ed States
ronmental Protection
ıcy

Office of
Water Programs
Washington, DC 20460

EPA-440/2-79-020
October 1979 C. I

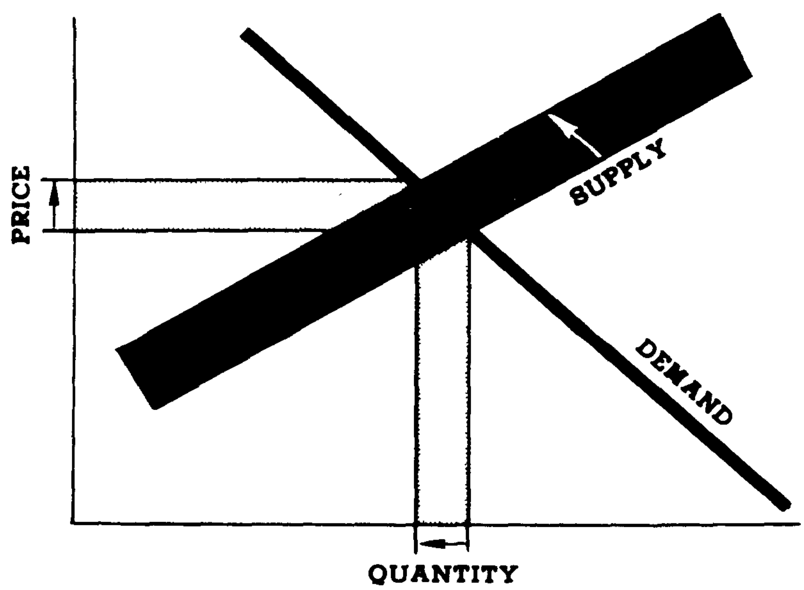
er

EPA

Economic Impact Analysis of Proposed Effluent Limitations Guidelines, New Source Performance Standards and Pretreatment Standards for the

Textile Mills

Point Source Category



This document is available through the U.S. Environmental Protection Agency, Economic Analysis Staff WH-586, 401 M Street, S.W., Washington, D.C. 20460, 202-755-2484

Development Planning and Research Associates, Inc.
P. O. Box 727, Manhattan, Kansas 66502

ECONOMIC IMPACT ANALYSIS OF PROPOSED EFFLUENT LIMITATIONS GUIDELINES, NEW SOURCE PERFORMANCE STANDARDS AND PRETREATMENT STANDARDS FOR THE TEXTILE MILLS POINT SOURCE CATEGORY

By

Richard E. Seltzer
Arthur C. Barker
Linda D. Chapman

Prepared for

U. S. Environmental Protection Agency
Office of Water Planning and Standards
Washington, D. C. 20460

Contract Number
68-01-4632

October 1979

PREFACE

This document is a contractor's study prepared for the Office of Water Planning and Standards of the Environmental Protection Agency (EPA). The purpose of the study is to analyze the economic impact which could result from the application of effluent standards and limitations issued under Sections 301, 304, 306 and 307 of the Clean Water Act to the textile industry.

The study supplements the technical study (EPA Development Document) supporting the issuance of these regulations. The Development Document surveys existing and potential waste treatment control methods and technology within particular industrial source categories and supports certain standards and limitations based upon an analysis of the feasibility of these standards in accordance with the requirements of the Clean Water Act. Presented in the Development Document are the investment and operating costs associated with various control and treatment technologies. The attached document supplements this analysis by estimating the broader economic effects which might result from the application of various control methods and technologies. This study investigates the effect in terms of product price increases, effects upon employment and the continued viability of affected plants, effects upon foreign trade and other competitive effects.

The study has been prepared with the supervision and review of the Office of Water Planning and Standards of EPA. This report was submitted in fulfillment of Contract No. 68-01-4632 by Development, Planning and Research Associates, Inc. and completed in October 1979.

This report is being released and circulated at approximately the same time as publication in the Federal Register of a notice of proposed rule making. The study is not an official EPA publication. It will be considered along with the information contained in the Development Document and any comments received by EPA on either document before or during final rule making proceedings necessary to establish final regulations. Prior to final promulgation of regulations, the accompanying study shall have standing in any EPA proceeding or court proceeding only to the extent that it represents the views of the contractor who studied the subject industry. It cannot be cited, referenced, or represented in any respect in any such proceeding as a statement of EPA's views regarding the textile industry.

ACKNOWLEDGEMENTS

This study was conducted by a team of Development Planning and Research Associates, Inc. (DPRA) staff members with Mr. Donald J. Wissman serving as the DPRA principal responsible for the project. DPRA staff members making major contributions to this project included Mr. Arthur C. Barker, Ms. Linda Drumhiller Chapman, and Mr. Michael S. Hanrahan.

DPRA especially acknowledges Ms. L. Jean Noroian and Mr. Anthony M. Montrone, U. S. Environmental Protection Agency, Office of Analysis and Evaluation, who served as the Project Officers for this study and who provided the necessary guidance in carrying out all aspects of the project. Also valuable contributions to this study were made by Mr. James R. Berlow and Dr. James Gallup, U. S. Environmental Protection Agency, Effluent Guidelines Division and Dr. James Buzzell, Sverdrup and Parcel and Associates, Inc., who provided information pertaining to the wastewater treatment technologies and associated costs utilized in this study.

The cooperation and assistance of the industry trade associations are acknowledged for their assistance in supplying industry information. In particular, the following individuals and associations have been helpful: Mr. George Wino and Mr. O'Jay Niles of the American Textile Manufacturers Institute; Mr. Karl Spilhaus of the Northern Textile Association; Mr. Barry Torrence of the Carpet and Rug Institute; and Ms. Mary Jimmink and Dr. Peter Britton of INDA, the Association of the Nonwoven Fabrics Industry.

