent that expenditures will exceed any of the budget accounts, the bookkeeper will bring this to the attention of the manager for his information and action.

BUDGET CONTROL ACCOUNTS

<u>Account Number</u>	<u>Monthly Expense</u>	<u>Monthly Budget</u>	<u>Annual Budget</u>	<u>Actual</u>
10 Administrative	\$ _____	\$ 304	\$ 3,650	_____
20 Sales	_____	666	8,000	_____
30 Direct Materials	_____	1,762	21,143	_____
40 Supplies	_____	116	1,500	_____
51 Power	_____	17	200	_____
52 Water	_____	8	100	_____
53 Fuel	_____	75	900	_____
60 Unforeseen Expense (Reserve Account)	_____	218	2,617	_____
71 Direct Labor*	_____	1,125	13,500	_____
72 Indirect Labor*	_____	1,000	12,000	_____
80 Depreciation (Reserve Account)	_____	532	6,390	_____

R. W. MITCHELL MANUFACTURING COMPANY

1422 BOSWORTH STREET, S. E.

65-22
514

ANYWHERE, U. S. A.

19

No.

10000

PAY

DOLLARS \$

TO THE ORDER OF

TO **FIRST NATIONAL BANK**
ANYWHERE, U. S. A.

R. W. MITCHELL MANUFACTURING COMPANY

BY

SAMPLE CHECK

VICE PRESIDENT

ACCOUNT NUMBER

Sample voucher check to be used for the payment of
all expenditures in connection with Budget Control.

R. W. MITCHELL MANUFACTURING COMPANY

ENGINEERS:

The services of professional engineers are desirable in the design of this plant, even though the proposed plant is small.

A correct design is one which provides the greatest economy in the investment of funds and establishes the basis of operation that will be most profitable in the beginning and will also be capable of expansion without expensive alteration.

The addresses of professional engineers who specialize in industrial design, some of whom may be willing to undertake such work on low cost projects overseas, can be secured by reference to the published cards in various engineering magazines. They may also be reached through their national organizations, one of which is the

National Society of Professional Engineers
2029 K Street, Northwest,
Washington 6, D. C.

Manufacturers of industrial equipment employ engineers familiar with the design and installation of their specialized products. These manufacturers are usually willing to give prospective customers the benefit of technical advice by those engineers in determining the suitability of their equipment in any proposed project.

The equipment manufacturers also know, and can recommend, professional engineers in private practice, who are willing and able to provide appropriate consulting services.

TRAINING:

Manufacturing an inferior quality of product during the training period could create sales resistance that might be difficult to cope with later. To avoid such possibilities, the quality of the product should be maintained at all times, including the training period.

In some areas skilled operators may be available locally. In other areas all the operators may have to be trained.

If skilled operators are not available, adequate training would be assured by using one or more of the following methods:

- A. If the plant is designed and installed by a competent engineering firm, the contract should be negotiated, if possible, on a turn-key basis. On this basis the contractor agrees to operate the plant and produce the quality and quantity of the product stated in the contract for an agreed period of time. Such a contract would assure adequate personnel training, since full quantity and quality could not be produced with an untrained organization.
- B. The engineering firm that designs and installs the plant can usually make training arrangements to have key personnel placed, for training purposes, in a foreign industry that produces the same type of product. This would provide training for the key personnel while the plant is being installed.
- C. If neither of the above methods is possible, then qualified and experienced individuals should be employed for the key positions, either permanently or temporarily, to perform the key operations and assist in training the organization, even if they must be secured outside the country.
- D. The manager should have years of successful experience in this type of business and be fully qualified in all phases of management, including the training of employees.

SAFETY:

There is always danger of accident and injury in any industrial plant. Because of this, the manager should take specific action to bring to the attention of each employee the importance of safety precautions and intelligent first aid.

Practically all machines have safety appliances, and the manager should see that these are in good working condition and that the operators are making full use of them.

In addition to constant watchfulness to make sure that all practicable safety precautions are taken, first aid supplies should be readily available. One complete first aid kit should be maintained near the manager's office, and others at appropriate places throughout the plant. Some of the employees should be trained to provide first aid service.

The use of accident posters in the plant have proved to be of value in reducing accidents. It is recommended that such posters be used, and that some direct special action be taken by the manager, at least once each month, to bring to the attention of all personnel the importance of safety precautions.

A fire brigade should be established and each member trained as to his responsibility in case of fire. Fire drills should be conducted periodically.

It is recommended that the employees be encouraged to offer suggestions or recommendations relative to prevention of accidents, removal of fire hazards and maintaining general interest in all safety factors.

OTHER CONSIDERATIONS

There are other important subjects, shown below, that should be fully investigated and considered. Information on these subjects is usually available from such sources as banks, government agencies, exporters and importers, wholesalers, retailers, transportation companies and manufacturers.

MATERIALS AND SUPPLIES

1. Are all materials and supplies available locally?
2. Is the local material market competitive?
3. Is satisfactory delivery of local materials assured at reasonable prices?
4. What materials and supplies must be imported?
5. Are they available in world markets at competitive prices?
6. Would prompt delivery of imported materials and supplies be assured so that large inventories would not be required?

