
Small Ceramics Plant

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VITA

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INDUSTRY PROFILES

Introduction

This Industry Profile is one of a series briefly describing small or medium-sized industries. The Profiles provide basic information for starting manufacturing plants in developing nations. Specifically, they provide general plant descriptions, financial, and technical factors for their operation, and sources of information and expertise. The series is intended to be useful in determining whether the industries described warrant further inquiry either to rule out or to decide upon investment. The underlying assumption of these Profiles is that the individual making use of them already has some knowledge and experience in industrial development.

Dollar values are listed only for machinery and equipment costs, and are primarily based on equipment in the United States. The price does not include shipping costs or import-export taxes, which must be considered and will vary greatly from country to country. No other investment costs are included (such as land value, building rental, labor, etc.) as those prices also vary. These items are mentioned to provide the investor with a general checklist of considerations for setting up a business.

IMPORTANT

These profiles should not be substituted for feasibility studies. Before an investment is made in a plant, a feasibility study should be conducted. This may require skilled economic and engineering expertise. The following illustrates the range of questions to which answers must be obtained:

- * What is the extent of the present demand for the product, and how is it now being satisfied?
- * Will the estimated price and quality of the product make it competitive?
- * What is the marketing and distribution plan and to whom will the product be sold?
- * How will the plant be financed?
- * Has a realistic time schedule for construction, equipment, delivery, obtaining materials and supplies, training of personnel, and the start-up time for the plant been developed?
- * How are needed materials and supplies to be procured and machinery and equipment to be maintained and repaired?
- * Are trained personnel available?
- * Do adequate transportation, storage, power, communication, fuel, water, and other facilities exist?
- * What management controls for design, production, quality control, and other factors have been included?
- * Will the industry complement or interfere with development plans for the area?
- * What social, cultural, environmental, and technological considerations must be addressed regarding manufacture and use of this product?

Fully documented information responding to these and many other questions should be determined before proceeding with implementation of an industrial project.

Equipment Suppliers, Engineering Companies

The services of professional engineers are desirable in the design of industrial plants even though the proposed plant may be small. A correct design is one that 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.

Professional engineers who specialize in industrial design can be found by referring to the published cards in various engineering magazines. They may also be reached through their national organizations.

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.

VITA

Volunteers in Technical Assistance (VITA) is a private, non-profit, volunteer organization engaged in international development. Through its varied activities and services, VITA fosters self-sufficiency by promoting increased economic productivity. Supported by a volunteer roster of over 5,000 experts in a wide variety

of fields, VITA is able to provide high quality technical information to requesters. This information is increasingly conveyed through low-cost advanced communication technologies, including terrestrial packet radio and low-earth-orbiting satellite. VITA also implements both long- and short-term projects to promote enterprise development and transfer technology.

PRODUCT DESCRIPTION

1. The Product

The products are small ceramic wares such as ashtrays, plates, cigarette boxes, dishes, bowls, water containers, cups, etc.

The Facility

This profile describes a small plant operating with one shift and producing 16,000 pieces a year. It also describes a medium-sized plant running a single shift producing about 80,000 units a year.

GENERAL EVALUATION

The investment and labor force required for this plant are very small. The objects are decorated with the application of ceramic colors, engobes, and stains, all of which can be purchased initially in the United States, England, France, or Germany, and later fabricated by the potter. The local market in less developed areas will be limited because of the low average income of the people. The market among tourists will depend to a large extent on the degree to which the products have preserved their native characteristics in the process of factory production. If a distinctive style is preserved and an export market established through direct shipments abroad (not only through tourist trade), factory production may be economically feasible.

1. Outlook

A. Economic

Like all handicrafts, the economics will depend on the quality and originality of the product.

B. Technical

A person who has talent as an artist or inventor should have no serious problems in making ceramics. It will require some persistence, however, and the availability of a small kiln to fire samples prior to production runs.

2. Manufacturing Equipment Flexibility

The basic element of any ceramics shop is the kiln, which can be purchased new or used, or made by the potter following expert consultation. The kiln may be heated by firewood, which may limit its cost to only labor, refractories, and a steel grate. Or it may be heated electrically, which will require heat resistant wiring, temperature controls, and automatic switches. Heat treat metals and the talent of the ceramist are also critical.

Adequate ventilation of the kilns is necessary to help eliminate hazardous dust particles from the atmosphere, and masks should be worn by those in continuous contact with dust. If the products are food containers, facility for conducting safety tests must be readily available.