Finally, the numerous textile mill owners and managements who submitted information and cooperated during staff interviews are acknowledged and thanked.

Richard E. Seltzer
Project Director

CONTENTS

CONTENTS (Continued)

CONTENTS (Continued)

CONTENTS (Continued)

EXECUTIVE SUMMARY

I. Introduction

This report analyzes the economic impacts of the imposition of water pollution controls on the Textile Mills Point Source Category (textile industry). Prepared under the supervision and review of the Office of Analysis and Evaluation, U.S. Environmental Protection Agency, the study, as required under the Clean Water Act, considers the economic effects of the controls imposed by that law over the industry's discharge of its effluents.

The specific economic impacts analyzed in this study include those affecting industry:

1. prices, profitability, and growth,
2. extent and determinants of capitalization,
3. number, type, and size of plants,
4. production and employment, and
5. community and balance-of-trade effects.

To determine the industry's water pollution control cost impacts, the study describes the industry's structural, financial, and pricing characteristics, develops representative model plants reflective of these, and by imposing controls costs supplied by EPA on the models, determines the economic impacts of those costs.

The data employed in the study were derived from reports issued by federal agencies, survey information required from industry firms, industry trade associations, and interviews conducted among industry personnel during the Contractor's plant visits. Common published sources included EPA's Development Document, Robert Morris' Statement Studies, Troy's Almanac of Financial Ratios, and the Bureau of the Census' Census of Manufactures. Data from these and other sources were used to develop the macroeconomic profile of the industry as well as the representative financial models.

II. Methodology

In this study, several interrelated analyses were used to evaluate likely economic impacts resulting from effluent control requirements on the textile industry. These in-depth analyses included: (1) a characterization and subcategorization of the technical and economic structure of the industry, (2) a description of the financial profile of the industry, (3) the construction of representative model plants, (4) an evaluation of pricing patterns within the industry, (5) a description of the technological options and their costs for meeting designated levels of pollution control, and (6) the analysis of the economic impacts. The exhibit on the following page illustrates the schematic organization of this study's analyses.

In the case of Best Available Technology Economically Achievable (BATEA) and Pretreatment Standards for Existing Sources (PSES), the analyses focused on price increases, plant closings, curtailments of production, dislocations of production, unemployment, community impacts, and balance of trade effects. For New Source Performance Standards (NSPS) and Pretreatment Standards for New Sources (PSNS), the impacts were assessed in terms of the effects on industry growth, prices, plant locations (i.e., domestic or foreign production), and balance of trade.

The fundamental methodology used in the impact analysis is the same as that generally employed in capital budgeting studies of new investments. The budgets of the representative model plants, derived from various data sources concerning existing industry plants, provided the baseline case upon which the costs of pollution controls were imposed to determine the impacts of those controls' costs.

The model plants, though not precisely representative of any single existing plant operation, reflect the financial and physical characteristics of the industry in 1977. Adjustments to model plant budgets reflecting pollution control investment and annual operating costs permitted pre- and post-pollution control economic analyses for impacts on prices, profitability, and production.

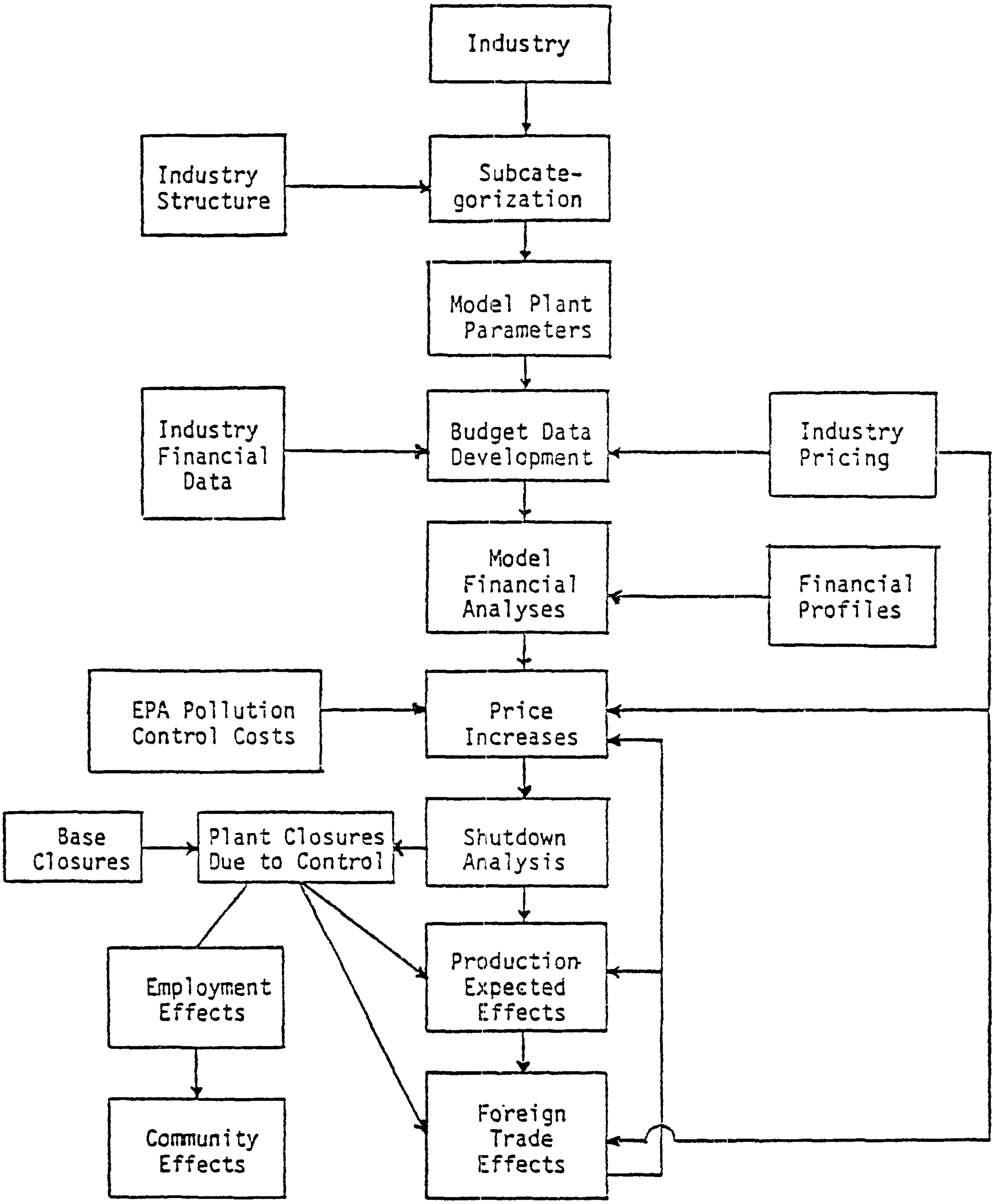
Price increases required to return the model plants to pre-pollution control levels of profitabilities were calculated to estimate the expected price effects. The abilities of the impacted plants to pass on such increases were then determined. Based on these price analyses, the abilities of plants to remain in operation after control expenditures were assessed.

