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The Balance Between Economic Development and Environmental Protection: A Case Study of the Rhode Island Jewelry Industry

Steven Paul Walton
University of Rhode Island

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THE BALANCE BETWEEN ECONOMIC DEVELOPMENT
AND
ENVIRONMENTAL PROTECTION

A case study of the Rhode Island Jewelry Industry

by

Steven Paul Walton

A Thesis Project Submitted in Partial Fulfillment of
the Requirements for the Degree of Master of Community
Planning

UNIVERSITY OF RHODE ISLAND

1980

MASTER OF COMMUNITY PLANNING
THESIS PROJECT
OF
STEVEN PAUL WALTON

Approved:

Major Advisor

Howard H. Fisher

Edward J. Girard, Jr.

UNIVERSITY OF RHODE ISLAND

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INTRODUCTION

Widespread concern for the unrestrained degradation of our natural environment was spawned during the social unrest of the 1960's. Vietnam, social inequalities, and environmental pollution were the issues of the decade. The 1960's were also a period of low unemployment and unprecedented increases in purchasing power and personal income. To many, the choice between an increased percentage in industrial productivity and growth and continued degradation of nature's delicate ecological balance was clear.

In the 1970's, however, the trade-offs between economic growth and environmental protection have become increasingly difficult to make. Today the issues of greatest concern involve high unemployment, continued inflation, and decreased buying power. The possibility of further disruption to an already staggering economy has placed severe impediments upon the productive implementation of federal legislation dealing with pollution control standards. The potential impact of the Federal Water Pollution Control Act Amendments of 1972 on the Jewelry Industry in Rhode Island provides a case in point.

During the 20th Century, Rhode Island has developed a competitive advantage in the production of jewelry and silverware products. Since the turn of the century, conditions have evolved in the State which enable this industry to manufacture and distribute its products more efficiently and cheaply than competing

regions in the country. Historically, regional growth and development have been sustained by a region's ability to export locally produced goods and services at a competitive advantage.¹ This ability to export creates a flow of money into the area which contributes to internal development. Some of these internal developments are related directly to the export industry. Others manifest themselves in the expansion of local markets for all sorts of goods and services which tends to encourage unrelated development.

Today Rhode Island is the nations largest manufacturer and exporter of body and costume jewelry.² At present, however, the ability of this industry to remain competitive from Rhode Island is being threatened. Recent developments have eroded the local jewelry industry's competitive advantage in the production and distribution of its products. Foremost among these occurrences is the passage of the Federal Water Pollution Control Act Amendments of 1972. This act is designed to achieve two national goals: the elimination of discharge pollution into the nation's waters by 1985 and the interim attainment of water quality which provides for the protection and propagation of fish and wildlife.³

While the intent of the federal legislation is of the most laudable nature, the requirements of providing effluent control facilities demanding large capital investment may be beyond the fiscal capabilities of many jewelry firms. This industry is characterized by hundreds of small businesses usually employing less than 25 people.⁴ Although there are large companies in the industry, the great majority of enterprises lack the financial base, management capabilities, and technical ex-

pertise to effectively satisfy federal environmental and health regulations. It is possible that enforcement of the federal legislation which fails to consider its impact on many of these individual businesses may result in their forced closings.

Since the competitive advantage a region has vis a' vis other regions in the production of certain products is relative, changes in Rhode Island's industrial structure may result in substantial shifts in the relative advantage which the State enjoys in the manufacturing of jewelry products. The potential costs to the Rhode Island economy caused by a large reduction in jewelry manufacturing may be more severe than the loss of direct employment and income. Both related and unrelated activities which depend upon the money generated by this industry would be affected.

The motivation for this study is a perceived need to find a common course of action for these two opposing forces of economic growth and environmental protection. On the one hand, there are the environmentalists who believe that protection of our natural resources is essential to the survival of our planet and its life forms. On the other hand, there are those groups to whom the imperatives of expanded employment opportunities and increased economic standards of living provide the essential ingredients for individual fulfillment. A basic theme of this paper is that both points of view have validity. The focus of this study is on ways in which programs can be developed which facilitate compliance with the federal act while encouraging the economic vitality of the jewelry industry and the economy of the State.

The success of a region's export base is a determining factor in the rate of internal growth and development. Therefore, in order to understand this growth, we must examine the locational factors which have enabled these staples to develop. The first section of this paper presents a general theory of industrial location. It surveys existing definitions of "optimum location" and presents a conceptual framework of the most influential determinants of the location of activities.

The second chapter looks at the Rhode Island Jewelry Industry's production process, performance requirements, and historical development to uncover those factors which are most influential as causes of location. Included in this discussion is an investigation of the particular elements of the State's competitive advantage as perceived by selected jewelry firms in the state.

The third part examines the importance of the jewelry industry to the state economy. It reviews the Export-Base Theory of economic development and compares the industry's employment, total wages and value added to other industrial sectors to illustrate the significant position of jewelry manufacturing within the local economy.

The fourth chapter presents the Water Pollution Control Act Amendments of 1972 with a discussion of the legislative requirements, intent, and enforcement procedures. It examines both the state and federal roles, including a look at the Act's specific programs and policies to achieve its goal of eliminating discharge pollutants into the nation's navigable waters by 1985.

This discussion is continued in the following section which analyzes the relationship of the federal legislation to jewelry

manufacturing. This chapter focuses primarily on the federal industrial pretreatment requirements relating to electroplating and metal finishing operations.

Though the activities covered by the federal regulations are found throughout the United States, they are of particular importance to the concentration of jewelry firms in Rhode Island. Chapter six brings together the major elements of the Rhode Island jewelry industry's locational development and the federal water pollution standards to illustrate the potential economic disruption to both the industry and the state.

The final chapter of this study proposes recommendations designed to help eliminate polluting effluents as required by the federal legislation while preserving the vitality of the jewelry industry. It presents specific proposals which both private and public agencies can adopt to meet these ends.

FOOTNOTES-INTRODUCTION

¹Harvey Perloff and Lowdon Wingo, Jr., "National Resource Endowment and Economic Growth", in Regional Policy-Readings in Theory and Applications, ed. John Friedmann and William Alonso (Massachusetts: The MIT Press, 1975), p. 316.

²U.S. Department of Commerce, Bureau of the Census, 1972 Census of Manufacturers, Vol II, Industry Statistics, pt. 3.

³U.S., Congress, Senate, an Act to Amend the Federal Water Pollution Control Act, Pub. L. 92-500, 92 HD/Cong., 2d sess., 1972, S. 2770, p. 1.

⁴Rhode Island Department of Economic Development, Rhode Island Basic Economic Statistics - The Economy, Summary, and Trends 1977-1978, (1977), p. 104.

CHAPTER ONE:

INDUSTRIAL LOCATION THEORY

Industrial location theory attempts to identify and analyze the principal factors responsible for the spatial organization of activities in our society. In locational analysis a distinction is often made between the approach emphasizing the theory of the firm and that which views location as a regional problem.¹ The first approach examines the decisions which an individual firm or an entrepreneur makes regarding the relevant production coefficients available at a particular site. The second method views location at an aggregate level, emphasizing patterns of land use and market interaction which result in competition and linkages between a host of different activities.

At the macro level, each business is seen to function in a system of spatial relations. The size of a region, its economic structure including raw materials, industrial mix, amenities, prices, tax rates, labor supply, . . . , its location relative to other regions, and the quality of its transportation system provide certain advantages for the production of various goods and services. Firms operating in these areas utilize the existing advantages to more profitably and competitively manufacture and distribute their products. The

relationship between competing regions constantly shifts due to population movements, technological innovations, and changes in demand and consumer preference.² These changes in regional comparative advantage result in the uneven distribution of economic activities.

On the micro level, traditional analysis of industrial location has been concerned with the "optimum" spatial distribution of individual firms. All businesses require, to differing degrees, land, labor, public investments and services, and to an increasing extent a desirable environment. Assuming economic rationality, complete information, and a static situation, a firm selects that site at which the proper combination of these production factors results in profit maximization.³ The theory proposes a series of techniques which can be utilized under certain conditions to determine the site where the balance between costs and revenues results in the optimum location.⁴ In actual practice, however, we may not be dealing with the "optimum" location. As August Losch perceptively recognized:

"The location of an industrial enterprise is selected by an entrepreneur. His choice rests upon subjective considerations. He will, of course, bear objective facts in his mind, but these alone cannot dictate location. Thus it is conceivable that under exactly the same external conditions, two entrepreneurs may choose entirely different locations."⁵

Firm location occurs at those sites which, when viewed by an individual entrepreneur, offer the most in terms of the factors of production for his particular manufacturing

process. By the same token, production does not always take place at those locations which seem best purely from an economic point of view. A number of noneconomic factors must also be considered and the decision of an entrepreneur may be swayed by these noneconomic influences.

The assumptions of economic rationality, complete information, and a static situation fail to accurately represent the dynamics of industrial location as practiced in our economy. Also, the distinction between the individual firm approach and the more aggregate analysis in reality is not as clear cut as the theoretical framework indicates. There is no dividing line which distinguishes the impact of these approaches on firm location. Depending upon the type of industry and the character of the decision-maker, the selection of a production site in actual practice is influenced collectively by:

- 1) The locational preferences of consumers and producers.
- 2) The requirements of the production process.
- 3) The interdependence of locations.

In seeking to locate, an individual entrepreneur examines the relationship of a particular region's comparative advantage to his manufacturing process and personal needs. He analyzes the area's transportation system, its supply of labor, the existence of related and supporting activities, potential market areas, local suppliers, and the general environment.

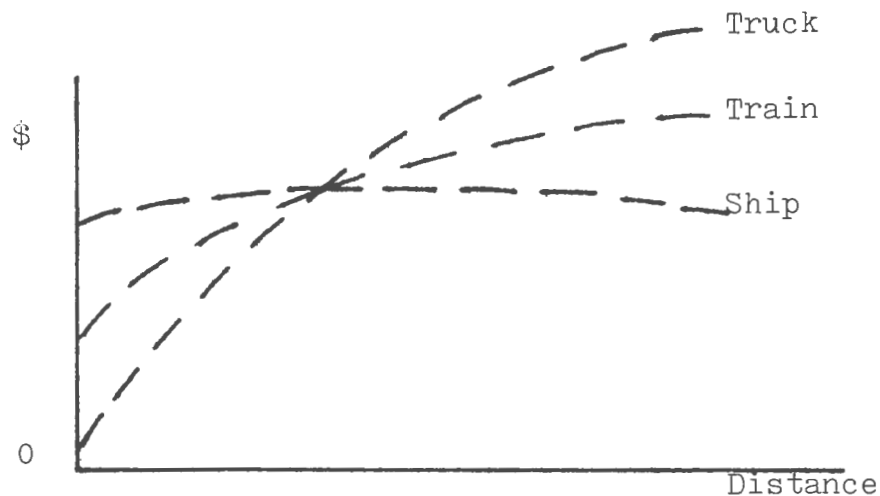
TRANSPORTATION

Transportation considerations are of fundamental importance to the spatial organization of regions as well as within them. The denser the transportation network the less roundabout transfer required and the cheaper the cost of shipping. The cost required for transporting goods over distances is a major determinant in the interchange of various items between regions.⁶ If such costs are high, each area may develop its own products to be consumed locally. If these costs are low, a great deal of trade may occur.

The first element to emerge in examining the structure of transport costs is the large variety of transfer mediums; ship, truck, air, rail, and so on. The shipper chooses the carrier with the lowest cost for the distance intended.⁷

Figure I shows the relation of cost to distance when alternative carriers are considered.

FIGURE I



SOURCE: William Alonso, "Location Theory," in Regional Policy - Readings in Theory and Applications, ed. John Friedman and William Alonso, (Massachusetts: The MIT Press, 1975), p. 40.

Although in all cases the costs of transporting goods increases with distance, they do not increase in direct proportion.⁸ This is because there are terminal and packaging costs resulting in lower rates for longer hauls. It is cheaper to make one 1000 mile trip than to make two 500 mile trips. In addition to distance and mode, rates differ by commodity, direction shipped, region of the country, size, and weight. Just as it is cheaper to rent by the month than by the week, transfer costs per pound decrease as the weight of the shipment increases. Bulky items, however, cost more per ton than easily stored items. Goods which require additional handling such perishable, fragile, and dangerous commodities also command higher rates. Differences in rates often depend on the direction of travel. It may be cheaper to ship in the direction of lighter traffic since the fixed costs to the transfer agency remain the same regardless of load.

Transportation considerations have traditionally been a principal factor in industrial location analysis. The procurement of production inputs and the distribution of outputs depend directly upon a means of transporting goods and services from one point to another.

All firms, however, are not equally dependent on locating at the point where total freight costs are lowest. Transport-oriented industries are those which find transportation costs of paramount importance in selecting a location.⁹ Such firms generally tend to produce high bulk-to-value ratio products.

Industries which are primary product-oriented (weight losing) tend to locate nearest the source of dominant material. This is the result of the savings in shipment costs which accrue from transporting lighter and less bulky items. If the production process requires multiple weight-losing materials, than a firm selects a site where total transport costs are at a minimum.

A similiar situation exists for industries which produce weight-gaining products. Such firms tend to be market-oriented. Locating close to the product's final destination will save the higher costs of shipping heavier items.

While generally true, this brief explanation simplifies the relationship of transportation to producing enterprises. First, there is no one point where transport costs for all modes are lowest. Second, for all activities the costs of transporting materials must be balanced with other inputs into the production process. Therefore, in actual practice an enterprise must consider the cost of shipping by available mediums with the cost and supply of the other factors of production at a particular location.