With some additional equipment, the product line could be expanded to include building materials such as floor and wall tiles or sanitary ware such as sinks, toilets, etc.

3. Knowledge Base

Talent is born, and acquiring ceramic knowledge will take years. But for the beginner, a few trial firings will be enough to have a basic idea of the process, particularly drying and firing for a specific types of clay.

4. Quality Control

The purchaser of an artwork or other original ceramic piece will tolerate small cracks and imperfections. Not so with dishes, cups, and other goods for everyday use. These must be hard, durable, and well glazed. Moreover, the products are breakable and care needs to be taken in packaging them for shipping.

5. Constraints and Limitations

- Uniform raw materials - this is absolutely critical + Reliable fuel supply + Transport system + Ceramic compositions to prevent food poisoning

MARKET ASPECTS

Users

Individuals, households, restaurants, and ceramic parts manufacturers.

Suppliers

The potter must find a good local supply of ceramic clays. Already mixed ceramic bodies are expensive. To learn about the available clays of a particular area, it is advisable to contact the geology or mining departments or ministries of the region or to ask local potters about the availability of ceramic clays. Or follow the rivers or streams and dig until strata of rather uniform clay is found. Sometimes good clay deposits are found far away from rivers. Test for plasticity, shrinkage during drying and firing.

In addition to clays, the potter will need the following minerals in order to fabricate ceramic glazes and colors: feldspar, silica (sand, flint or quartz), borax, lead silicate, bentonite, nepheline syenite, whiting (calcite), antimony oxide, potassium carbonate, sodium carbonate, iron oxides, chromium oxide, nickel oxide, tin oxide, copper oxide, and cobalt oxide. The latter oxides are used as coloring agents in very small quantities and can be prepared following VITA reports on the subject. The potter should make sure that suppliers provide a material data sheet that describes the hazard potential of their products. Packing supplies could be a problem in a small town or rural area.

1. Sales Channels and Methods

Plant would sell to jewelry and departmental stores, gift shops, supermarkets, and also to exporters for shipment abroad. Ceramics to be sold to jewelry stores must be of exceptional quality.

2. Geographic Extent of Market

Distribution will depend on transportation facilities.

3. Competition

Domestic - Imported mass-produced products will often be competitive.

Inexpensive locally-made handicraft items may also compete.

Export - The success of articles of this type in the export market, particularly when not bought by tourists but exported directly, depends largely upon the quality of the products, and the extent to which they have preserved their native characteristics in the process of factory production.

Market Capacity

No specific population figure is necessary to support this plant. Level of income would be the major limitation on domestic consumption. The plant would depend partly upon exports, both direct and indirect. Volume of tourist traffic, and their relative price level will determine export demand. If the price, quality, and design are right, they can create their own Local market, replacing or supplementing articles currently in use.

PRODUCTION AND PLANT REQUIREMENTS

Requirements Annual Output 16,000 80,000 pieces 60/day 300/day

Infrastructure, Utilities Small Plant Medium Plant

Land 1,000 sq.ft 500 sq. ft Building 20' x 30' 50 ft x 60 ft Power 16,000 kw-hr 80,000 kw-hr Fuel

Water 10 gal/day 300 gal/day Other

1. Major Equipment & Machinery Small Plant Medium Plant

Tools & Machinery fire brick kilns 2 2 small metal kiln 1 2 ball mill 2 3 jaw crusher 1 1 muller 1 1 molds, brushes, knives

spatulas, scrapers sieves, sgraffito knives stilts for kilns, 2 spray 1 2 spray guns for glazing storage tanks (liquid, 55 gal) 2 4

Support equipment & parts benches & bins

*TOTAL ESTIMATED COSTS of equipment & machinery only \$55,000
\$90,000

*Based on \$US 1987 prices. The costs provided are estimates and are given only to provide a general idea for machinery costs. They are not intended to be used as absolute prices. Costs still need to be determined on a case by case basis.