Probable plant closures, a key part of the analysis, were determined through a net present-value analysis, by which expected future cash proceeds were discounted at a firm's estimated cost of capital. A net present-value of less than zero implies that it would be more practical for the owner to liquidate the plant and reinvest the salvage proceeds at the cost of capital.

The projected model plant closures were then extrapolated to the existing mills associated with the respective model plants. These closures were projected for the base case (without control expenditures) and the impacted case (with control expenditures). For new source mills (those yet to be constructed), projections for the base case and the impacted case were also determined utilizing the same methodology.

Finally, a qualitative analysis of economic determinants indicated the broad macroeconomic effects on industry production and employment, on its communities, location, and on balance of payments.

A detailed description of the study's methodology comprises Chapter II.



Schematic of economic impact analysis of effluent control guidelines

III. The Structure of the Industry

According to the Department of Commerce, the United States textile and apparel industry is characterized as being comprised of two distinct industry groups: the Textile Mill Products Group--SIC 22 (the textile industry) and the Apparel and Other Textile Products Group--SIC 23 (the apparel industry). The processes associated with the apparel industry are generally considered dry and do not result in the generation of wastewater. Consequently, the facilities in the apparel industry do not require wastewater discharge regulations and are excluded from an economic impact evaluation in this report.

The textile industry is comprised of a diverse group of establishments which typically create and/or process textile related materials for further processing into apparel, home furnishings, or industrial goods. Under the Standard Industrial Classification (SIC) system, the industry includes 30 separate SIC industries which manufacture approximately 90 classes of products. These establishments are principally engaged in receiving and preparing fibers; transforming these materials into yarn, thread, or webbing; converting the yarn into fabric or related products; and dyeing and finishing these materials at various stages of production. Many of these establishments produce final consumer products such as thread, yarn, bolt fabric, hosiery, towels, sheets, carpets, etc., while the rest produce transitional products for use by other establishments in the textile industry and by establishments in the apparel industry as well as others. The SIC system groups establishments according to similar end products produced and is useful in that much of the published data of the industry are presented according to SIC groupings. However the SIC groupings are often relatively large and thus represent a variety of types of establishments.

Another approach to structural characterization of the industry is to categorize establishments according to the manufacturing functions performed at the facility. This functional approach is considerably more applicable to this study since it enables the industry establishments to be grouped into "subcategories" of wet processors with similar wastewater characteristics. The limiting factor of this approach is that there are very limited published data corresponding to the specific functional categories or as subcategories. Accordingly, both categorization approaches are utilized in this report to describe the industry structure. The SIC system is used primarily to provide a framework in which the economic characteristics of the industry are analyzed from available published data. The functional categorization is used in the development of model plants and the subsequent detailed economic impact analysis of the subcategories (wet processors).

Census data for the period 1963-1977 reveal that the total number of establishments in the textile industry has remained fairly stable, fluctuating between 7,100 and 7,200. While the total number of mills has remained stable, the numbers within the various SIC industry groups have been more volatile. To a great extent, this volatility reflects reclassifications under the SIC system based on changes in the product mixes (a trend towards greater use of man-made fibers). In the functional categorization of the industry, a master list was developed by the Technical Contractor of 1,777 wet production facilities. Of this number, 1,165 were identified as wet processors which would be principally affected by effluent limitations. The remaining 612 mills were classified as low water use processing operations.

Census data indicative of plant size by number of employees are considered reflective of general industry characteristics. From the data, it can be determined that the majority of the mills are relatively small with 70 percent of the mills employing less than 100 employees (in 1972). In the aggregated industry, 37 percent of the mills were classified as small (less than 20 employees), 32 percent were defined as medium (20 to 99 employees), 29 percent fit into the large category (100 to 999 employees) with the remainder (2 percent) employing greater than 1,000 workers.

Textile mills were among the first type of industrial plants established in this country. As a result, the early centers of the industry were in the New England and Southern states. The heaviest concentrations remain in the Northeast and South with five states, New York, New Jersey, Pennsylvania, North Carolina, and Georgia, comprising 62 percent of the total mills operating in the United States. The Northeast has the greatest number of mills with 47 percent while the South has the next greatest with 43 percent. Although the Northeast has the greatest number of mills, the South has the largest size mills. Regarding plants with 20 or more employees, the South accounts for 51 percent of the total and the Northeast 42 percent.