AGGLOMERATIONS

Agglomerations refer to a clustering of activities and people which result in external economies that are available to firms in their transactions.¹⁰ Those industries which operate in agglomerations enjoy savings in costs which arise from close proximity to these activities. These

savings may be the direct result of the price and delivery reliability of production materials and finished products, quick and easy communication with business relations, ability to reach wider market areas and draw on a larger number of suppliers, and so on.

In discussing agglomerations it is useful to distinguish between internal and external agglomerations for producers of similiar goods and services and those for producers of different goods and services. Alfred Weber has delineated three categories of agglomerations:

- 1) Simple enlargement of a firm, bringing into existence economies of large scale production.
- 2) Local association of several firms presumably of the same industry, which encourages the development of technical equipment and facilitates the sale of the finished product.
- 3) Aggregation of activities of unrelated as well as related types which leads to conditions which are more favorable to any single firm or group than they could develop for themselves. ¹¹

Agglomerations for similiar goods and services are both horizontal and vertical. Horizontal factors are advantages which accrue through such activities as advertising and the ability to exchange technical and product innovations. Vertical agglomerations deal with the inputs into the production process and the distribution of the final goods. Often firms of the same industry locate in close proximity to each other to share the benefits of specialization. Such external economies manifest themselves in the linkages between firms manufacturing similiar or re-

lated products.¹²

Agglomeration economies for industries producing different goods and services occur from both inside and outside the private sector. The principal advantages, often called urbanization economies, are such things as the availability of financing and the cost of borrowing, communication facilities, rents, housing, size of market areas, educational and recreational facilities, power costs, taxes, police and fire services, and local governmental regulations.

Generally speaking, decreases in the scale of production implies a reduction in self-sufficiency and an increasing reliance on external activities. Therefore, smaller establishments appear to have stronger connections with local agglomeration economies. This suggests in turn that as the size of the establishment increases, external economies exert a weakening locational pull. Those industries which are highly dependent upon the benefits of agglomeration economies will have a stronger incentive to locate at sites where these advantages are most prevalent.

LABOR

The productive capacity of an economy in a given period in time is largely influenced by the available supply and quality of land, labor, and capital. With a fixed quantity of capital and land and a given state of technology (none of which vary in the short-run), the level of production will be determined by the size and quality of the labor force and how fully it is utilized.

In examining the operation of the labor market, emphasis is generally placed on market supply and demand.¹³ The labor requirements of all employers in a region and the wages they pay constitute the demand side of the labor market. An area's level of economic development, industrial mix, and state of technology are the principal determinants of demand. The level of economic development and industrial mix dictate the composition of that demand. The existing technology determines the types of skills and education required by the local industry. As the technology becomes more complex and productive, labor requirements and work patterns change, job contents shift, and therefore the skills demanded by the economy must adjust.

The major determinants of labor supply are population size and composition and the labor force participation rate. The greater the size of the population the larger the pool of labor from which to draw workers. The composition of the population dictates the types of skills available for prospective employers. The labor force participation rate is defined as the proportion of individuals sixteen years or older that are active in the labor force, either as workers or as job seekers. The greater the percentage of the population in this category the greater the supply of labor.

The extent to which labor enters into the production process of an individual firm depends on the type of product that is being produced, the technology that is being used, and the relative prices of labor compared with the

other factors of production. In certain activities the need for and the existence of an adequate supply of professional, skilled, unskilled, or dependent labor may be the dominant element influencing plant location.¹⁴ Concentrations of certain industries may foster the development of a labor force particularly productive in those jobs which that industry requires. Thus workers skilled in particular tasks may be found in large numbers where that industry is well established.

The major factors of location which have just been reviewed do not operate in isolation. The value of a particular site to any firm may depend upon the quality and accessibility of existing transportation facilities, which in turn are a factor of the forces of agglomeration economies, which may be the result of the resource endowment which has been influenced by changes in technology and tastes. In addition, it is rare that industrial location is determined by any one single element. Just as these forces are highly interrelated, their influence in determining spatial organization is cumulative. That is to say it is all these forces working together, though with varying degrees of importance for different firms, that mold the spatial distribution of activities.

With this in mind we can now examine the jewelry industry and analyze how these factors have collectively influenced its spatial distribution. Chapter Two looks at the industry's historical development, performance re-

quirements, and production process in order to uncover those forces which are most important as causes of location.

FOOTNOTES--CHAPTER I

¹See August Losch, Economics of Location, trans. William H. Woglom and Wolfgang Stapler (New Haven: Yale University Press, 1954).: Edgar M. Hoover, Location of Economic Activity, (New York: McGraw-Hill Book Company, 1948).: Walter Isard, Location and Space Economy, (New York: John Wiley & Sons, 1956).: Alfred Weber, Theory of the Location of Industries, trans. Carl J. Fredrich, (Chicago: University of Chicago Press, 1929).: F. E. Ian Hamilton, ed., Spatial Perspectives on Industrial Organization and Decision-Making, (London: John Wiley & Sons, 1974).

²Harvey Perloff and Lowdon Wingo, Jr., "National Resource Endowment and Economic Growth", in Regional Policy - Readings in Theory and Applications, ed. John Friedmann and William Alonso, (Massachusetts: The MIT Press, 1975), p. 315.

³William Alonso, "Location Theory", in Regional Policy-Readings in Theory and Applications, ed. John Friedmann and William Alonso, (Massachusetts: The MIT Press, 1975), p. 54.

⁴The major simplifying conditions are 1) that there is a single county, 2) we are dealing with a single product, 3) the sources of raw materials are known, 4) the locations and size of markets are known, 5) labor is geographically fixed, and 6) transportation costs are a function of weight and distance.

⁵Losch, op. cit., p. 4

⁶Walter Isard, Location and Space Economy, (New York: John Wiley & Sons, 1956), p. 27.

⁷Alonso, op. cit., p. 40

⁸Ibid., p. 41

⁹Ibid., p. 57

¹⁰Edgar Hoover, Location of Economic Activity, (New York: McGraw-Hill Book Company, 1948), p. 23.

¹¹Alfred Weber, Theory of the Location of Industries, trans. Carl J. Fredrich, (Chicago: University of Chicago Press, 1929), p. 101.

¹²Hoover, op. cit., p. 25.

¹³The discussion is a simplified explanation of the actual market operation. In actuality there are various labor markets and different levels of demand for labor. For further reading see: C. Glyn Williams, Labor Economics, (New York: John Wiley & Sons, 1970).: Juaneta M. Kreps, Gerald G. Summers, and Richard Perlman, Contemporary Labor Economics: Issues, Analysis, and Policies, (California: Wadsworth Publishing Company, 1974).: Peter B. Doeringer and Michael J. Peore, Internal Labor Markets and Manpower Analysis, (Massachusetts: D.C. Heath & Company, 1971).: Sor A. Leviton, Gorth L. Mangum, and Ray Marshall, Human Resources and Labor Markets, (New York: Harper & Row Publishers, 1976).

¹⁴Dependent labor is defined as those workers who are not the primary breadwinners and who often work to supplement the family income. These persons often do not regard attachment to a job as their primary responsibility. From time to time they may remove themselves from the labor force to satisfy other more demanding needs.

CHAPTER TWO:

THE JEWELRY INDUSTRY AND ITS LOCATION

In 1805 the embryonic jewelry industry in Rhode Island employed thirty people.¹ By 1975 this industry had matured to include 1,055 firms employing in excess of 27,000 workers making it the single largest manufacturing activity in the State.² Today the smallest state in the union is the nation's largest producer of Body or Costume jewelry. The major segments of the local industry are divided into the following Standard Industrial Classifications:³

1. Costume Jewelry: This is the low and the medium priced sector of the jewelry industry. This activity utilizes precious metals in combination with base metals, often adorned with imitation stones and pearls. The seat of the Costume Jewelry Industry is the Greater Providence Area, Rhode Island. Substantial segments are also located in the New York-New Jersey Area and more recently a smaller concentration has developed in the Los Angeles Region.

2. Jewelry and Precious Metal: The Jewelry and Precious Metal industry utilizes alloys of precious metals, usually platinum and gold, often adorned with precious stones and pearls. The development of this activity has centered in

the Mid-Atlantic Region, most predominately in New York which in 1972 supported nearly one-third of the nation's 1,524 firms.⁴

3. Jeweler's Materials and Lapidary Work: The manufacturers of finished products, in both the Precious Metal and Costume Jewelry segments, often buy semi-finished parts from specialized jobber shops. This group of suppliers includes findings manufacturers, assemblers, castors, electroplaters, polishers, solderers, stone cutters, faceters, and engravers.

As the United States has grown and prospered over the past three and one-half centuries, the jewelry industry has developed and expanded with it. In 1972 the industry employed 74,500 people in 3,163 firms across the country.⁵ The distribution of this growth is concentrated in a relatively small geographic area as shown in Table I. Collectively the Northeast supports 73 percent of the nation's jewelry firms and 80 percent of its employment. More specifically, Rhode Island and New York dominate with 1,877 of the country's 3,163 businesses, or 60 percent.

HISTORICAL DEVELOPMENT

Jewelry manufacturing in the United States dates back centuries before the discovery of America in 1492. Indigenous Indians used bits of ivory, bone, and metal for body ornamentation and for insignias indicating standing in the tribe.

The modern jewelry industry traces its roots back to the 1600's. The early Dutch settlers to the New World imported

TABLE I: 1972 GEOGRAPHIC DISTRIBUTION OF
JEWELRY MANUFACTURERS

AREA	TOTAL FIRMS	TOTAL EMPLOYMENT
NEW ENGLAND	836	35,000
Rhode Island	655	21,000
Massachusetts	136	9,500
MID-ATLANTIC	1471	24,200
New York	1240	17,800
New Jersey	123	4,200
BALANCE OF NATION	856	15,300
TOTAL	3,163	74,500

SOURCE: U. S., Department of Commerce, Bureau of the Census, 1972 Census of Manufacturers, vol. II, Industry Statistics, pt. 3.

their customs and lifestyles, including the affinity for jewelry adornment. Broaches, buckles, and rings were an integral part of the popular attire. Gold and silversmithing grew into established activities. These craftsmen became the jewelers, watchmakers, silversmiths, and coppersmiths all rolled into one.

During the next 250 years the industry continued to grow, though sporadically. By 1859 there were nationally 684 firms employing 7,388 workers.⁶ By the end of World War I these numbers had multiplied to 2,569 firms with total employment

approaching 47,000.⁷ New York became the natural center for the production and distribution of jewelry items. Before the Decade of the Depression, New York was the world's largest market for gems and precious stones.⁸ Maiden Lane was the center for the production of Jewelry and Precious Metals in the United States.

By the end of World War II, New York was firmly established as the undisputed King of Jewelry. In 1947 the State supported 1,362 jewelry firms, or 55 percent of the nation's total.⁹ Today, New York remains the largest manufacturer of jewelry products in the country. Its dominance, however, no longer is unchallenged.

In the 25 year period between 1947 and 1972 the number of firms in the United States producing Costume Jewelry, Jewelry and Precious Metals, and Jeweler's Materials and Lapidary Work increased from 2,655 to 2,858.¹⁰ During the same period, New York's share of the total declined from 1,362 to 1,232.¹¹ The year 1939 marked the beginning of an era which was to see Rhode Island's jewelry industry boom to become the nation's largest producer of Costume Jewelry. In 1972 the smallest state had 35 percent of the country's costume jewelry firms and 40 percent of its employment.¹²

The first jewelers appeared in Rhode Island in the mid-1700's before banking had become established in the State. Successful merchants invested their profits in easily identifiable objects which served to deter theft.¹³ As local trade prospered, the demand for silversmiths increased accordingly.

Costume Jewelry, by far the most important sector of the

TABLE II: HISTORICAL DISTRIBUTION OF JEWELRY MANUFACTURING
IN RHODE ISLAND AND NEW YORK

	RHODE ISLAND			NEW YORK		
	1947	1963	1972	1947	1963	1972
COSTUME JEWELRY	232	300	269	429	400	254
JEWELRY AND PRECIOUS METAL	128	120	193	693	780	729
JEWELER'S MATERIALS AND LAPIDARY WORK	135*	160*	165	240	265	249
TOTAL	495	580	627	1,362	1,445	1,232

*Estimates

SOURCES: U.S., Department of Commerce, Bureau of the Census,
Census of Manufacturers, 1947, 1963, 1972.

local industry, began with the manufacturing of silver and gold shoe buckles. Such items were very costly and appealed only to the few extremely wealthy who could afford such luxuries. Efforts to expand the market were rewarded in 1794 when Nehemiah Dodge discovered a technique of gold plating copper and brass.¹⁴ This created a product which attracted large numbers of buyers and the industry began to rapidly expand.

Within 80 years, 133 firms were in operation in the State employing 2,667 people.¹⁵ Most of the industry's early growth centered in Providence as demonstrated by the fact that 129 of the 133 enterprises in 1875 were located in the capitol.¹⁶

Aided by the supply of inexpensive labor provided during the late 1800's to the early 1920's by immigrants arriving from Europe, the Rhode Island industry continued to grow.¹⁷ An event which heralded the State's burgeoning strength as a center for jewelry manufacturing was the founding of the

Manufacturing Jewelers and Silversmiths of America (MJ & SA) in Providence in 1903. This agency is a trade association providing a number of services to the industry.