2. Materials & Supplies Small Plant Medium Plant 16,000 units/yr 80,000

units/yr 60 units/yr 300 units/yr Raw Materials clay 100 lb/day 500 lb/day glazes, various types & colors 10 gal/day 50 gal/day decalcomanias 100/day

500/day glaze stains & underglaze stains 0.25 lb/day 1.25 lb/day overglaze
plaster 20 lb/day 100 lb/day supplies hand tools maintenance & repair parts
office supplies Packaging

3. Labor Small Plant Medium Plant

Skilled kiln firing 1 5 caster 1 5

wheel potter 1 5 batch formula 2 10 Semiskilled ware cleaner 2 10 ware glazer 2 10
raw material preparation 1

3 Unskilled clean-up 1 3 Indirect Manager 1 2 bookkeeper 1 2 scheduling 1 2 plant
operator 1 2

PROCESS DESCRIPTION

All the machines and equipment needed for this plant can be fabricated in a small machine shop by an experienced mechanic, including the kiln shell or frame. The ceramist can easily install the brickwork in it, but must have some expertise in electrical work in order to do the wiring. <see work plant>

Usually ball clays and China clays can be dried and crushed to walnut size or finer. When mixed with water, the clays will break down to a very fine particle size (minus 325 mesh). All non-clay materials (silica, feldspar, limestone, talc, etc.) should be ground to 200 mesh or finer. A ball mill can be used for this.

Once the raw materials are in a useable size (200 mesh), batch the ceramic body ingredients by either of two methods: weighing on a scale, or using specific volumes for each ingredient.

For slip casting, the raw materials are mixed with water in the clay blungers. Sodium silicate and soda ash are added to the materials in the blunger to control specific gravity and casting properties. Body scrap can be recycled in the clay blungers along with new raw materials.

Ceramic body for the potter's wheel is made by using the muller. Dry raw materials are added to the muller. Water is added until a stiff workable mass is developed.

After the ware is removed from the plaster mold and the potters' wheel, it must be dried sufficiently to allow handling. The cleaned greenware must be dried before decorating and glazing and the glazed ware must be dried before firing. Any moisture left in the glazed ware will cause the ware to crack and fall apart during the kiln firing process.

REFERENCES

Unless otherwise stated, these addresses are in the United States.

1. Technical Manuals & Textbooks

Pitman Publishing Ltd., 39 Parker St., London WC2B 5PB publishes a series of books on ceramics under Ceramic Skillbooks: Kiln Building, Glazes, oriental Glazes, Pottery Science, Working with Porcelain, Saltglaze, clays, etc.

Green, D., Pottery, Materials, and Techniques: A Handbook of Pottery Glazes, Watson Gupthill Publications, 1515 Broadway, New York, New York 10036.

Kingery, W.D., Introduction to Ceramics, John Wiley & Sons, New York.

Newlson, G. C., Ceramics: A Potter's Handbook, Holt Rinehart Winston Publishers, 383 Madison Ave., New York, New York 10017

Elements of Ceramics, Norton. Addison Wesley Press, Cambridge, Massachusetts.

Rhodes, D., Clays and Glazes for the Potter, Chilton Book Co., Radnor, Pennsylvania.

2. Periodicals

Ceramic Industry Bulletin American Ceramic Society 275 Washington St. 65
Ceramic Drive Newton, Massachusetts 02158 Columbus, Ohio 43214 USA

Ceramica Y Cristal Argentina Claycraft F. Lacroze London & Sheffield
Publishing Co. 215 Buenos Aires 1426 Stamford House 65-66 Turnmill St.
Argentina London EC1M 5RA England

Popular Ceramics PO Box 6466 Glendale, California 92105 USA

3. Trade Associations

Tile Council of America, Inc. P. O. Box 326 Princeton, New Jersey 08542 USA

4. Equipment Suppliers, Engineering Companies

Ceramic Glazes, Colors, etc.:

FERRO Corp., 4150 56th St., Cleveland, Ohio 44101 USA, plus sales offices
and plants in many other countries

Enamelnager, Ltd. Hommel Company 28/8 Garight Rd. Hope Street Calcutta,
India Carnegie, Pennsylvania 15105 USA

Duncan Ceramic Products, Blythe Mathey, Ltd. PO Box 7827 195 Heart Lake
Rd. Fresno, California 93727 USA South Brampton, Ontario Canada

Kilns:

Harper, Inc., W. Drullar Sreet, Lancaster, New York 14086 USA Alpine, Inc.,
3051 Fujita St., Torrance, California 90505 USA Aten, Inc., 5721 Odana Rd.,
Madison, Wisconsin 53719 USA

5. Directories

Ceramic Source 1986 Ceramic Industry Buyers Guide American Ceramic
Society

6. VITA Resources

Understanding the Small-Scale Clay Products Enterprise, by Miska
Petersham. Volunteers in Technical Assistance, Arlington, Virginia, 1984.

Understanding Clay Recognition and Processing, by Miska Petersham.
Volunteers in Technical Asistance, Arlington, Virginia, 1984.