During the past twenty years, significant changes in technology have affected the textile industry primarily as a result of the introduction and use of man-made fibers. Increased operating efficiencies have occurred in weaving mills with the adoption of shuttleless looms. The major advancements in knitting technology have been associated with women's hosiery and double knit fabrics made possible by developments in the use of man-made fibers. In yarn milling, increased efficiencies have been brought about by the development of texturized yarns and open-end spinning systems. The major advances in carpet milling have involved tufting which produces carpets at a speed of about six times faster than weaving.

The employment level in the industry has remained fairly stable over the past ten years ranging between 900,000 and 1,000,000. Employment peaked in 1973 at a level of 1,026,000; the low occurred in 1975 when it declined to 897,000. In 1977, the level was slightly over 900,000. The largest number of workers are employed in the weaving mills with over 300,000 workers or a third of the industry employment. The knitting mills account for 28 percent of the industry work force. Less than 10 percent are employed in the textile finishing plants.

IV. Industry Profile

Production, capacity, and utilization within the textile industry closely parallel the general economy. Total U.S. mill fiber consumption has increased at a rate of about 3.5 percent during the last 15 years. In recent years the increase has slowed down to under two percent annually. While total production has been fairly stable, as reflected in the rate of consumption of fiber, consumption by types of fiber has changed dramatically. Cotton consumption has declined from over 4 billion pounds in 1965 to 3 billion in 1978; consumption of wool is less than a third of its level in the early 1960's. While the consumption of natural fibers has declined, the consumption of man-made fiber has nearly tripled during the period.

During the past ten years, the average rate of capacity utilization for the textile industry was 87 percent which is slightly less than the average rate for the total nondurable manufacturing sector. The highest utilization (93 percent) occurred in 1973 during the industry's peak production year. A rate of 74 percent, the lowest during the period, occurred during the 1975 recession.

The major markets for the textile industry include apparel, home furnishings, industrial fabrics and exports. The largest is apparel fabrics with 42 percent of the fibers consumed entering this market. Home furnishings account for 32 percent of all fiber processed. The industrial market ranks third accounting for 23 percent of the total fiber processed. The international market receives 4 percent of the textile products produced in the industry as measured by fiber consumption.

International trade has had a significant influence on the U.S. textile markets with the increases in the import levels overshadowing moderate increases in export. The value of textile imports ($6 billion) was over 4 percent of all merchandise imported to the U.S. in 1977. As measured by the raw fiber equivalent of semi-manufactured and manufactured textiles, imports have doubled during the last 10 years with total pounds climbing from under 800 million in 1968 to approximately 1,600 million in 1978. In 1978, semi-manufactured products (yarn and fabric) comprised approximately one-third of the textile imports. This represents a significant decrease from the composition ten years ago when these products amounted to about 50 percent of the trade.

While imports in dollar volume have doubled during the early 1970's, textile exports have tripled reaching a level close to $2.5 billion in 1976. However, since exports have been expanding from a much smaller base, a continuing deficit in the textile trade exists reaching $2.8 billion in 1976. This deficit represented 30 percent of the nation's $9.2 billion merchandise trade deficit. For the past several years, textile exports have remained at about 7 percent of domestic production. While apparel products account for the greatest portion of imports, piece goods account for the largest share of exports.

Textile imports are regulated by a series of international trade agreements. One of the major regulations involves the Tokyo Round Trade Agreement which was signed into law in July 1977 by President Carter after almost six years of strenuous negotiations. It is intended to harmonize existing U.S. laws with new international codes primarily dealing with tariff levels and certain non-tariff barriers to trade. One of the most controversial issues of the Tokyo Round involved the reduction of tariffs by an average of 21 percent on textile imports. While the agreements will promote trade by reducing tariff levels, it could also have an adverse impact on the U.S. textile industry. The U.S. plans to reduce the impacts on the industry by strengthening existing legislation principally by changes to the Multifiber Arrangement (MFA). Under the MFA, imports are held at an average annual growth rate of 6 percent. There is a wide spread view within the industry that the 6 percent rate is too liberal since it is significantly greater than the increase in the domestic markets and that the gap between the two should be narrowed. The industry is pressing for more restrictive regulations which would include a reduction of the six percent quota growth factor to come in line with the growth in the domestic market which has been about 3 percent.

The value of shipments of the textile industry accounts for about 3 percent of the shipments from all manufacturing industries. However, the profits of the industry have been less than 2 percent of the manufacturing industries. After-tax profits have been traditionally low in the industry averaging about 2.5 percent of sales over the past 10 years. This return on sales has been significantly lower than the return for all manufacturing which has averaged just under 5 percent.

Because of the relatively low profitability in the industry, depreciation levels have been inadequate to permit the industry to keep abreast of its capital requirements. This has been particularly detrimental to the industry since it has been forced to rely primarily on internally generated funds to meet these requirements.

V. Price and Price Determination

The economic impacts resulting from the imposition of pollution controls are, in part, dependent upon the industry's ability to absorb or pass the economic costs of these controls backwards or forwards. For the textile industry, this ability would be partially dependent on the industry's influence over the prices and pricing processes of its end products (apparel) or its supply (fiber).

The supply and demand for textile fibers and goods are based on a number of price and non-price factors which vacillate over time. For example, the uncertain supply and price fluctuations of cotton were withstood for many years prior to 1965, when advancements in man-made fibers offered mills a relatively steady source of raw materials. As man-made fiber quality continues to improve while prices decline, their use increasingly persists by both textile mills and consumers.

While the utilization of the natural fibers such as cotton and wool has decreased since 1965, the major use of these fibers remains in the manufacture of apparel. Specifically, cotton supplied 56 percent of all fiber used in apparel manufacturing in 1965, but by 1977, its use had dropped to 33 percent. Conversely, while the rate of cotton consumed by apparel manufacturers in 1965 was 42 percent of all cotton consumed, the rate increased to 51 percent in 1977. During the same time, the utilization of man-made fibers grew from 33 to 64 percent of all fibers used for apparel goods. Even though man-made fibers are gaining increasing shares of many major textile markets, their use remains predominately in the apparel and home furnishing sectors.