By 1921 Rhode Island supported 268 jewelry firms employing 6,885 workers.¹⁸ Throughout the remainder of this century Rhode Island's industry has continued to expand. Between 1950 and 1976 the State's manufacturing employment declined from 148,000 to 122,400.¹⁹ During the same period employment in the jewelry industry grew from 19,900 to 26,900.²⁰ In the years 1970 to 1976 total civilian employment in Rhode Island increased 5.4 percent compared to 35.2 percent for the jewelry industry.²¹

Although Costume Jewelry is classified by the Bureau of the Census as "Miscellaneous Manufacturing," it is anything but miscellaneous in its importance to Rhode Island. The next section of this chapter examines the industry's production process and requirements to uncover those factors which result in Rhode Island's competitive advantage in the manufacture and distribution of jewelry products.

LOCATION OF THE RHODE ISLAND JEWELRY INDUSTRY

In 1875, 98 percent of Rhode Island's burgeoning jewelry industry was located in Providence. Today this pattern of concentration remains essentially unchanged. Almost 80 percent of the State's firms listed in the 1977-1978 Buyers' Guide are located in Providence or adjoining cities. The clustering of these plants in one geographic area appears to stem from the industry's dependence on the existence and development of ag-

TABLE III: JEWELRY EMPLOYMENT BY FIRM

1935 (April) AND 1975 (First Quarter)

1935 Establishments Employing	N	%	1975 Establishments Employing	N	%
2- 20 workers	84	49.7	0- 49 workers	325	77.6
21- 50 "	43	25.4	50- 99 "	46	11.0
51- 100 "	22	13.0	100-249 "	36	8.6
101- 200 "	13	7.7	250-499 "	5	1.2
201- 300 "	2	1.2	500 & over	6	1.4
301- 500 "	3	1.8			
501-1000 "	2	1.2			
Total Establishments	169			419	

Source: The Providence Community Center, Preliminary Report on the Jewelry Manufacturing and Silverware Industries in Rhode Island. Quoted from, "Rhode Island Jewelry Industry - Perspectives on Development and Reform," Mimeograph by Douglas Johnson, 1976, p. 11.

Note: Statistics in table are for City of Providence only.

glomeration economies. Jewelry manufacturing is traditionally comprised of small and medium sized firms. In 1975, as shown in Table III, 88.6 percent of all plants located in Providence had under 99 employees. The Rhode Island industry average for 1973 was under 25 employees per firm.²²

Agglomeration economies exert a strong influence on firms of small scale production. Such economies appear to manifest themselves for the jewelry industry in horizontal and vertical linkages between firms and activities producing similiar and related goods and services, and an adequate supply of labor.

AGGLOMERATIONS OF ACTIVITIES PRODUCING RELATED GOODS

Jewelry production entails a number of specific tasks leading to the construction of the finished good. Today there are two basic methods of jewelry manufacturing. Parts are "Stamped" with a press from flat stock, wire, and tubing or they are "Cast" by pouring liquid metal or some other base material into molds made of bronze, rubber or plastic.

Once the basic ornaments or findings that comprise the body to the jewelry piece are made, the next series of operations assembles these pieces into the finished stem. This may be done in one of two ways. Mechanized assembly uses rivets, screws, and springs to attach the pieces together. Soldering requires the use of a hand torch or iron to weld one piece to another.

Depending on the metals used and the final effect desired, finishing operations vary. Precious metals such as gold and platinum require only a polishing. Bimetal products, gold-filled and gold plated, go through a two stage finishing process. After polishing, the piece is given a quick electroplating both to color it as desired and to hide any raw edges.

In less expensive jewelry made of brass, tin, or other base metal it is customary after the part has been polished to place electroplated coatings of different types on the surface. The final coat is generally a precious metal.

In very inexpensive jewelry and novelty items, finishing may be a light electroplating, polishing followed by a coating of clear lacquer, or vacuum plating which consists of covering the piece with colored aluminum.

The jewelry industry is supported by a large network of firms which specialize in one or more of these inputs into the production process. Well over one-half of the 1,500 firms listed nationally in the Manufacturing Jewelers and Silversmiths of America's 1977-1978 Buyers' Guide specialize in such specific tasks as assembling, casting, electroplating, polishing, soldering, findings manufacturing, enameling, and engraving. Subcontracting out several of these tasks is a prevalent practice. These vertical linkages between firms producing similar and related goods is perhaps the most distinguishing feature of the jewelry industry. Their existence is a major factor contributing to an area's competitive advantage for the jewelry

industry, thus encouraging the spatial clustering of these activities in a few select geographic areas.

Horizontal agglomerations for the jewelry industry consist predominately of advertising and the ability to exchange product and technical information. Jewelry manufacturing is sensitive to rapid changes in styles and production processes. To remain competitive in this volatile industry, firms must be able to quickly change production in response to shifts in demand.

The establishment of the Manufacturing Jewelers and Silversmiths of America in Providence in 1903 contributed to Rhode Island's growth and development to a position of prominence in the industry by providing services available to all firms. Every two years this organization publishes a Buyers' Guide which lists all the members across the nation (currently it has 1,507 registered members) and identifies them by location, types of merchandise manufactured, distribution methods, product quality, and approximate retail selling price. In addition, they provide insurance programs at prices well under what individual firms could obtain elsewhere; they publish a monthly magazine, America Jewelry Manufacturer, which supplies readers with the latest information on manufacturing techniques and processes, translations of the most recent governmental rulings and regulations, and general news of the industry; they provide vocational and educational training programs; they furnish a lobbying service in Washington D.C.; and they sponsor such large, industry-wide undertakings as the Manufacturing Jewelers'

Suppliers and Equipment Exhibition in New York, the Providence Convention and Industrial Exposition, and the United Jewelry Show in Providence and New York.

One of the MJ & SA's most successful projects has been the founding of the Jewelers Shipping Association (JSA). This non-profit organization insures transported valuables at their full cost and is able to ship at 15 percent lower than Interstate Commerce Commission common carrier rates. It is currently estimated that 90 percent of the jewelry products and materials transported in the Rhode Island-Massachusetts region are handled by the JSA.²³

AGGLOMERATION OF LABOR

Because jewelry is actually a federation of industries producing hundreds of items from many materials, the different skills required are numerous. The adequate supply of labor is a major factor in the growth and development of this industry.

Jewelry manufacturing is a labor intensive activity requiring an abundance of unskilled and semi-skilled workers. According to James P. O'Donnell, Director of Education and Training of the Manufacturing Jewelers and Silversmiths of America, approximately 80 percent of the present work force is unskilled and semi-skilled.²⁴ Generally these occupations require little or no training and special knowledge. The principal requisites for the unskilled tasks are finger dex-

terity and good hand and foot coordination. Typical jobs in this category include press operators, linkers, and carders. Semi-skilled occupations such as polisher, solderer, tool-setter, and annealer require a superficial knowledge of metals and use of hand tools and lathes.

During the late 1800's to the early 1920's this supply of labor was provided by the immigrants who had recently arrived from Europe. As the number of foreigners entering the country began to decline, the industry turned to women, who currently comprise 60 percent of all employees.²⁵

The existence of a large home work industry in Rhode Island (both legal and illegal) has enabled many manufacturers to minimize their production costs by eliminating certain overhead and other operating expenses. This is accomplished by distributing specific jobs to people who agree to work at their homes at reduced rates. The subcontractor avoids the costs associated with providing a work environment and fringe benefits while the laborers collect tax free wages.

Cheap labor, however, is only one side of the labor coin. Skilled jobs in jewelry plants consist of a high degree of hand craftsmanship (i.e. jeweler, ring-maker, stone and diamond setter, engraver), or require a high degree of technical information (i.e. toolmaker, electroplater, assayer, mechanical and chemical engineers). This is in addition to the artistic and managerial occupations.

Skilled jobs in jewelry industry consist of two principal

types; first the modern counterpart of the gold and silver craftsman of old; and second, the highly skilled jobs that have been adapted to jewelry production. Most of these jobs demand years of training and development. Concentrations of the jewelry industry have fostered the evolution of a labor force which is particularly productive in these tasks.

Collectively, it appears that agglomerations of related and supporting activities plus a good supply of unskilled and highly skilled labor go a long way in explaining the Rhode Island jewelry industry's present location and development to a position of national prominence. However, to return to an earlier quotation by August Losch, "The location of an industrial enterprise is selected by an entrepreneur."²⁶ In actual practice, therefore, the question must be asked whether businessmen do, in fact, utilize the rationale and techniques presented by the traditional theory. Many, of course, do not. The choice of a production site is influenced by an infinite number of variables, many of which remain outside the formal theory and are unquantifiable. For example, how much is it worth to have access to a good tax lawyer, or to be able to spend free time with family, or to do business with school friends? It is not only difficult to quantify these advantages, it is often difficult to identify them.

The next step in this investigation examines the local competitive advantage as seen by the individual entrepreneur.

This stage focuses on a mail survey of 148 of Rhode Island's jewelry firms.

SURVEY TECHNIQUE

The type of sample utilized in this study is a Stratified Random Sample. This method involves the drawing of samples separately from subgroups of the total population. Table IV illustrates this technique. The number of firms listed in the Buyer's Guide in each category is tallied, and their percentage of the total number is then computed. This proportion determines the number of samples each subgroup experiences. For example, Manufacturing Jewelers comprise 50.7 percent of the 602 Rhode Island firms listed. This category would therefore consist of 50.7 percent of the sample size 150, or a total of 75.

SURVEY RESPONSES

During the summer of 1977, 148 questionnaires were mailed to local jewelry firms. By September, 38, or 27 percent of those surveyed, returned the completed forms. In terms of size of operation, the responses corresponded generally with the data on Table III. Over 76 percent of the surveyed firms employ less than 99 people, compared with 88.6 percent for the City of Providence. This difference may be attributed to the tendency of larger firms to locate outside of Providence more

TABLE IV: STRATIFIED RANDOM SAMPLE METHOD

CATEGORY	TOTAL #	FIRMS		SAMPLE SIZE
			% OF TOTAL	
Manufacturing Jewelers	305		50.7%	75
Table Ware	16		2.7%	4
Electroplaters	80		13.3%	20
Enamelers	18		3.0%	4
Engravers	4		0.6%	1
Findings Manufacturers	108		17.9%	27
Polishers	27		4.5%	6
Refiners	10		1.7%	3
Solderers	16		2.7%	4
Stone Dealers	18		3.0%	5
TOTAL	602		100.0%	148**

** 148 total due to rounding off.

frequently than small businesses.

Questions 3, 4, and 5 of the questionnaire (which is re-

produced in Appendix A) serve principally to test data which maintains that a high percentage of the labor force is unskilled, the basic raw materials are purchased locally, and the range of the industry's markets extends throughout the United States and the world.

As shown on Table V, 62 percent of the work force are laborers and operatives. These are predominately unskilled and semiskilled occupations which require a limited amount of training. Craft & Kindred and Management & Administration comprise 20 percent of the labor force of the surveyed firms. These categories generally demand extended training and development, often including up to a five-year apprenticeship.

TABLE V: EMPLOYMENT BY CATEGORY

CATEGORY	NUMBER	PERCENTAGE
Management & Administration	158	7%
Clerical	199	9%
Service	118	5%
Sales	107	4%
Craft & Kindred	289	13%
Operative	399	17%
Laborer	1017	45%
TOTAL	2287	100%

Table VI demonstrates that gold and brass are the principal raw materials used in the production process of responding firms. Platinum appears to be of lesser importance than previously assumed, while sterling silver was included in the "other" category twelve times. A quick review of the table indicates clearly that these material inputs are purchased predominately within Rhode Island, and almost totally within the New England Region.

TABLE VI: MAJOR MATERIALS AND LOCATION PURCHASED

MATERIAL	FREQUENCY LISTED	% PURCHASED IN RI	% PURCHASED IN NEW ENGLAND	% PURCHASED IN U.S.
Gold	20	65%	30%	5%
Lead	11	82%	18%	-
Tin	10	82%	9%	9%
Copper	11	60%	30%	10%
Brass	19	79%	10%	5%
Silver	12	42%	58%	-

Table VII illustrates the market range of the surveyed firms. It is evident from these responses that the local jewelry industry is an export activity. While almost one-half of the enterprises do some business locally, over two-thirds sell to

markets throughout the country and 45 percent sell internationally.

TABLE VII: MARKET RANGE OF SURVEYED FIRMS

MARKETS	# OF RESPONSES	% OF SURVEYED FIRMS RESPONDING
Local	16	42%
New England	14	37%
Eastern U.S.	13	34%
United States	26	68%
Internationally	17	45%

Question number 6 - "Rank the following factors (1,2,3) in terms of their importance to your firm's operation and success in Rhode Island" - was designed to uncover specifically the factors of location dynamics that are viewed as most important for the local jewelry industry by individual entrepreneurs.

The supply of labor, both skilled and unskilled, emerges as the principal advantage which Rhode Island offers local businesses. Nineteen firms rated labor as the single most important element. Collectively, cheap labor and skilled labor account for 39 percent of the total responses to this particular question.

TABLE VIII: THE MOST IMPORTANT ADVANTAGE RHODE ISLAND OFFERS AS A LOCATION FOR SURVEYED FIRMS

PERCEIVED ADVANTAGE	RANK			TOTAL
	1	2	3	
Supply of Inexpensive Labor	9	9	7	25
Supply of Highly Skilled Labor	10	3	2	15
Proximity of Markets	6	3	2	11
Proximity of Materials	2	8	9	19
Proximity to Related Firms and Activities	8	7	5	20
Existence of a Good Transportation System	1	5	5	11
Other	1	0	0	1

A distant second to labor is the proximity to related jewelry firms and activities. This category includes the supportive shops which specialize in various activities of the manufacturing process. The linkages between these firms manufacturing similar or related products is supported by the high percentage of business which occurs locally as shown in Table V. The existence of these agglomerations was listed twenty times as one of the top three advantages which Rhode Island offers.