MARKET FACTORS

1. Is there already a demand for the product?
 - A. Who are the principal consumers?
 - B. Who are possible new consumers?
2. How is demand for the product now satisfied?
 - A. By local production? If so, what is the volume of annual production?
 - B. What percentage of consumption is filled by local production?
 - C. By imports? If so, what is the volume of annual imports?
 - D. What percentage of consumption is met by imports?
 - E. From what areas are imports derived?
3. What is the estimated annual increase in local consumption over the next five years?
 - A. How were such estimates made?
 - B. By reference to official figures on population growth, family budgets, imports, etc.?
 - C. By consultation with trade or industry, ministries, associations, bankers, commercial houses, wholesalers, retailers, industrial consumers, etc.?

4. If the product is already being manufactured, can the existing and estimated future local market absorb production of the new plant without price-cutting or other dislocations?
5. Would the estimated sales price and quality of the new product make it competitive with an imported equivalent?
 - A. After adjusting cost to local conditions, is the estimated sales price of the product so high that tariff protection is necessary to protect it from imports?

EXPORT MARKETS:

1. Could the product compete in export markets on the basis of price, quality and dependability of supply?
2. Can export markets for the product be developed?
3. If so, in what areas and in what annual volume?
4. What procedures would be necessary to develop export markets?
5. What would it cost?

MARKETING PROBLEMS:

1. In calculating costs of the product, has adequate allowance been made for the expense of a sales department, advertising and promotion that might be required?
2. Do consumer prejudices against locally manufactured products exist?
 - A. If so, why?
 - B. Would they apply to the new product?
 - C. If so, how could they be overcome and what would it cost to do so?
3. Do marketing and distribution facilities for the product exist?
 - A. If not, can they be set up?
 - B. What would it cost to do so?
4. Will the product be sold to:
 - A. Wholesalers?
 - B. Retailers?
 - C. Direct to consumer?
 - D. Other industries?
 - E. Government?

ECONOMIC FACTORS:

1. How much foreign exchange (and in what currency) is required to import machinery, equipment and supplies:
 - A. How much foreign exchange (and in what currency) is required for annual interest payments and amortization of any loans contracted to import machinery and equipment, or for payment of royalties and technical services?
 - B. How much foreign exchange (and in what currency) is required for annual import of raw materials and supplies?
 - C. What are estimated annual foreign exchange earnings and in what currencies?
 - D. Has careful consideration been given to the possibility of depreciation in the foreign exchange value of the local currency?
 - E. Has careful consideration been given to the possibility of import controls, or restrictions on availabilities of foreign exchange necessary to operate the business?
 - F. What benefits would the new business bring to the economy in the use of local raw materials: in employment and in technology?
 - G. Do dependable facilities exist for transportation, power, fuel, water and sewage?
 - (1) If not, can existing deficiencies be eliminated satisfactorily?
 - (2) What would be the cost to do so?

PERSONNEL:

1. Is there an adequate labor supply near the plant location?
 - A. If not, how can the problem be solved?
2. Can the problem of training competent management and supervisory personnel be solved?
 - A. Also, the training of skilled labor?
 - B. Is technical advice available in the locality?
 - C. If not, where can it be obtained and what will it cost?

LAWS AND REGULATIONS:

1. Do existing labor laws, government regulations, laws and taxes favor establishment of new business?
 - A. If not, can existing obstacles be removed?
 - B. If so, how and when?

FINANCIAL FACTORS:

1. Technical advice on selection of machinery and equipment.
 - A. In selecting the machinery and equipment for the new plant, have reputable and competent engineers and technicians been consulted?
 - B. Have they been asked for advice on the most suitable types of machinery and equipment for the process and locality?
 - C. Have they carefully compared costs of various suppliers?
 - D. Credit terms offered purchasers?

FINANCIAL REQUIREMENTS OF THE PROJECT:

1. In estimating the cost of the project, has careful consideration been given to:
 - A. The effect on costs of delays in construction schedules?
 - B. In delivery and installation of machinery and equipment?
 - C. In import of essential raw materials and supplies?
2. In calculating cash flow and working capital requirements, has careful consideration been given to:
 - A. Maintaining adequate inventories of raw materials?
 - B. Supplies and spare parts?
 - C. Seasonal fluctuations in the business?
 - D. The time required to liquidate credit sales to customers and bad debts?
 - E. The period necessary to get the plant into production?
 - F. Cash required to amortize its principle loans?
3. If the economy is in a period of inflation, has full allowance been made for the influence of rising prices and wages on the cost of the project and on working capital requirements?

SHORT TERM BANK CREDITS:

1. Has it been possible to make arrangements with local banks to finance short-time working capital requirements of the business?

FINANCIAL PLAN:

1. Has a definite plan to finance the project been worked out?
 - A. Is sufficient capital available locally?
 - B. If not, what is the plan to obtain the required capital?

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