Imports of raw materials have little effect on domestic supplies with wool being the only fiber imported in significant quantities. However, imports of foreign semi-manufactured and manufactured products are commanding an increasing share of the U.S. market, which in turn, reduces the demand for U.S. fiber.

The industry's annual production of textile products increased by 49 percent, from 9,050 million pounds of fiber in 1965 to 13,496 million pounds in 1977, reflecting the increasing demand for textile goods. Historically cotton fibers accounted for the majority of total fibers used in textile production; since 1968, however, man-made fibers, in particular non-cellulosics, have made significant inroads into the overall textiles industry. The latest figures available depict that in 1977, man-made fibers contributed 70 percent of total available fibers while cotton fibers comprised 28 percent of the supply.

In the past, the textile industry's pricing process was depicted as the closest model of pure competition existing in the major manufacturing industries in the U.S. Today, however, the competitive environment has changed, and accordingly the applicability of pure competition has been reduced. While the available supply and market demands for specific textile goods are major determinants of the price of the goods, numerous other factors, such as character of the product, elasticity of supply, and product specialization have considerable influence on the actual price received by the textile manufacturers. In addition, demand determinants for textile end-use products include several fundamentally important variables which are altogether outside manufacturers' control (e.g., housing starts, per capita disposable income, total employment). Furthermore, quantitative evidence indicates that end-use demand is not highly sensitive to price. However, prices are of fundamental importance in the determination of the demand for individual textile fibers. Technological and institutional processes, difficult to quantify, are of major influence in both markets (end-use and fiber). Briefly, price determination for textile goods is highly complex and dynamic. Prices are fundamentally sensitive to many factors over which firms have no control.

In summary, there is little confidence that manufacturers' costs increases can be smoothly passed through to consumers by way of higher priced textile goods. If costs increase at a time of economic vigor, with incomes and employment strong, few impacts may occur. Conversely, if cost increases occur during a period of weak or slow economic growth, the impacts on individual firms or an entire industry subcategory might be greater. In addition, the technological dynamics of the fiber and fabric segments suggest a potential for differential impacts resulting from the imposition of effluent control costs. If any differential impacts also affect relative fiber prices, potential fiber market dislocations will be highly significant.

VI. Representative Model Plants

Model plants were developed to represent mills and plants - both existing and new sources - which could be affected by the imposition of effluent control guidelines. Models were based on the production sizes and subcategories contained in the Development Document; subcategories include:

1. wool scouring,
2. wool finishing,
3. low water use processing, (no economic models were developed for this subcategory),
4. woven fabric finishing,
5. knit fabric finishing (includes hosiery products),
6. carpet finishing,
7. stock and yarn finishing,
8. nonwoven manufacturing,
9. felted fabric processing.

In addition to the above structure with its focus on mill waste characteristics, models were further segmented into type mills in order to reflect economic characteristics associated with product ownership and extent of integration. Types include commission finishers, own fabric (finishers), and integrated mills. The "commission" models represent those plants which are engaged in job finishing on a commission or fee basis; they do not purchase the textiles processed. The own fabric finishers are similar to commission plants with respect to the processes accomplished but differ in economic aspects. These plants either purchase the textile inputs or are plants within multiplant firms which are vertically integrated. The "integrated" models represent those mills engaged in both greige milling and finishing operations. Models were developed for the above types of mills because of the significant differences in the financial profiles and their abilities to absorb pollution control costs.

The model plants were developed from a synthesis of data obtained from surveys of the industry as well as the published sources indicated in Chapter II. Economic aspects of the models address the operational characteristics and financial profiles of the mills represented. Operational characteristics concern mill utilization rates and levels and classifications of employment. Financial profiles encompass investment, sales, cost, profit and cash flow characteristics of the mills. Furthermore, the models were designed to represent industry conditions of 1977; these baseline models do not reflect the effects of water pollution control costs (except for BPT which was generally in-place in 1977).

VII. Wastewater Control Costs

The wastewater control costs considered in this study were provided in the Development Document and were developed for both direct and indirect dischargers (as well as existing and new source plants discussed in the previous chapter). The discharge status of the industry was based on survey data reported by the Technical Contractor in the Development Document. An estimated 80 percent of the wet processors (indirect dischargers) are discharging to publicly owned treatment works (POTW) while the remaining 20 percent (direct dischargers) are discharging to surface or receiving waters. Of all the 1,165 wet processors in the industry, it is estimated only about 20 percent would be affected by the guidelines. Ten percent of the direct dischargers have advanced treatment systems while most of the remainder have BPT systems in-place. Only about 10 percent of the indirect dischargers are discharging wastes which would require them to add pretreatment controls; these wastes are those that contain heavy metals.

A broad range of alternative treatment technologies were used in establishing model treatment costs. These included chemical coagulation, filtration, flotation, activated carbon adsorption and ozonation. After cost analyses (described in the Development Document), the more sophisticated technologies such as ozonation were excluded from further consideration because they were either too costly or energy intensive. (However, they are included in this analysis to demonstrate their impacts). The remaining technologies were selected as proposed treatment options for a detailed analysis. From these proposed options, EPA has recommended specific options to be used in establishing limitation guidelines and performance standards.

VIII. Projected Economic Impacts

The impacts described in this report were assessed for each of the model textile operations described in Chapter VI utilizing the various wastewater control alternatives' costs presented in Chapter VII. The methodology used (described in Chapter II) was based on a net present value (NPV) analysis to determine the models' required price increases, their ability to make price increases necessary to offset control expenditures, and the potential financial impacts attributable to such expenditures. Other potential impacts such as plant closures, employment losses, community effects, dislocation effects, and balance of payment effects were also assessed for each proposed treatment option. The impacts presented are reflective of the industry conditions as of 1977/78.