A third factor which emerges as being significant is the proximity to raw materials. As previously noted, the large

majority of important material inputs are purchased within the State. Though only two firms consider the proximity to these inputs of primary importance, a number perceive it as a strong secondary factor. This may be due to the fact that the jewelry industry is very sensitive to rapid changes in styles and tastes. The close proximity to these materials allows firms to maintain small inventories which enables them to quickly accomodate changes in demand.

The existence of a good transportation system and the proximity to markets are seen by local firms as less critical elements in their production process. This may be explained in part by the fact that finished products in jewelry manufacturing contain a high value-to-bulk ratio. The acquisition and the distribution of these factors represent a small portion of the total production costs. Therefore these elements are not perceived as major determinants of location.

Table IX illustrates the relationship of these factors just examined to the size of the firm. All firms responding to the survey, regardless of size, view the local supply of unskilled and therefore cheap labor as a major local competitive advantage. The term cheap in this instance is relative. Unskilled labor in other regions of the country may be provided at rates lower than those historically offered in New England. The difference, however, lies in the availability of unskilled labor combined with other local advantages, and labor's price relative to the capital investments of machinery.

TABLE IX: ADVANTAGES BY FIRM SIZE

PERCEIVED ADVANTAGE	SMALL 0-49 Emp.		MEDIUM 50-99 Emp.		LARGE 100+ Emp.		TOTAL	
	#	%	#	%	#	%	#	%
Supply of Inexpensive Labor	13	25%	5	22%	7	26%	25	25%
Supply of Highly Skilled Labor	5	10%	6	26%	4	15%	15	14%
Proximity to Markets	8	15%	1	4%	2	7%	11	11%
Proximity to Materials	9	17%	4	17%	6	22%	19	19%
Proximity to Related Jewelry Firms and Activities	9	17%	4	17%	7	26%	20	20%
Existence of a Good Transportation System	7	13%	3	13%	1	4%	11	11%
Other	1	2%	0	0	0	0	1	1%
TOTAL	52	99%	23	99%	27	100%	102	101%

Jewelry is a labor intensive activity. During the industry's formative years, the labor participation rate among dependent laborers in the region was sufficiently high to provide an adequate supply of workers. Though the production processes have improved over the past generations, the industry remains characterized by a large number of tasks requiring simple hand skills. The ability to substitute low labor costs for capital investments has been critical to the local industry's competitive position. The high degree of interdependence of firms within the industry has enabled this condition to develop. Firms of large scale production have the capacity to purchase the necessary machinery required for many operations. These same firms are very dependent on the many smaller jobber shops to provide specialized inputs. The smaller jobber shops can operate successfully without buying much machinery by hiring a group of unskilled workers to produce items to sell to the larger businesses. Thus, though unskilled labor may be relatively cheaper in other regions, the industrial infrastructure that has developed in Rhode Island is not available. This analysis seems to be supported by the fact that as the size of the firm increases, the importance of the other local factors examined in reducing overall operational costs appear to weaken. As the scale of production expands, businesses tend to emphasize increases in production and output rather than simply reduction of costs.

Firms employing less than 50 people exhibit the greatest

dependency on outside activities which aid in reducing production costs. The existence of a reliable and inexpensive transport facility (JSA), the proximity to markets, close and easy access to related firms, and the proximity to materials all serve to reduce the acquisition and distribution costs for these specialty shops. Rhode Island offers the opportunity for small shops to enter the market with a minimum of initial capital investment and operating expenses. Highly skilled and highly paid labor is the weakest local advantage perceived by these smaller firms primarily due to its expensive nature.

Medium size firms, those employing 50-100 people, demonstrate similiar responses to the small firms in the categories of unskilled labor, proximity to material and related activities, and the existence of a good transportation system. The differences occur in the importance placed on the supply of highly skilled labor and the proximity to markets. As a business increases in size, it tends to expand and diversify its product line. This creates a greater demand for highly skilled artisans and technicians which incur greater operational costs. The emphasis begins to change from the strict concern for reducing expenses to that of increasing output. The development and supply of a labor force particularly productive in the required tasks is seen as the primary local competitive advantage by medium size firms. The four percent response rate to proximity of markets illustrates these enterprises' minor

concern for the distribution costs of their product. Transportation remains relatively important partly due to cheaper costs, but also because of the local system's efficiency and speed in delivering products anywhere in the country. It is not clear at this stage whether the proximity to materials and related firms is a result of the tendency to maintain lower costs or due to the desire to increase productivity. This trend, however, becomes fully exposed by the responses generated from firms employing over 100 people.

Distribution costs, as represented by the proximity to markets and the existence of a good transportation system, are clearly of minor importance for larger firms. Skilled labor remains a vital concern, but is secondary to the two most influential local advantages; the proximity to materials and the proximity to related jewelry firms and activities.

As previously discussed, jewelry manufacturing is very sensitive to changes in tastes. It is critical for firms of large scale operation to be able to quickly change production in response to shifts in demand. The proximity to the material inputs provides the opportunity to quickly effectuate these changes.

One of the prevalent practices of the local jewelry industry is the subcontracting out several of the specific tasks leading to the final product. A very large percentage of the local business occurring within the state and the New England region (See Table V) is precisely this type of activity. According to the results in Table VII, larger firms are highly dependent

on these developments. In fact, the existence of these smaller shops providing specialized inputs is considered the single most important advantage which Rhode Island offers firms of large scale operation.

In summary, this survey indicates that smaller firms rely on the existence of external activities in order to keep production costs at a minimum. As the scale of production increases, savings from these external economies exert a weakening locational pull. Larger firms are more concerned with maximizing output with the aid of local subcontractors and the proximity to materials.

Rhode Island provides an opportunity and competitive advantage for small firms to enter the market and continue operation. These specialized shops require little capital investment to initiate production. Locally there exists a supply of cheap labor, proximity to required materials, a means to quickly and cheaply transport their goods, and the existence of a local market in the clustering of related jewelry activities to sell the processed product. Larger firms are aided in their production by the large number of small subcontractors, the development of a highly skilled labor force to draw upon, the proximity to materials and the supply of unskilled labor.

Let us now turn to the next chapter which discusses the jewelry industry's importance as an exporting activity and its relationship to the Rhode Island Economy.

FOOTNOTES-CHAPTER II

¹Douglas Johnson, "The Rhode Island Jewelry Industry-Perspectives on Development and Reform," (Mim-eographed, 1976). p. 37.

²Rhode Island Department of Economic Development, Rhode Island Basic Economic Statistics-The Economy, Summary, and Trends 1977-1978, (1977), p. 104.

³Costume Jewelry SIC Code 3961; Jewelry and Precious Metal SIC Code 3911; Jeweler's Materials and Lapidary Work SIC Code 3915. The Rhode Island Jewelry and related industry also includes manufacturers of Silverware and Plated Ware, Watch Part Suppliers, Stone Dealers, and Metal Suppliers.

⁴U.S., Department of Commerce, Bureau of the Census, 1972 Census of Manufacturers, vol. II, Industry Statistics, pt. 3.

⁵Ibid., pt. 3.

⁶U.S., Department of Commerce, Bureau of the Census, Biennial Census of Manufacturers, 1921.

⁷U.S., Department of Commerce, Bureau of the Census, 1947 Census of Manufacturers, vol. II, Statistics by Industry.

⁸George R. Frankovich, The Jewelry Industry, (Providence: Manufacturing Jewelers and Silversmiths of America, n.d.) , p. 10.

⁹1947 Census of Manufacturers, op. cit.

¹⁰U.S., Department of Commerce, op. cit. 1947, 1963, and 1972.

¹¹Ibid.

¹²1972 Census of Manufacturers, op. cit.

- ¹³Johnson, op.cit., p. 10
- ¹⁴Frankovich, op. cit., p. 9.
- ¹⁵Johnson, op. cit., p. 12.
- ¹⁶Ibid., p. 12.
- ¹⁷Ibid., p. 16.
- ¹⁸Biennial Census of Manufacturers, 1921, op cit.
- ¹⁹Rhode Island Department of Economic Development, op. cit., p. 104.
- ²⁰Ibid., p. 104
- ²¹Interview with James P. O'Donnell, Director of Education and Training, Manufacturing Jewelers and Silversmiths of America, Providence, Rhode Island, 22 April 1977.
- ²²Ibid.
- ²³Frankovich, op. cit., p. 20.
- ²⁴August Losch, Economics of Location, trans. William H. Waglam and Wolfgang Stapler. (New Haven: Yale University Press, 1954), p. 4.
- ²⁵Rhode Island Department of Economic Development, op. cit., p. 105.
- ²⁶Ibid., p. 105.
- ²⁷Ibid., p. 106.

CHAPTER THREE:

THE JEWELRY INDUSTRY AND THE RHODE ISLAND ECONOMY

Economic development occurs across the nation in an uneven fashion. That is to say, certain regions in the country develop faster and/or differently from other regions. The Export-Base Theory of economic growth proposes that this unbalanced spatial concentration of economic activities is the result of competition between regions and their abilities to export locally produced goods at a competitive advantage.¹ This concept maintains that the major factor stimulating local economic development is the expansion of an area's export base.

According to the theory, the structure of the economy is divided into two essential activities - the 'Basic' which produces goods and services for export to customers outside of the region, and the 'Non-Basic' production of goods and services for internal consumption. The basic industries are considered as the key to an area's economic vitality. The ability to export generates a flow of money into the region which stimulates internal development. Some of these internal developments are related directly to the export activity. Others manifest themselves in the expansion of local markets for other goods and services. Thus, for example, the growth of the automobile industry in Detroit has resulted in the pro-

liferation of supporting activities which supply direct inputs into the industry. The increased spendable income from expanded employment stimulates demand for new housing, food, recreation, clothing, and other goods and services.

The basic and non-basic elements of regional economic growth are brought together in the concept of competitive advantage. Regions tend to differ by what happens to the income generated from export sales and by the type of development associated with the export sector. Any advantage which a particular region may have vis à vis other regions is, of course, relative.² Improved methods of transfer, labor utilization, material use, changes in production costs, shifts in taste, and so on exert changes in the competitive advantage among regions.

JEWELRY AS AN EXPORT INDUSTRY

The concentration of the jewelry industry in a few select geographic locations clearly indicates its nature as an exporting activity. The survey responses in Chapter Two delineating the market range of the sampled Rhode Island firms further supports this contention. The magnitude to which the industry produces for external consumption, however, may not be fully appreciated. Therefore, to more clearly illustrate the degree to which the industry exports its products, the following section measures the Rhode Island jewelry industry's capacity as an export activity.

The analytic tool which most accurately measures the amount of export business for specific industrial sectors within a region is the Input-Output Table. Since such a Table does not exist for Rhode Island, this analysis utilizes a technique commonly called coefficients of localization, or Location Quotients. The underlying rationale of this method is that: "If a given community is highly specialized relative to the nation in the production of a particular commodity, the product is presumed to be an export item."³

The technique itself is relatively simple. It assumes that the local demand patterns are equivalent to those which exist on a national level.⁴ If Rhode Island is self-sufficient in the manufacture of jewelry products, local employment in the industry will proportionately equal jewelry employment for the nation as a whole.⁵ In other words, if two percent of the United States labor force is employed in jewelry production, then the expected Rhode Island employment in the industry will equal two percent. Suppose, however, that local jewelry employment is three times the proportion which exists on a national scale. In this instance, the Rhode Island economy is considered to specialize in the activity and export two-thirds of its output. One-third is assumed to satisfy local demand.

The Location Quotient formula used to compute the Rhode Island jewelry industry's export status is:

$$\frac{X}{\text{Total R.I. Manufacturing Employment}} = \frac{\text{National Employment in the Jewelry Industry}}{\text{Total National Manufacturing Employment}}$$

Solving for X determines the number of workers which would be employed in the Rhode Island jewelry industry if it produced sufficient amounts to supply its own needs.

The base year for our analysis is 1972. National manufacturing employment for that year reached 18,841,000, while Rhode Island supported 115,900 workers in manufacturing industries.⁶ For the same period, the jewelry industry listed 62,000 employees across the United States.⁷ Assuming Rhode Island is self-sufficient in the production of jewelry goods, expected state employment would equal .0032 of the local labor force, or 381 workers.

$$\frac{X}{115,900} = \frac{62,000}{18,841,000} ; \quad X = 381$$

According to the 1972 Census of Manufacturers, 18,100 people were employed in the State's jewelry industry. Therefore, the Location Quotient method indicates that 17,719 (18,100 - 381) of the local industry's 18,100 workers, or 98 percent, are engaged in exporting.

Having established the approximate magnitude of the jewelry industry's export nature, we must now turn to evaluate its influence of the State economy. The fact that a particular industry is engaged in exporting activities does not

automatically indicate positive local impact. Exports may be described as 'good' or 'bad' for regional economic expansion depending upon their capacity to provide stimulating economic linkages with the local economy. A predominately export industry which is capital intensive and which exhibits weak linkages with the regional economy in itself does little to encourage economic growth. A regional exporter can be described as good based on the degree to which it meets the following criteria:

- 1) Manufactures a product of growing national demand.
- 2) Is characterized by extensive regional forward and backward linkages.
- 3) Has a high regional multiplier.

DEMAND

Over the past forty years, the Rhode Island jewelry industry has grown by leaps and bounds. The most recent available data on the industry shows a yearly high employment for 1977 exceeding 31,000.⁸ This is an increase of 17,200 jobs, or 125 percent, since 1939.⁹ More recently, the industry has expanded by approximately 5,000 jobs in the past thirty months.¹⁰

The industry growth is not limited to the local area. On the national level jewelry manufacturing has continued to expand its markets, though at a somewhat slower pace. In the nine years between 1963 and 1972, the country's jewelry employment increased 15,259, or 33 percent.¹¹ More signi-

ificantly, however, has been the growth of value added by manufacturing and the total value of industry shipments.

TABLE X: GROWTH OF THE U.S. JEWELRY INDUSTRY FOR SELECTED YEARS 1947, 1963, AND 1972

YEAR	VALUE ADDED BY MANUFACTURE (\$ MIL)	VALUE OF INDUSTRY SHIPMENTS (\$ MIL)	TOTAL EMPLOYMENT
1947	258.5	448.8	52,736
1963	402.1	827.5	46,741
1972	928.9	1,921.8	62,000

SOURCE: U. S. Department of Commerce, Bureau of the Census Census of Manufacturers, 1947, 1963, 1972.

The large increases in value added compared to employment in the years 1947-1972 indicate the improved productivity of the industry since World War II. Combined with a quadrupling in the total of merchandise shipped, the above figures illustrate the continued growth and expansion of the demand for jewelry items. The importance to the State economy of jewelry manufacturing's continued vitality manifests itself in the linkages which the industry has established locally.

LINKAGES

The second criteria for determining a good export activity

is the forward and backward linkages which the industry maintains with the local economy. Perhaps the most distinguishing feature of jewelry manufacturing is its dependence upon and its support of a host of related enterprises which supply specific inputs into the production process. For analytic purposes, this paper has defined the jewelry industry as specifically comprised of three Standard Industrial Classifications: SIC 3961, Costume Jewelry; SIC 3915, Jeweler's Materials and Lapidary Work; and SIC 3911, Jewelry and Precious Metals. Within Rhode Island, however, there are a series of related activities which comprise the jewelry manufacturing infrastructure and contribute greatly to Rhode Island's competitive advantage.

REGIONAL MULTIPLIER

The 216 firms in Table XI on the following page represent development which is directly related to jewelry manufacturing. They do not indicate the indirect linkages which the industry creates. These indirect linkages determine the level of the industry's regional multiplier. Multipliers may be defined as that proportion of the return from the export sector which finds its way into active demand for regional goods and services.¹²

A rigorous analysis which traces the specific linkages and multipliers of the jewelry industry within the Rhode Island economy is available in Input-Output analysis. As previously mentioned, this data does not exist for the Rhode Island economy. However, the labor intensive nature of jewelry manufacturing may provide an indirect measurement of the industry's regional multiplier.

TABLE XI: RELATED ACTIVITIES TO JEWELRY MANUFACTURING IN RHODE ISLAND
1977-1978

ACTIVITY TYPE	NUMBER OF FIRMS
Boxes, Cases, Cards & Displays	56
Brazing Alloys, Flux & Mill Products	9
Casting Equipment & Suppliers	58
Electroplating Equipment & Suppliers	21
Stone Dealers & Misc. Suppliers	46
Watch Part Suppliers	26
TOTAL	216

SOURCE: Manufacturing Jewelers and Silversmiths of America, 1977-1978
Buyers' Guide, (Providence: 1976).

The Rhode Island jewelry industry reported total wages of \$234,142,269 for the year ending December, 1976.¹³ Let us suppose that 50 percent of this income is spent locally on goods and services.¹⁴ This is called the "propensity to consume locally." (The remaining 50 percent of the income may be divided among savings, taxes, and goods purchased outside of the region.) Now, the total propensity to consume locally does not necessarily become local income. A portion of the money may bring in merchandise from outside of the

State, may go as wages to non-residents, or may support other non-local sources. Suppose that 40 percent remains as local income. Therefore, out of every dollar of local income, 50 cents will be spent locally on consumer goods and services, and 40 percent of this 50 cents, or 20 cents, remains local income.

This, however, does not complete the process of income multipliers. The 20 cents additional local income will again be spent locally by consumers, creating increased local income; and so on and so on. A multiplier formula which can compute the successive rounds of income generated by the original export dollar is:

$$\text{TOTAL INCOME} = \text{EXPORT INCOME} \times \frac{1}{1 - (.5 \times .4)}$$

1- (propensity to consume locally X income created per dollar of local consumption sales).

The application of this equation is much less complicated than at first may appear. As discussed earlier, 98 percent of Rhode Island jewelry production involves exporting. Therefore, 98 percent of the industry's total wages, \$234,142,269, equals export income; \$229,459,410.

Utilizing the figures on local income discussed above, the second term on the right hand side equals:

$$\frac{1}{1 - (.5 \times .4)} = \frac{1}{1 - .2} = 1.25.$$

Therefore:

$$\text{Total income} = \$229,459,410 \times 1.25 = \$286,823,750.$$

Forgetting for a moment the direct benefits and other indirect linkages which the Rhode Island jewelry industry maintains with the State economy, employment in this activity generates \$286,823,750 of local income. The bulk of this money is from external sources, injecting new dollars into the local economy. While this analysis was not intended to represent a rigorous examination of the jewelry industry's relationship to the State economy, it clearly indicates its influential position. The industry's income flow combined with the expanding demand for jewelry products contains important implications for the future economic development of Rhode Island.

This study thus far has concentrated on the economics of the Rhode Island jewelry industry. We have studied its historical development, examined the State's competitive advantage for jewelry production, and analyzed the industry's relationship to the local economy.

Assuming that external forces cause the forced closing of electroplating firms in the State, the impact on the economy will far exceed the first round losses of employment. Second round effects may be felt most severely by related jewelry enterprises which depend upon these jobber shops for specialized inputs. As this process continues, the local competitive advantage will slowly erode, as more and more small shops are forced to close. The ultimate loser will,

of course, be the Rhode Island economy. The loss of a growing industry which brings in million of dollars of related business would prove a very severe blow to the state's future development.

The external force of which we are speaking is the Water Pollution Control Act Amendments of 1972. The following two chapters of this study examine the Federal Act, including a discussion of legislative requirements, intent, enforcement procedures, and relationship to the jewelry industry. These sections attempt to bridge the gap of understanding between the economists and the environmentalists. Once the problem has been properly defined, only then can proper steps be taken to eradicate it.

FOOTNOTES-CHAPTER III

¹Harvey Perloff and Lowden Wingo, Jr., "National Resource Endowment and Economic Growth," in Regional Policy-Readings in Theory and Applications, ed. John Friedmann and William Alonso (Massachusetts: The MIT Press, 1975), p. 316.

²Ibid., p. 317.

³Charles M. Tiebout, The Community Economic Base Study, (New York: Committee for Economic Development, 1962), p. 47.

⁴The principal assumption underlying the Location Quotient technique is that local residents have the same demand patterns which prevail on the national level. The nature of demand for jewelry products appears to be consistent with this statement. A second common criticism directed towards this method arises from the possibility that the study area may be more or less productive than the national average in output per employee. This problem, however, is easily solved by examining data on value added. According to the 1972 Census of Manufacturers, the industry value added average per employee for 1972 was \$14,982, compared to \$14,104 for New England and \$15,349 for the Mid-Atlantic region. This difference may be attributable to the concentration of precious jewelry production in New York compared to costume jewelry manufacturing in Rhode Island. Adjusting for the deviation would indicate that our analysis of Rhode Island's exporting nature may be overstated by as much as six percent; an insufficient degree to invalidate our analysis.

⁵For purposes of measurement and definition, jewelry employment will be limited to the following Standard Industrial Classifications: SIC 3961, Costume Jewelry; SIC 3915, Jeweler's Materials and Lapidary Work; and SIC 3911, Jewelry and Precious Metals.

⁶Federal Reserve Bank of Boston, "New England Economic Indicators," (Boston: Federal Reserve Bank, December, 1972), p. 5.

⁷U.S., Department of Commerce, Bureau of the Census, 1972 Census of Manufacturers, vol. II, Industry Statistics, pt. 3.

⁸Interview with Jerome Lessuch, Economist, Rhode Island Department of Economic Development, Providence, Rhode Island, 1 June 1978.

⁹Rhode Island Department of Economic Development, Rhode Island Basic Economic Statistics-The Economy, Summary, and Trends 1977-1978, (1977) p.

¹⁰Interview with Jerome Lessuck, op. cit.

¹¹1972 Census of Manufacturers, op. cit.

¹²Perloff and Wingo, op. cit., p. 318.

¹³Rhode Island Department of Employment Security, "Employment Covered by the Employment Security Act - 1976."

¹⁴Tiebout, op. cit., p. 59.

CHAPTER FOUR:

WATER POLLUTION CONTROL ACT AMENDMENTS OF 1972

In early February, 1971, a Congressional Subcommittee on Air and Water Pollution published the results of a two year study which concluded that "... the national effort to abate and control water pollution had been inadequate in every vital aspect."¹ Existing federal legislation had failed to effectively enforce standards which substantially reduced the amount of pollution entering the country's water systems. These findings encouraged Congress on October 18, 1972 to enact the Federal Water Pollution Control Act Amendments of 1972. This Act represents the most significant federal commitment to date for the protection and restoration of the nation's deteriorating water quality.

Chapter Four is designed to introduce the reader to the intent and operation of the present water quality control legislation. It examines both the state and federal roles, focusing upon the Act's specific programs and policies to achieve its goal of eliminating discharge pollutants into the nation's navigable waters by 1985.²

THE EXPANDING FEDERAL ROLE

Prior to 1965, federal legislation in the arena of water

quality control delegated prime responsibility to the states "...to prevent, control and abate water pollution."³ Federal participation consisted primarily of financing research projects demonstrating new technologies and providing loans for the construction of improved facilities.

The first major piece of legislation which recognized the increasing severity of water pollution and the need for increased federal involvement was the Water Quality Control Act of 1965. This act represented a significant break with previous efforts by authorizing a greater degree of federal participation and calling for the promulgation of a national policy regarding the continued pollution of the nation's water systems.

A significant feature included in the new legislation was the requirement that each state develop standards for water quality for all interstate waters flowing within their boundaries. These guidelines were to be submitted to the newly organized Federal Water Pollution Control Administration for approval by July 1, 1967. Once adopted, these performance criteria were intended to serve as:

- 1) measures of performance establishing the maximum levels of pollution allowable in interstate waters.
- 2) avenues for legal action against offending polluters.⁴

By 1971, only 27 of the 54 jurisdictions covered by the program had adopted approved water quality standards.⁵ In only one instance was an illegal discharger of pollutants taken to court for remedial action.⁶ By the early 1970's it

had become clear that existing federal water quality control programs were unable to effectively curtail the dumping of wastes into water systems and thus failed to alleviate pollution and the rapid degradation of the nation's rivers, streams, lakes, and oceans. The growing need for improved mechanisms to restore the "...natural chemical, physical, and biological integrity of the Nation's waters"⁷ prompted the Congressional Subcommittee on Air and Water Pollution to recommend the adoption of a national policy for water quality control which included:

- 1) The elimination of polluting discharges into navigable rivers by 1985;
- 2) The achievement of an interim goal of water quality by 1983 providing for the protection and propagation of fish, shellfish, and wildlife;
- 3) The prohibition of toxic discharges in toxic amounts;
- 4) The initiation of a major research and demonstration effort to find the technological methods necessary to eliminate waste discharges.⁸

These recommendations eventually became incorporated as the principal goals of the most recent Congressional water quality control legislation, the Federal Water Pollution Control Amendments of 1972.

1972 WATER POLLUTION CONTROL ACT

Public Law 92-500, the Federal Water Pollution Control Act Amendments of 1972, is the most comprehensive and expensive legislation attacking the problem of continued degradation of the nation's water quality. In order to achieve the

goal of eliminating discharge pollutants into the nation's navigable waters by 1985, the Act provides for expanded federal involvement; increased funding for planning and the construction of new facilities; improved regulatory controls; and, perhaps most significantly, changes in the enforcement mechanism and procedure.

Under the 1965 Water Quality Control Act, water quality standards were to be established by each state as the water quality control mechanism. States were given prime responsibility to determine the kinds and amounts of pollutants to be permitted, the degree of pollution abatement required, and the time allowed for abatement control.⁹

This program met with limited success. In addition to the failure of most states to publish approved standards, difficulty arose in translating water quality standards into effluent limitations which would be upheld in a court of law. The 1972 Act establishes that effluent limitations, not water quality, will form the basis for the prevention and elimination of pollution. "Except as in compliance with this section...the discharge of any pollutant by any person shall be unlawful."¹⁰

Thus, water quality has become a measure of program effectiveness and performance, not a means of elimination and enforcement. In order to achieve this goal, the legislation requires that pretreatment guidelines and standards be developed which provide a mechanism for the control of industrial

pollutants introduced into publicly owned treatment works (POTW's). Under Title III of the Act, "Standards and Enforcement," Section 304 (f):

"...the Administrator shall publish... guidelines for pretreatment of pollutants which he determines are not susceptible to treatment by publicly owned treatment works. Guidelines under this subsection shall be established to control and prevent the discharge into navigable waters, the contiguous zone, or the ocean of any pollutant which interferes with, passes through, or otherwise is incompatible with such works."¹¹

These guidelines are intended to establish an approach for a uniform national pretreatment policy. In addition, the Environmental Protection Agency is required to establish standards of performance for specific categories of discharge sources and types of pollutants. These performance requirements set forth rules and regulations designed to protect POTW's from possible harmful effects of industrial wastewaters introduced into the systems. These standards must reflect the maximum reduction of pollution possible through the use of the "Best Available" control technology.¹² Twenty-four industrial categories and forty-two specific pollutants are listed by the Act to be covered by these standards.¹³

The enforcement of these performance criteria is designed to be accomplished through the use of an expanded permit program. This system establishes a direct link between the federal government and each industrial source of discharge

into navigable waters. According to Section 402 (a):

"...the Administrator may, after the opportunity for public hearing, issue a permit for the discharge of any pollutant, or combination of pollutants...upon condition that such discharge will meet all applicable requirements...of this Act."¹⁴

Civil and criminal penalties are provided the administrator to enforce permit violations.