The proportion of the industry which will be required to make control expenditures, the strong competitive threat from foreign textile producers, and the existing domestic intra-industry competition indicate the U.S. textile industry will not be able to adequately raise prices to offset wastewater control expenditures. The projected financial impacts assume the portion of the industry affected by control compliance requirements will absorb all the associated wastewater treatment costs.

The impact analysis suggests some textile facilities may not choose to continue operations after the imposition of control requirements. Although closures and resulting losses in employment in small communities may impact those areas, such closures are not expected to seriously disrupt the industry as a whole. Their lost production could be absorbed by existing plants, and their effects on the national balance of payments would be negligible.

The impacts of the recommended control options are summarized below.

1. BATEA (Existing Direct Dischargers)

For BATEA, the EPA has recommended the selection of BATEA Option 2 for Woven Fabric Finishing (4), Knit Fabric Finishing (5 but excluding 5c), Carpet Finishing (6), Stock and Yarn Finishing (7), and Nonwoven Manufacturing (8) and BATEA Option 4 for Wool Scouring (1), Wool Finishing (2), and Hosiery Products (5c) as the basis for proposal of BAT effluent limitations. BATEA Option 1 has been recommended for Felted Fabric Processing (9).

The imposition of these options will potentially affect 214 direct discharging facilities with three felted fabric processing (9) facilities currently achieving BATEA Option 1 and 22 facilities in the other subcategories presently achieving their respective BATEA Options 2 or 4. Compliance with these options is anticipated to require an initial investment amounting to $48 million with annualized costs of $21 million. The price increases required to offset such expenditures have been projected to be 2.2 percent or less. With respect to financial effects, assuming no price increases, the BATEA recommended options could reduce the models' returns on sales from a base case range of -0.9 to 5.9 percent to a range of -3.8 to 5.0 percent, cause reductions in cash flows, and cause reductions in the models' net present values. Prior to compliance with these options one model was a base case closure, three models were marginal with the remainder models all being viable. When the models were impacted with the recommended options nine models indicated closure, four models indicated marginal, with the remainder being viable. These financial impacts resulted in the projection that 19 existing direct dischargers may close due to compliance requirements resulting in potential production losses amounting to 126.5 million pounds and employment losses of 3,401 employees. Resultant community impacts associated with the closures will vary, but it is anticipated some communities, particularly in the southeast may incur impacts. Balance of payment impacts are anticipated to be nominal.

2. PSES (Existing Indirect Dischargers)

The EPA has recommended PSES Option 2 for all existing indirect dischargers. Compliance with this option will affect 107 indirect dischargers and will require an initial investment amounting to $38 million with annualized cost approximating $19 million. Required price increases needed to offset compliance expenditures for the model plants were 4.3 percent or less. If no price increases were assumed the models' financial impacts included declines in the models' returns on sales from a range of -1.6 to 4.1 percent for the base case to a range of -11.8 to 3.7 percent for the impacted case, reductions in the models' annual cash flows, and reductions in the models' net present values. Prior to control compliance (base case) one model was projected to be a closure, four models were considered to be marginal with the remainder being considered viable. In the impacted case twelve models indicated closure, three models were marginal, and the remainder were viable. These financial impacts resulted in the projection that 20 existing indirect discharging facilities may close due to compliance requirements. These closures could result in production losses totaling 74.7 million pounds and employment losses totaling 2,909 employees. The severity of the community affects will vary but it is anticipated some communities, particularly in the southeast, may incur impacts. Balance of payments impacts are expected to be nominal.

3. NSPS (New Source Direct Dischargers)

NSPS Option 2 has been recommended by EPA as the treatment requirement for new source direct dischargers. Impacts associated with new source models were difficult to assess as they represent facilities which have yet to be constructed. However, based on the new source models, the imposition of NSPS Option 2 expenditures resulted in the new source models requiring projected price increases to offset control expenditures ranging from 0.8 to 3.4 percent. Assuming no price increases, projected impacts reflected reductions in returns on sales from a base case range of 3.3 to 7.4 percent to an impacted range of 1.8 to 6.7 percent, reductions in the annual cash flows but none to negative levels, and reductions in the models' net present values with none becoming negative in the impacted case which were not negative in the base case. Predicated on the financial impact analysis it was projected that only one model changed its viability status due to the imposition of control expenditures. This model was the medium felted fabric processing (9) model which was marginal in the base case and became a closure in the impacted case. This subcategory (felt) was the only projected subcategory which the imposition of control requirements may have significant effects on the likelihood of the entrance of new facilities.

4. PSNS (New Source Indirect Dischargers)

The EPA has recommended PSNS Option 2 apply to new source indirect dischargers. As mentioned above new source model plant impacts caused by the imposition of wastewater control requirements were difficult to assess as new source models represent facilities which have yet to be constructed. However, based on the new source models, the imposition of PSNS Option 2 resulted in individual model plant projected required price increases ranging from 0.4 to 2.3 percent. Assuming no price increases, projected financial impacts reflected reductions in the models' returns on sales from a base case range of 2.7 to 8.5 percent to an impacted case range of 1.9 to 7.1 percent, reductions in the models' annual cash flows (none to the point of being negative), and reductions in the models' net present values with only the medium own yarn stock and yarn (7) model reflecting a negative net present value which was not negative in the base case (prior to control expenditures). Based on the financial analysis it was determined it would be doubtful if new source integrated wool finishing (2) facilities would be constructed even without control expenditures and that medium own yarn stock and yarn (7) operations may prove to be only marginally viable if required to meet PSNS Option 2 requirements. It is unlikely future growth in the other subcategories will be significantly affected by PSNS requirements.

IX. Limits of the Analysis

There was considerable published information covering the structure and economic data of the textile industry at the major (or total) and the minor (or weaving and finishing, knitting, other textile products) industry levels and also by SIC industries. However, there was very little published information available which addressed the industry under the functional classification system used in this study. While information and data were utilized from a variety of sources, major sources included published governmental and industry reports, the industry data collection portfolio, and extensive contacts with individuals associated with the industry.