"Any person who willfully or negligently violates any permit condition or limitation...shall be punished by a fine of not less than \$2,500 nor more than \$25,000 per day of violation, or by imprisonment for not more than one year, or both."¹⁵

In addition to these functions, the bill provides for increased federal involvement in planning, research and development, and construction of new facilities. For example, to assist the states and localities, the Act proposes a four year program of federal grants for the construction of sewage treatment plants. The federal match, totaling \$14 billion through fiscal year 1975, can equal up to 75 percent of the project's cost. Additional monies are allocated for the development and preparation of comprehensive plans and for the purpose of demonstrating new and improved methods of preventing, reducing, and eliminating polluting discharges.

In each case where the bill authorizes the Environmental Protection Agency Administrator to regulate and enforce the performance criteria, states have the option to develop

superior programs of local control. However, to insure the active involvement of each state in the program, the legislation mandates that the Governors develop plans for area-wide waste treatment management within their boundaries. Section 208 requires that regional water quality management plans be developed and implemented to assure adequate control of all sources of pollution in each state.¹⁶ This section provides for the development of an areawide plan to inventory, evaluate, and manage all activities associated with the generation of point and non-point sources of pollution.

In response to these requirements, the Rhode Island Governor Philip Noel designated thirty-eight Rhode Island municipalities and the neighboring Massachusetts communities of Blackstone and Millville as one planning area. He named the Rhode Island Statewide Planning Program as the agency charged with the preparation of the '208' Plan. On June 25, 1975 the Environmental Protection Agency approved the program and awarded \$2.3 million in federal funds to carry out clean water planning in the State.

STATE WATER QUALITY CONTROL

The main objective of the Rhode Island '208' Planning Program is to develop a water quality management plan which is capable of attaining the Act's goal of eliminating discharge pollutants by 1985.¹⁷ To achieve this objective, the Rhode Island Statewide Planning Program has established a

four point strategy.

- 1) Identification and Recommendations For All Point Source Pollution Sites.

This includes industrial and municipal discharges; sewage discharges and overflows; sludge from wastewater treatment plants; and an analysis of anticipated municipal and industrial treatment facilities and construction over a 20 year period.

- 2) Identification and Recommendations For All Point Pollution Sites.

Nonpoint pollution is defined as a generalized discharge of waste into a water body which cannot be located as to a specific source. It includes runoff water from sand and gravel operations, construction sites, roads, farms, and landfill sites.

- 3) Provisions For Proper Land Use as a Means of Controlling Water Pollution.

This involves the identification of physical constraints to development; the effects of existing plans on water quality, and the preparation of a land use plan that addresses water quality issues.

- 4) Recommendations For the Proper Legal, Institutional and Financial Arrangements of Water Planning and Management.

The fourth stage concerns the selection of management agencies to implement the plan with an examination of the expected costs and the economic, social, and environmental impacts. It includes the establishment of a regulatory process which provides for the evaluation and control of all point and nonpoint pollution sources; the regulation of location and construction of waste discharging facilities; and enforcement of satisfactory pretreatment requirements for commercial and industrial waste discharges into publicly owned treatment facilities.¹⁸

Currently, 21 of the 40 communities covered by the '208' Program have publicly owned wastewater treatment and collection facilities available through either local or regional systems. Within five years it is estimated that a total of 19 publicly owned treatment works will be in operation ser-

ving domestic and industrial waste water from 28 communities.¹⁹ To effectively manage the waste discharges into these systems, the State of Rhode Island has adopted policies which require that;

- 1) Industrial development causing other than domestic waste discharges occur only in areas served by public sewer systems.
- 2) Recycling of industrial wastes be undertaken whenever possible to conserve resources and reduce treatment problems.
- 3) Pretreatment of industrial waste be accomplished before discharge to a public sewer system wherever necessary.²⁰

These policies in conjunction with the requirements of PL 92-500 comprise the state of current water quality control programs. Though expanded planning and demonstration activities are called for, the key to both the Rhode Island and the Federal efforts is the establishment and enforcement of effective industrial discharge limitations. Chapter Five examines these limitations in greater detail with a focus upon their relationship to the jewelry industry.

FOOTNOTES-CHAPTER IV

¹United States Congressional Code and Administrative News, p. 3674.

²The Federal Water Pollution Control Act Amendments of 1972, P.L. 92-500, 33 U.S.C. Section 101 (a) (1).

³United States Statutes at Large, P.L. 80-846. 80th Congress, 2nd Session, 1948.

⁴Op. Cit., U. S. Congressional Code, p. 3671.

⁵The 54 jurisdictions covered by the Act include the 50 States, the District of Columbia, Guam, Puerto Rico, and the Virgin Islands.

⁶In that case, involving a MidWestern City, after four years of litigation the city constructed a sewage treatment plant. Within two years, the plant was treating only half of the city's sewage. Five million tons of raw sewage were being dumped into the river each day.

⁷Public Law 92-500, Section 101 (a).

⁸Op. Cit., U. S. Congressional Code, p. 3674.

⁹P.L. 89-234, U. S. Statutes at Large, 89th Congress, 1st Session, 1965.

¹⁰Op. Cit., P.L. 92-500, Section 301 (a)

¹¹Ibid., Section 301 (b) (1) (A)

¹²Ibid., Section 301 (b) (2) (A)

¹³Included in these categories are Electroplating and non-ferrous metals manufacturing.

¹⁴Op. Cit., P.L. 92-500, Section 401 (a) (1)

¹⁵Ibid., Section 309 (c) (1)

¹⁶Ibid.

¹⁷Rhode Island Statewide Planning Program, Areawide Quality Management Plan. (Providence: November 1977). p viii.

¹⁸Rhode Island Statewide Planning Program, Project Control Plan Outline. Mimeograph.

¹⁹Op. Cit., Areawide Quality Management Plan, p. 2.

²⁰Ibid., p. 2.

CHAPTER FIVE:

JEWELRY MANUFACTURING AND INDUSTRIAL PRETREATMENT

The 1972 Water Pollution Control Act's primary emphasis for achieving the total elimination of discharge pollutants into the nation's waters by 1985 has been placed on the promulgation of procedures for controlling the introduction of wastes into publicly owned treatment works (POTW's). According to Section 307 (b) of the Act:

"The administrator shall...publish proposed regulations establishing pretreatment standards for introduction of pollutants into treatment works...which are determined not to be susceptible to treatment...or which would interfere with the operation of such treatment works."1

In response, the Rhode Island '208' Program has developed policies which require that industrial development occur in areas served by sewer and, most important, that pretreatment of industrial waste be accomplished whenever necessary. Chapter Five discusses the federal industrial pretreatment program and its relationship to jewelry manufacturing.

ELECTROPLATING AND METAL FINISHING

Jewelry manufacturing, as previously discussed in Chapter Two, is characterized by a series of operations involved in the production of a finished item. The electroplating and

metal finishing steps are designed to improve both the surface appearance and structural qualities of the metals. This is achieved through a variety of electro-chemical procedures such as electroless-plating, electrodeposition, anodizing, and chemical conversion. Stated more simply, these processes involve the immersion of the metal in a bath of different chemical and acid solutions which provide a decorative finish, corrosion protection, special electrical and engineering properties, or an adhering base for painting and coating.

Following each process, the item is rinsed in a water solution to remove the films of the processing baths from the surfaces of the newly plated materials. In rinsing the metal, the water becomes contaminated with concentrations of the material being finished as well as the elements contained in the processing solution. The major pollutants emitted in this process along with average concentrations are listed below in Table XII. While most of these materials are present at low levels in normal domestic wastewater, the high concentrations emitted from metal finishing and electroplating activities create significant adverse effects on secondary treatment facilities.²

According to the Water Pollution Control Act's performance standards (see Chapter Four p. 58) designed to protect POTW's from harmful effects of industrial wastewater:

"Not later than July 1, 1983, effluent limitations for categories and classes of point sources shall require application of the Best Available technology economically available."³
(Emphasis added).

TABLE XII: METAL FINISHING AND ELECTROPLATING POLLUTANT CONCENTRATIONS

<u>POLLUTANT</u>	<u>AVERAGE CONCENTRATION, mg/l**</u>
Zinc	10 - 100
Cadium	10 - 100
Nickle	10 - 100
Copper	10 - 100
Lead	10 - 100
Sodium	500
Aluminum	50 - 100
Chromium	10 - 50
Cyanide	20 - 100
Fluoride	5 - 500
Phosphate	5 - 500

** These estimates are based upon 10,000-500,000 gallons of continuous and intermittent water flow.

SOURCE: U.S. Environmental Protection Agency, Office of Water Program Operations, Federal Guidelines - State and Local Pretreatment Programs, Vol. III, Appendix 8, p.8-9-9.

In the case of metal finishing and electroplating, the "Best Available" technology determined by both the Environmental Protection Agency and the Rhode Island '208' Program is onsite wastewater pretreatment.⁴

FEDERAL PRETREATMENT STANDARDS

Pretreatment is defined as "any operation or series of

operations which remove the incompatible pollutants from industrial waste water to make it acceptable for discharge into publicly owned collection and treatment facilities designed to receive primarily municipal waste water."⁵

Generally, publicly owned treatment works are designed to handle wastewaters that are amenable to treatment by settling and biological decomposition. This process is biologically dependent and sensitive to fluctuations in flow and the physical and chemical characteristics of the waste water. Domestic wastes usually present minimal problems to POTW's. Industrial wastes, on the other hand, contain various amounts of hazardous and toxic pollutants which may pass through the treatment facility unaffected into the receiving waters or which may prevent the POTW from operating effectively.

Interference with the operation of a POTW is caused by a wide variety of chemical, biological, and physical phenomena. Generally, interference consists not only of materials which inhibit biological sewage treatment processes, but also substances which cause problems in sewage collection systems, sludge disposal or utilization methods, water reuse, land application of wastewater and other operations. Collection system problems include fire and explosion potential, corrosion, and the clogging of screens with solids.

Whether a substance is inhibitory depends on a large number of factors, including its concentration and synergistic and antagonistic effects.

Synergism is defined as an increase in the inhibitory

effect of a particular substance caused by the presence of another substance.⁶

Antagonism is the opposite of synergism in that it is defined as a decrease in the inhibitory effect of a substance caused by the presence of another.⁷

Given the severity and complexity of the problems related to industrial pollutants, the Environmental Protection Agency has established a national pretreatment program to prevent problems caused by industrial contaminants discharged into POTW's. The program is designed specifically to:

- 1) prevent the introduction of pollutants into POTW's which interfere with the operation of those POTW's; and
- 2) prevent the introduction of pollutants into POTW's which will pass through the treatment works or otherwise be incompatible with such works.⁸

In order to accomplish this mission, the Agency has established two sets of pretreatment standards designed specifically to prohibit the discharge of pollutants by any user of a POTW which substantially interfere with the operation of the facility.

The first set of standards are directed towards specific industrial categories which are believed to be discharging pollutants of the greatest environmental concern. These standards contain numeric limitations for pollutants emitted from the classes of activities listed in Table XIII.

The second set, "prohibitive discharge" standards, have been established for specific types of pollutants which are known

TABLE XIII: INDUSTRIES CONSIDERED FOR NUMERIC PRETREATMENT STANDARDS

<u>S.I.C.</u>	<u>TYPE OF INDUSTRY/PRODUCTS</u>
22	Textile Mill Products
23	Apparel and Other Finished Products
24	Lumber and Wood Products (except furniture)
26	Paper and Allied Products
27	Printing, Publishing and Allied Industries
28	Chemical and Allied Products
29	Products of Petroleum and Coal
30	Rubber and Plastic Products
31	Leather and Leather Products
32	Stone, Clay and Glass Products
33	Primary Metal Industries
34	Fabricated Metal Products
35	Machinery (except Electrical)
36	Electrical Machinery, Electronics and Allied Industries
37	Transportation Equipment
38	Professional, Scientific and Controlling Instruments; Photographic and Optical Goods; Watches and Clocks
39	Jewelry, Jewelry Findings, Silverware and Related Items
49	Electric, Gas and Sanitary Services
72	Personal Services (Laundries, Photo Studios, Beauty and Barber Shops, etc.)

SOURCE: Areawide Water Quality Management Planning Project, Technical Memorandum: Control of Industrial Wastes Discharged to Publicly Owned Treatment Works, p. 14.

to substantially interfere with or pass through POTW's with secondary treatment, as shown in Tables XIV and XV.

Both sets of regulations have a very definite influence on the jewelry industry. First, Standard Industrial Classifi-

TABLE XIV: POLLUTANTS THAT MIGHT INTERFERE WITH POTW'S

<u>Inorganic Substances</u>	<u>Organic Substances</u>	<u>Other Substances</u>
Acidity, alkalinity	Alcohols	Corrosive materials
Ammonia	Phenols	Materials that cause
Alkali and alkaline	Chlorinated hydro-	sewer blockages
earth metals	carbons	Explosive and flam-
Arsenic	Chloroform	mable materials
Borate	Carbon tetrachloride	High temperature
Cadmium	Methylene	wastes
Chloride	Agricultural chemicals	
Chlorine	Organic nitrogen	
	compounds	
	Surfactants	
	Misc. organic	
	chemicals	
	Oils and grease	

TABLE XV: POLLUTANTS THAT MIGHT PASS THROUGH POTW'S

Cadmium	Iron
Chloride	Manganese
Chromium	Phosphorus
Cyanides	Nitrogen
Lead	Phenolics
Mercury	Oils and grease
Copper	Organic carbon
Nickle	Suspended solids
Zinc	Radioactive wastes

SOURCE: Areawide Water Quality Management Planning Project, Technical Memorandum: Control of Industrial Wastes Discharged to Publicly Owned Treatment Works, pp. 6-7.

ation 34 - Fabricated Metal Products, and 39 - Jewelry, Jewelry Findings, Silverware and Related Items, are included in the Environmental Protection Agency's list of industries considered for

numeric limitations. Second, jewelry manufacturing involves the concentrated discharge of contaminants considered "prohibitive" under the Agency's second set of regulations.

It has been estimated by the Environmental Protection Agency that enforcement of these standards could prevent approximately 40 million pounds per year of toxic pollutants involved in jewelry manufacturing from entering the nation's waters or concentrating in the sludge from municipal treatment systems.⁹ However, it is also noted that this environmental improvement cannot be attained without significant economic impact. "Economic analysis by the Agency indicates that many firms whose primary business is metal finishing or printed board manufacturing are vulnerable to adverse economic impact."¹⁰

Though the activities covered by the federal regulations are found throughout the United States, they are of particular importance to the concentration of jewelry firms in Rhode Island. Chapter Six examines the potential magnitude of the problem and its impact on the jewelry economy and therefore the state economy.

FOOTNOTES-CHAPTER V

¹The Federal Water Pollution Control Act Amendments of 1972, P.L. 92-500, 33. U.S.C. Section 307 (b).

²U. S. Environmental Protection Agency, Federal Guidelines: State and Local Pretreatment Programs, (Washington, D.C.; Office of Water Program Operations) January, 1977, Volume 1, pp. E1-E51.

³Op. Cit. P.L. 92-500, Section 301 (b).

⁴Rhode Island Statewide Planning Program, "Potential Management Approaches," Areawide Water Quality Management Plan, (Providence:) May, 1978, p. 34.

⁵Rhode Island Statewide Planning Program, "Control of Industrial Wastes Discharged to Publicly Owned Treatment Facilities," Areawide Water Quality Management Plan. (Providence) November, 1977, p. 1.

⁶Op. Cit. U.S. Environmental Protection Agency, p. E2.

⁷Ibid., p. E3.

⁸U. S. Environmental Protection Agency, "Pretreatment Standards for Existing and New Sources of Pollution," Federal Register, (Washington, D.C.), February, 1977, pp. 6477-6478.

⁹U. S. Environmental Protection Agency, "Electroplating Point Sources Category - Proposed Pretreatment Standards for Existing Sources," Federal Register, (Washington, D.C.), Tuesday, February 14, 1978, p. 656.

¹⁰Ibid., p. 656.

CHAPTER SIX:

ECONOMIC IMPACT OF WATER REGULATIONS ON THE JEWELRY INDUSTRY

Industrial pretreatment, mandated by federal legislation and supported by state planning, will directly affect 1,659 jewelry firms in Rhode Island.¹ These businesses are required by July 1, 1983 to install the Best Available Technology (BAT) to eliminate the discharge of harmful pollutants into the nation's waters.² In all cases, the required application of abatement techniques will result in higher operating costs, loss of sales, and a reduction in employment. Many firms unable to meet the substantial capital investments and financial commitments will be forced to close.

Chapter Six analyzes the potential economic impacts of the water pollution control legislation on the Rhode Island jewelry industry. It begins with an examination of first round consequences measured by the cost of abatement technology, loss of employment, and plant closures. The discussion then brings together the industry's economics with the pretreatment standards to uncover second and third round losses to Rhode Island's economic base.

COSTS, EMPLOYMENT, CLOSURES³

The Best Available Technology (BAT) for pretreatment of

jewelry manufacturing waste products is defined by the Environmental Protection Agency as:

- Reduction of hexavalent chromium to the trivalent form.
- Destruction (oxidation) of cyanide.
- Precepitation and clarification of metals.⁴

This technology is to be applied to all firms discharging to a Publicly Owned Treatment Works performing one or more of the processes regulated under the Environmental Protection Agency's two sets of pretreatment standards (See Chapter Five).

According to Rhode Island's 208 Management Plan, there are 4017 industrial firms located in 28 municipalities "that will have publicly owned sewers in the next five years that may discharge incompatible toxic, hazardous, and other harmful wastes."⁵ Over 41 percent, or 1,659 of these businesses are directly related to jewelry manufacturing. To calculate the potential capital investments needed by these firms to meet the BAT requirements, the Environmental Protection Agency suveyed 2221 of the nation's metal finishing job shops and captive operations against the following scenario:

The treatment technology for pretreatment consists of the destruction of cyanide amenable to chlorination by single stage alkaline chlorination and the reduction to hexavalent chromium to the trivalent state for plants whose total daily metal finishing process flow is less than 10,000 gallons per day. The technology for plants with higher daily flows consists of the oxidation of cyanide in two stage alkaline chlorination, reduction of hexavalent chromium to the trivalent form, and precipitation and clarification of metals. All plants, regardless of flow, were required to remove lead and cadmium if they were present."⁶

The findings of the Agency's analysis for Rhode Island electroplating activities are shown in Table XVI.⁷ Recognizing that the application of the BAT requirements will vary depending upon the individual production processes of each firm, the "Mean Capital Investment" projections have been disaggregated according to business employment. Based on 1977 dollars, firms employing under 50 people will require an average financial commitment of \$76,929, while larger enterprises will be forced to invest almost double this amount.

TABLE XVI: PROJECTED MEAN CAPITAL INVESTMENT OF BAT REQUIREMENTS FOR THE RHODE ISLAND JEWELRY INDUSTRY

EMPLOYMENT SIZE OF FIRM	NUMBER OF RI CASES	MEAN CAPITAL INVESTMENT (1977 Dollars)
1- 49	1,287	\$76,929
50- 99	182	\$149,295
100-249	142	\$146,153

SOURCE: U. S. Environmental Protection Agency, Office of Planning and Evaluation, Economic Analysis of Proposed Pretreatment Standards for Existing Sources of the Electroplating Point Source Category, p. 88.

These projected costs will be felt throughout the jewelry industry regardless of firm size. According to Table XVII, the Environmental Protection Agency estimates that due to these investments, one-quarter of Rhode Island's metal finishing operations will be forced to close. This analysis is based on the following model:

- Full BAT for everyone.

- A five year repayment at 10 percent cost of capital.
- A rise in prices by each firm by exactly that amount corresponding to the incremental annualized cost of the investment.
- A forced closure if equity infusion fails a 1.5 coverage ratio criterion.⁸

Translated into sales and employment, the Agency expects these closures to result in a 26 percent loss of sales and a 29 percent reduction in employment.⁹ By themselves, however, these figures tell only a partial story. They illustrate the first round impacts on Rhode Island's jewelry industry which may result from the federal pretreatment standards. Of equal importance to this study are the subsequent second round consequences which relate to the State's Competitive Advantage for jewelry manufacturing.

TABLE XVII: PROJECTED BUSINESS CLOSURES

EMPLOYMENT SIZE OF FIRM	NUMBER OF RI CASES	PROJECTED CLOSURES
0- 49	1,287	360
50- 99	182	50
100-249	142	38

SOURCE: U. S. Environmental Protection Agency, Office of Planning and Evaluation, Economic Analysis of Proposed Pretreatment Standards for Existing Sources of the Electroplating Point Source Category, p. 114.

COMPETITIVE ADVANTAGE

Rhode Island's development into the nation's center for the production of Body and Costume Jewelry, discussed in Chapter Two, is based on the growth of agglomeration economies. Such economies manifest themselves in horizontal and vertical linkages between firms and activities producing similiar and related goods and services. Jewelry manufacturing is traditionally comprised of small and medium sized firms. Historically, these shops have required little capital investment to initiate production. Larger firms depend on these small subcontractors to provide specialized inputs into their production process. This relationship, and thus Rhode Island's Competitive Advantage, is being threatened by the federal legislation's BAT requirements.

The supply of inexpensive labor is cited as the single most important advantage Rhode Island offers as a location to the firms surveyed in Chapter Two. Historically, this resource has been provided by new immigrants arriving to this country, and more recently by the secondary labor market.

The cost of water pollution control technology does not directly impact the cost of labor and initially would appear not to affect this major location advantage. It should be noted that inexpensive labor by itself does not provide Rhode Island with a unique resource. The New England economy discovered this during the middle of the 20th century when the textile industry left for new opportunities and equally cheap labor. In addition, the jewelry industry today faces stiff competition from foreign

suppliers whose labor costs continue to run below United States' figures. Inexpensive labor's importance, however, to Rhode Island jewelry lies in what it says about the State's Competitive Advantage. Small and medium sized firms employing under 50 people exhibit the greatest dependency on outside activities which aid in reducing production costs. Rhode Island presently offers the opportunity for small shops to enter the market with a minimum initial capital investment and operating expense. Highly skilled and highly paid labor is the weakest local advantage perceived by these smaller firms primarily due to its expensive nature. A mean capital investment of \$76,929 for BAT requirements will effectively eradicate the opportunity for small electroplaters and metal finishers to enter the market. The production costs of existing firms will no longer be minimized. Any savings which might accrue from the supply of cheap labor and other agglomeration economies will be more than offset by the high costs of technology. Larger firms employing over 50 people will also feel the crunch of these costs.

Unlike the smaller enterprises, the bigger shops' greatest locational advantage stems not only from inexpensive labor, but also from the proximity to related jewelry firms and activities. Jewelry production involves a number of specific tasks leading to the manufacture of the finished good. The Rhode Island industry is supported by a large network of firms which specialize in one or more of these inputs into the production process. Well

over one-half of the 1,500 firms listed nationally in the Manufacturing Jewelers and Silversmiths of America's 1977-1978 Buyer's Guide specialize in such specific tasks as assembling, casting, electroplating, polishing, soldering, findings manufacturing, enameling, and engraving. Subcontracting out several of these tasks is a prevalent practice. These vertical linkages between firms producing similar and related goods is perhaps the most distinguishing feature of the jewelry industry. Their existence is cited by the surveyed firms as the second most important advantage Rhode Island offers as a location. Yet according to the Environmental Protection Agency over one-quarter of these firms will be forced to close by the 1983 deadline thus severely damaging Rhode Island's second most vital locational advantage.

This analysis has recognized throughout that Competitive Advantage is not based on any single element. To quote Chapter One:

"The major factors of location...do not operate in isolation. The value of a particular site to any firm may depend upon the quality and accessibility of existing transportation facilities, which in turn are a factor of the forces of agglomeration economies, which may be the result to the resource endowment, which has been influenced by changes in technology and taste. In addition, it is rare that industrial location is determined by any single element. Just as these forces are highly interrelated, their influence in determining spatial organization is cumulative. That is to say, it is all of these factors working together, though with varying degrees of importance for different firms, that mold the spatial distribution of activities."

This examination of the impacts on Rhode Island's Competitive Advantage for jewelry production resulting from BAT

requirements does not deal directly with each locational advantage discussed in Chapter One. However, neither do the Environmental Protection Agency's projections go beyond the immediate impacts resulting from cost factors. Competitive Advantage is cumulative and all regions offer specific combinations from which they compete for development. The costs of BAT will significantly affect Rhode Island's two greatest benefits for the jewelry industry:

- 1) Low capital investment required to initiate production.
- 2) The existence of related and supporting activities.

This in turn will exert an as yet unquantifiable impact on the supply of highly skilled labor, a good transportation system, and proximity to materials. The cumulative impact goes far beyond the Agency's 28 percent closure predictions, beyond the erosion of an industry's development, to affect the entire Rhode Island economy.

IMPACT ON THE STATE ECONOMY

The concentration of jewelry firms in a few select geographic locations clearly indicate its nature as an exporting industry. According to the Location Quotient Analysis in Chapter Three, 98 percent of jewelry production is export activity. Exports are considered a key to an area's economic vitality based on the degree to which they meet the following criteria:

- (1) Is characterized by extensive forward and backward linkages with the regional economy.

- 2) Manufactures a product of growing national demand.
- 3) Has a high regional multiplier. (See Chapter Three).

Jewelry's high rating in these important areas suggests that a serious decline in its productivity will go beyond the first round losses of employment and wages, and will also impact internal development both related and unrelated to the industry.

Local activities directly related to jewelry manufacturing are manifest in the industry's linkages with a variety of related enterprises. The 1977-1978 Buyer's Guide lists 216 Rhode Island firms which are not included in the Environmental Protection Agency's analysis, but which comprise an integral part of the industry's production process. These businesses comprise 10 percent of Rhode Island's durable goods manufacturing base which will experience a loss of jewelry suppliers and markets.¹⁰

Developments unrelated to the jewelry industry's production process are not as readily apparent as the direct impacts discussed above, but are more critical to Rhode Island's growth and development. It is these unrelated activities which are most affected by jewelry's position as an industry of growing national demand with a **high** regional multiplier. Unfortunately, it is these third round considerations which the Environmental Protection Agency ignores.