The estimated data error ranges, as an average for the industry, were as follows:

1.	Information regarding the organization and structure of the industry, number, location and size of plants, and other information descriptive of industry subcategories	± 10%
2.	Price information for products and raw materials	± 20%
3.	Cost information for plant investments and operating costs	± 20%
4.	Financial information concerning the industry	± 15%

In an economic impact analysis of most any industry, it is inevitable that simplifying assumptions must be made to bring the problem into a framework of analysis consistent with the constraints of time, budget, and data availability. The major critical assumptions used in this analysis were as follows:

1. Types and sizes of the model plants were representative of plants actually existing in the industry and of plants expected to be built in the future.

2. It was assumed that the financial data were representative of costs and returns of existing plants or new plants to be constructed after promulgation of proposed guidelines. As stated earlier, the model plant financial data are on a constant 1977 dollar basis and can be adjusted at future times to reflect the future economic activity.

3. Levels of profitability reflected in model plant profiles (based primarily on the average of the period from 1970 to 1977 so as to include years of high and low profits) would be the same in the future 21 years.

4. It was assumed that the economic impacts of wastewater controls on those products not included in the detailed analysis of "representative" plants could be evaluated in general terms through associating them with those "representative" model plants for which detailed analyses were made. This association was based primarily on the fact that models were developed for a single product plant which represented a majority of industry subcategory's production. In most cases, there were actual plants producing products in similar combinations as those described in the model plants.

I. INTRODUCTION

Section 301(b) (1) (A) of the Clean Water Act (the Federal Water Pollution Control Act Amendments of 1972, as amended by P.L. 95-217, the Clean Water Act of 1977) requires existing industrial dischargers to waters of the U.S. to achieve by July 1, 1977, effluent limitations requiring the application of the best practicable control technology currently available (BPT). By July 1, 1984, these same dischargers are required to achieve effluent limitations requiring the application of the best available technology economically achievable (BAT) and the best conventional pollutant control technology (BCT) pursuant Sections 301(b)(2)(A), (b)(2)(C), (b)(2)(E). Additionally, new industrial dischargers are required to comply with new source performance standards (NSPS) under section 306 of the Clean Water Act (the Act), and new and existing industrial dischargers to publicly owned treatment works (POTW's) are subject to pretreatment standards (PSES for existing sources and PSNS for new sources) under Sections 307(b) and 307(c) of the Act.

The purpose of this study is to assess the economic impacts of these requirements on the Textile Mills Point Source Category (hereafter referred to as the textile industry).

A. Scope of This Report

The analysis of the economic impacts of these effluent limitations on the textile industry necessitates analyses at both micro and macro economic levels. To accomplish such analyses, the aggregate industry as well as individual firms within the industry must be represented.

This report depicts the textile industry's structure, financial characteristics, marketing and pricing practices, representative model plants, proposed wastewater control costs, and the analyses of their resulting economic impacts. The report includes, also, a description of the methodology to determine these impacts. The specific types of economic impacts analyses in this report include those upon:

(1) prices (including effects upon an industry's suppliers and consumers)
(2) profitability
(3) industry growth
(4) ability to raise capital
(5) number of plants
(6) production
(7) employment
(8) communities, and,
(9) others as appropriate (such as dislocation and balance of trade).

B. Organization of This Report

This report presents an overall description of the textile industry. This description includes discussion concerning the industry's structural, financial, and pricing characteristics. From these data, representative economic model plants were developed as a baseline (before the imposition of control costs) upon which the impact analysis was based. (These models reflect new and existing mills representing common industry subcategories and sizes and their discharge compliance status.)

The impact analyses are presented in two parts. The first, the direct discharger impacts, consider those resulting from BATEA and NSPS. The second examines the impact effects from the PSES and PSNS limitations on municipal (POTW) dischargers. It should be noted in Chapters VI, VII, and VIII, the material is first presented for existing sources followed by the material for the new sources. This order of presentation corresponds with the presentation order in the Development Document.1/

C. Data Sources

Data utilized in the development of this report were obtained from both primary and secondary sources. Primary data typically pertained to specific industry plants or subcategories, and secondary data typically pertained to published data reflecting the aggregate industry. Some of the more commonly used data sources are described below. A bibliography is presented in Appendix A.

It should be noted throughout this report an attempt was made to utilize the latest data and information available. While not all sources were available depicting 1978-79 conditions, attempts were made to qualitatively describe the current industry situation. The model plants pre--sented in Chapter VI were developed from both primary and secondary data sources. The primary sources were reflective of 1977/78 conditions. Accordingly, the impact analysis presented in this report reflects the industry's impacts as the industry would incur them as of 1977/78.

1. Primary Data Sources

Information acquired directly from mills or from representatives of the industry were considered primary data. The major sources of this study's primary data were individual mills, as well as mill and industry representative visits by DPRA personnel.

1/ Development Document for Proposed Effluent Limitations Guidelines, New Source Performance Standards and Pretreatment Standards for the Textile Mills Point Source Category, U.S. Environmental Protection Agency, Effluent Guidelines Division, EPA 440/1-78-022b, October 1979.

Under the authority of Section 308 of the Act data collection portfolios were sent to 532 textile plants from a list provided by the technical contractor. The distribution of the mailing of the portfolios and the number of initial responses received are shown in Table I-1. Overall, 308 individuals receiving the portfolios responded with 100 of these being from "dry" operations which do not generate wastewaters and 208 being from "wet" operations. Of the 208 responses from "wet" operations, 73 percent contained good, useable data, 13 percent contained only fair useable data, and 14 percent contained little, if any, useable data.