In the 40 years since 1939, jewelry manufacturing has exhibited strong and steady growth in employment, value added by manufacture, and value of industry shipments (See Chapter Three).

Any industry with expansion potential is more valuable to the future economic growth of a region than an activity which through changes in demand, production techniques, or other factors is experiencing a sustained decline. In Rhode Island, however, the importance of the jewelry industry's development goes beyond this rather obvious conclusion.

Historically, Rhode Island's economy has been closely associated with labor intensive industries which have provided abundant employment opportunities for new immigrants. Jobs which demand little skill and training have been plentiful in the State. Foremost among these were textile and related occupations.

The origin of the American textile industry can be traced to a small cotton spinning mill built in 1790 at Pawtucket Falls.¹¹ In the ensuing 150 years, this industry was to boom to become the mainstay of Rhode Island's manufacturing economy with 45 percent of all manufacturing employment in textile products as late as 1947.¹² However, beginning in the period following World War II, an exodus of the State's textile industry began which by 1970 had taken over 50,000 jobs.¹³ This mass industrial migration is a well known story throughout New England. Many of the scars remain in the blighted urban mill centers which dot the countryside. Yet, it was during this same period that the local jewelry industry experienced its greatest growth. An examination of Table XVIII illustrates that as the textile industry declined from 42 percent of the State's manufacturing employment in 1950 to less than 10 percent in 1977,

the jewelry industry rose from 13.4 percent to over 25 percent of Rhode Island's manufacturing employment during that same period.

TABLE XVIII: COMPARATIVE GROWTH AND DECLINE OF RHODE ISLAND JEWELRY AND TEXTILE INDUSTRIES

	<u>1950</u>	<u>1960</u>	<u>1970</u>	<u>1977</u>
TEXTILE EMP. AS A % OF RI'S MANUFACTURING EMP.	42%	23%	12.6%	9.2%
JEWELRY EMP. AS A % OF RI'S MANUFACTURING EMP.	13,4%	17%	17.8%	25.8%

SOURCE: Rhode Island Department of Economic Development, Basic Economic Statistics - The Economy, Summary, and Trends, 1971-2, 1973-5, 1977-8.

Many vacated structures abandoned by textiles were occupied by jewelry firms which took advantage of both the low rents and the abundant supply of unskilled and semi-skilled workers left behind. Today, Rhode Island's economy remains structurally very similiar to the pre-World War II period. Manufacturing is pre-dominant, employing well over one-third of the labor force.¹⁴ However, unlike 30 years ago, there is no industry waiting in the wings to provide employment opportunities to the many low and semi-skilled, manually dextrous workers. Large numbers of the Environmental Protection Agency's first round job loss pre-dictions will be unable to quickly and easily find new employment.

The structural unemployment will impact other unrelated activities in the State.

According to the Export-Base Theory of Economic Growth, spendable income derived from export activities provides new money into a region which stimulate demand in local markets for a variety of unrelated goods and services (See Chapter Three). The Environmental Protection Agency has projected a 29 percent reduction in jewelry employment as a result of the BAT requirements. This translates into a direct loss of 75 million dollars in wages which are presently available for local housing, food, clothing, and other items. However, this 75 million dollars also represents income to local businesses which in turn is spent on similiar goods and services. Based on the analysis of jewelry's regional multiplier in Chapter Three, for every dollar of direct export income last to the State, there will occur a cumulative reduction of \$1.25 of new money spent in the local economy from external sources. This computes into a total loss of 100 million dollars which no longer will be circulated in the State's economy. For many unrelated activities this loss of business will result in similiar first, second, and third round consequences which this chapter has analyzed for jewelry production.

In November, 1977, the Rhode Island jewelry industry employed 34,690 workers with a yearly payroll exceeding 258 million dollars.¹⁵ The second largest manufacturing employer in the State

for this year was textiles, which employed less than 12,500.¹⁶ No other employer in Rhode Island, with the exception of sales and clerical, approaches jewelry's figures. Based on the Environmental Protection Agency's analysis discussed in this chapter, the Federal water pollution control BAT requirements will result in a first round loss of 10,060 jobs and approximately 75 million dollars in wages. Second round impacts are apparent in the erosion of the State's Competitive Advantage for jewelry manufacturing. Rhode Island will no longer offer firms the special combination of resources which historically have led to the State's growth into the Body and Costume Jewelry Capital of the world. By any standards, these two potential developments present serious implications regarding the local economy. However, it is the third round consequences, linkages with local internal developments, which are of greatest concern to Rhode Island's future economic growth. The next and final chapter in this study presents a series of recommendations which can help the State to meet the goals of the Federal Water Pollution Control Act Amendments of 1972 and maintain the jewelry industry as a viable and productive component of the economy.

FOOTNOTES-CHAPTER SIX

¹Rhode Island Statewide Planning Program, Technical Memorandum: Control of Industrial Water Discharged to Publicly Owned Treatment Works. (Providence: November, 1977), p. 10.

²The Federal Water Pollution Control Act Amendments of 1972, P.L. 92-500, 33 U.S.C. Section 101 (a)(1).

³In developing these projections, the Environmental Protection Agency recognizes that the specific technology will vary based on the different production characteristics of each firm. The projections therefore contain limitations inherent in averaging and consistent with the assumptions.

⁴U.S. Environmental Protection Agency, Economic Analysis of Proposed Pretreatment Standards for Existing Sources of Electroplating Point Source Category, (Washington, D.C.: 1977), p. 72.

⁵Rhode Island Statewide Planning, op.cit., p. 14.

⁶U.S. Environmental Protection Agency, op.cit., p. 73.

⁷These figures are computed based on the Environmental Protection Agency's analysis of firms throughout the country. Percentages and costs are then applied to the Rhode Island experience.

⁸U.S. Environmental Protection Agency, op.cit., p. 99.

⁹Ibid., p. 114.

¹⁰Rhode Island Department of Economic Development, Rhode Island Basic Economic Statistics - The Economy, Summary, and Trends, (Providence: 1977-1978), p. 104.

¹¹Rhode Island Development Council, Rhode Island Basic Economic Statistics, (Providence: 1970), p. 86.

¹²Ibid., p. 88.

¹³Rhode Island Department of Economic Development, op.cit., p. 104.

¹⁴Ibid., pp. 104-106.

¹⁵Ibid., p. 67.

¹⁶Ibid., p. 67.

CHAPTER SEVEN:

CONCLUSION AND RECOMMENDATIONS

The motivation for this study is the perceived need to find a common course of action between the two opposing forces of economic growth and environmental protection. The focus is on ways in which programs can be developed which facilitate compliance with the Federal Water Pollution Control Act Amendments of 1972 while encouraging the economic viability of the Rhode Island jewelry industry. Chapter Seven presents specific proposals which both private and public agencies can adopt to eliminate the polluting effluents as required by the Federal legislation while maintaining and assisting the jewelry industry's contribution to Rhode Island's economic growth and development. The recommendations involve three major areas:

- Appreciation of the Problem
- Organizational Development
- Financial Assistance

APPRECIATION OF THE PROBLEM

The large majority of current economic development activities at both the state and local levels involves one of two alternatives:

- 1) Suburban industrial park development.

2) Downtown commercial revitalization.

Industrial land in such communities as North Kingstown, Warwick, Cranston and Lincoln is being assembled and promoted with the goal of attracting new, high paying, nonpolluting business. These high prestige industries are seen as the answer to local tax difficulties and state employment concerns.

Downtown rejuvenation projects currently ongoing in the State's urbanized centers are designed to maintain the health and viability of these principal activity centers.

In contrast to these two efforts, the jewelry industry employs a predominance of low-skilled laborers at low pay and is located in areas removed from the public eye. However, it was demonstrated in Chapter Six that jewelry is an integral and vital component of Rhode Island's economic base. This first recommendation emphasizes the need for a redirection of public economic development programs which recognize the difficulties facing the State's jewelry industry and its importance to the local economy. A major first step in this direction should be a study which:

- 1) Identifies where the jewelry/metal finishing firms are specifically located in the State.
- 2) Identifies the types of processes used at each location.
- 3) Identifies which firms discharge directly to surface waters and which discharge into waste treatment systems.
- 4) Identifies priority pollutants and flow rates for each firm.
- 5) Identifies which firms already have appropriate treat-

ment technology.

- 6) Determines which subpart of EPA regulations are applicable to each firm.
- 7) Determines whether state or local requirements will be more stringent than federal requirements.
- 8) Determines what treatment technology is available, its space and cost requirements for each firm.
- 9) Identifies the public sectors' role and ability in helping solve the jewelry industry's environmental and economic problems.

ORGANIZATIONAL DEVELOPMENT

The Rhode Island jewelry industry is characterized by a large number of small, fiercely independent shops scattered throughout the State's urbanized centers. By themselves, these businesses will be unable to meet the capital investments required by the Federal legislation. However, by joining together to share treatment technology expenses, these firms may be able to meet the new costs. This proposal would require a reorganization of the industry's development patterns. It would not eliminate the important role of small subcontractors in the industry's infrastructure.

Rhode Island's urbanized centers contain millions of square feet of industrial space, almost all of which is housed in two - three story delapidated mill buildings. A large percentage of this space currently is vacant or is used for storage and other nonproductive activities. In the past five years Providence, Pawtucket and Central Falls have turned to Section 8 Housing in order to return these structures to more productive

use. Another alternate use of these buildings would be the development of industrial condominiums. These complexes would house several independent jewelry firms under one roof, all contributing to a shared pollution control facility. In addition to meeting federal legislative requirements, this approach would assist local community development efforts, provide jewelry with a needed opportunity to continue productive operation, and add to the state's economic strength.

FINANCIAL ASSISTANCE

In 1978, Congressman Harley Staggers introduced bill HR13178 entitled "Environmental Technical Assistance Act of 1978", to establish an Office of Small Community and Small Business Concerns within the Environmental Protection Agency. This office would provide information and technical assistance on the requirements of environmental laws, the least costly methods of complying with legal requirements, and available sources of Federal aid to assist in compliance with environmental requirements. To date no approval is expected on the proposal. This study recommends passage of this or an alternate bill in the near future. Public and private cooperation is essential if both environmental protection and economic development are to be achieved. Other existing federal assistance which can be used to implement the recommendations in this report include:

Urban Development Action Grant

All cities in Rhode Island where jewelry manufacturing is concentrated - Central Falls, Cranston, Pawtucket, Providence

and Woonsocket - are eligible for UDAG's. This HUD economic development initiative provides federal money to help leverage private investment in communities meeting specific distress criteria. This program would be ideal to help develop an industrial condominium for jewelry concerns.

Small Business Administration Loans

Section 8 of the Federal Water Pollution Control Act Amendments of 1972 authorizes the Small Business Administration to assist small business concerns to add to or alter their equipment, facilities or methods of operation in order to meet the water pollution control requirements established under the Federal act. The loans are to provide relief to eligible small businesses which might otherwise incur substantial economic injury without some financial assistance.

EPA Industrial Participation Grants

Under Section 105 of the Federal Water Pollution Control Act Amendments of 1972, industry may participate in various grant programs for the construction of permanent wastewater treatment facilities on industry property to develop and demonstrate new or improved methods of treating industrial wastewaters or otherwise preventing pollution.

Economic Development Administration Loans

The Economic Development Administration is charged with

the responsibility of stimulating the industrial growth and economic development of economically depressed areas of the Country. EDA business development loans are available to firms in an attempt to upgrade an area through the creation of new jobs for local residents.

Combined with industrial revenue bonds and tax incentives, these federal assistance programs provide a required link in balancing economic development with environmental protection. What is needed is a full effort supported by both private and public concerns, working together in the 1980's, to bring these two important, though often opposing forces, into a productive balance.

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APPENDIX A

QUESTIONNAIRE

The following brief questionnaire is part of a research paper dealing with the importance of the Jewelry Industry in the State of Rhode Island. Under no conditions will individual returns be published. Your cooperation in completing this form is greatly appreciated.

- 1) In what year was your firm established? _____
- 2) What is the current number of paid employees? _____
- 3) What is the approximate number and/or percentage of employees in the following categories?

Management & Administration	_____
Clerical	_____
Service	_____
Sales	_____
Craft & Kindred	_____
Operative	_____
Laborers	_____

- 4) Rank the following materials (1,2,3) used in your production process in order of their importance and indicate where they are purchased; A) Within Rhode Island B) Within New England C) Within the U.S. D) Outside the U.S.

	Rank	Where Purchased
Gold	_____	_____
Lead	_____	_____
Copper	_____	_____
Tin	_____	_____
Brass	_____	_____
Platinum	_____	_____
Other (Please Specify)	_____	_____

- 5) In what market areas do you sell your product?

Local	_____
New England	_____
Eastern U.S.	_____
United States	_____
Internationally	_____

- 6) Rank the following factors (1,2,3) in terms of their importance to your firm's operation and success in Rhode Island.

Supply of Inexpensive Labor	_____
Supply of Highly Skilled Labor	_____
Proximity of Markets	_____

Proximity to Materials _____
Proximity of Related _____
Jewelry Firms and Activities _____
Existence of Good _____
Transportation System _____
Other (Please Specify) _____

- 7) Is it important or particularly advantageous for your firm to be located in or near Providence rather than in an outlying area of Rhode Island? YES () NO ()
WHY? _____