The data received from the initial mailing of the survey provided much of the basis for the development of the model plants. A follow-up survey effort resulted in additional information being received from 74 facilities who did not originally respond and 47 facilities who only partially responded originally. The data received from the follow-up effort has been compared to the initial data base and since no significant deviations were evident, the follow-up data was qualitatively incorporated into the analysis. It is presently planned to quantitatively incorporate the follow-up survey data into the model plants and the analysis during the period between proposal and promulgation of the regulations.

A copy of the data collection portfolio is presented in Appendix C. DPRA personnel also visited several textile operations to gain insight into their respective operational and managerial characteristics. These plant visits were coordinated through various industry trade organizations and the facilities selected are believed to be fairly representative of a cross-section of the industry. The information obtained during these visits supplemented data received from the economic survey.

2. Secondary Data Sources

The published data utilized in this analysis were predominately obtained from various reports obtainable from both private and governmental sources. These secondary data sources were utilized throughout this analysis to depict historical industry trends and to supplement and check information received from primary sources. This latter use of secondary information was particularly important in the development of the financial model plants to assure the representativeness and accuracy of the models. A complete listing of the major secondary sources utilized in the development of this report are listed in Appendix A.

Table I-1. The Textile Industry: Survey Distribution and Initial Response Rates

		Surveys Returned						Quality of "Wet" Operations' Survey Responses					
		Total		"Dry" Operations		"Wet" Operations		Good Useable Data		Fair Useable Data		Little Useable Data	
	Number of surveys sent	Number	Percent of total sent	Number	Percent of total sent	Number	Percent of total sent	Number	Percent of wet responses	Number	Percent of wet responses	Number	Percent of wet responses
Wool Scouring	18	12	67	4	23	8	44	7	88	1	12	0	0
Wool Finishing	33	16	48	3	9	13	39	11	89	0	0	2	11
Low Water Use Processing (Greige)	104	62	60	38	39	24	23	8	33	6	25	10	42
Woven Fabric Finishing	79	43	54	5	6	38	48	26	68	6	12	6	12
Knit Fabric Finishing	75	42	56	9	12	33	44	28	85	2	6	3	9
Hosiery Manufacturing	65	31	48	5	8	26	40	19	73	3	12	4	15
Carpet Manufacturing	43	29	67	7	16	22	51	14	64	5	23	3	13
Stock and Yarn Finishing	70	44	63	19	27	25	36	23	92	2	8	0	0
Nonwoven Fabric Manufacturing	45	29	64	10	22	19	42	15	80	2	10	2	10
Total	532	308	58	100	19	208	39	151	73	27	13	30	14

Source: Development Planning and Research Associates, Inc.

II. METHODOLOGY

The methodological approach utilized to assess the likely economic impact of effluent control limitations on the textile industry is summarized in this chapter. In this impact study, economic impact is defined as the differences between (1) the projections of the likely effects on a plant, a local area, the United States, and on foreign activity which would result from an industry's compliance with a given level of effluent control standards and (2) the projection of industrial activity and changes which would likely occur in the absence of control standards (baseline conditions).

In particular, the principal economic variables of interest in this study are:

(1) price effects--including effects upon industry's suppliers and consumers,
(2) profitability--growth and capital availability,
(3) number, size, and location of plants that can be expected to close or curtail employment,
(4) changes in employment,
(5) community impacts,
(6) dislocation effects,
(7) balance of trade consequences,
(8) other impacts.

In the case of best available technology economically achievable (BATEA) and pretreatment standards for existing sources (PSES), the analysis focused on price increases, plant closings, curtailments of production, dislocations of production, unemployment, community impacts, and balance of trade effects. For new source performance standards (NSPS) and pretreatment standards for new sources (PSNS), the impacts were assessed in terms of the effects on industry growth, prices, plant locations (i.e., domestic or foreign production), and balance of trade. The specific bases for effluent control relating to the textile industry are described in detail in a separate EPA report. 1/

1/ Development Document for Proposed Effluent Limitations Guidelines, New Source Performance Standards and Pretreatment Standards for the Textile Mills Point Source Category, U.S. Environmental Protection Agency, Effluent Guidelines Division, EPA 440/1-79-022b, October 1979.

Several interrelated analyses were used to evaluate likely economic impacts resulting from effluent control requirements on the textile industry. These in-depth analyses included: (1) a characterization and subcategorization of the technical and economic structure of the industry, (2) a description of the financial profile of the industry, (3) the construction of representative model plants, (4) an evaluation of pricing patterns within the industry, (5) a description of the technological options for meeting designated levels of pollution control and the costs associated with each option, and (6) the analysis of economic impacts.

The overall analysis, however, was not a simple sequential one; rather, it employed interacting feedback steps. The schematic of the analytical approach is shown in Exhibit II-1. Due to the fundamental causal relationships among the financial and production effects and other impacts, a greater emphasis was devoted to plant closure analysis.

A. Industry Structure and Subcategorization

The industry structure and subcategorization analysis primarily involved describing and segmenting the industry in terms of its past and current economic characteristics in order to provide an information base for the subsequent analytic steps. In particular, the information on industry characteristics was useful in determining an appropriate disaggregation design for industry subcategorization.

The subcategorization involved segmenting the plants within the industry into relatively homogenous classes with respect to plant size, regional differences, technology employed, number of products, existing level of pollution, scale of technological processes, level of output, or other relevant factors important for assessing the impact of pollution controls. This delineation of industry subcategories served as the basis for the definition and construction of representative model plants and the determination of the wastewater treatment technological options and costs appropriate to each.

B. Financial Profile of the Industry

The ability of firms within the industry to finance investment for pollution control was determined, in part, by the past and expected financial conditions of those firms. Under the heading "financial profile of the industry," various factors were studied to develop insight into the financial characteristics of actual plants in the industry. Much of the data compiled in this section was also useful in determining the financial profiles of representative model plants.

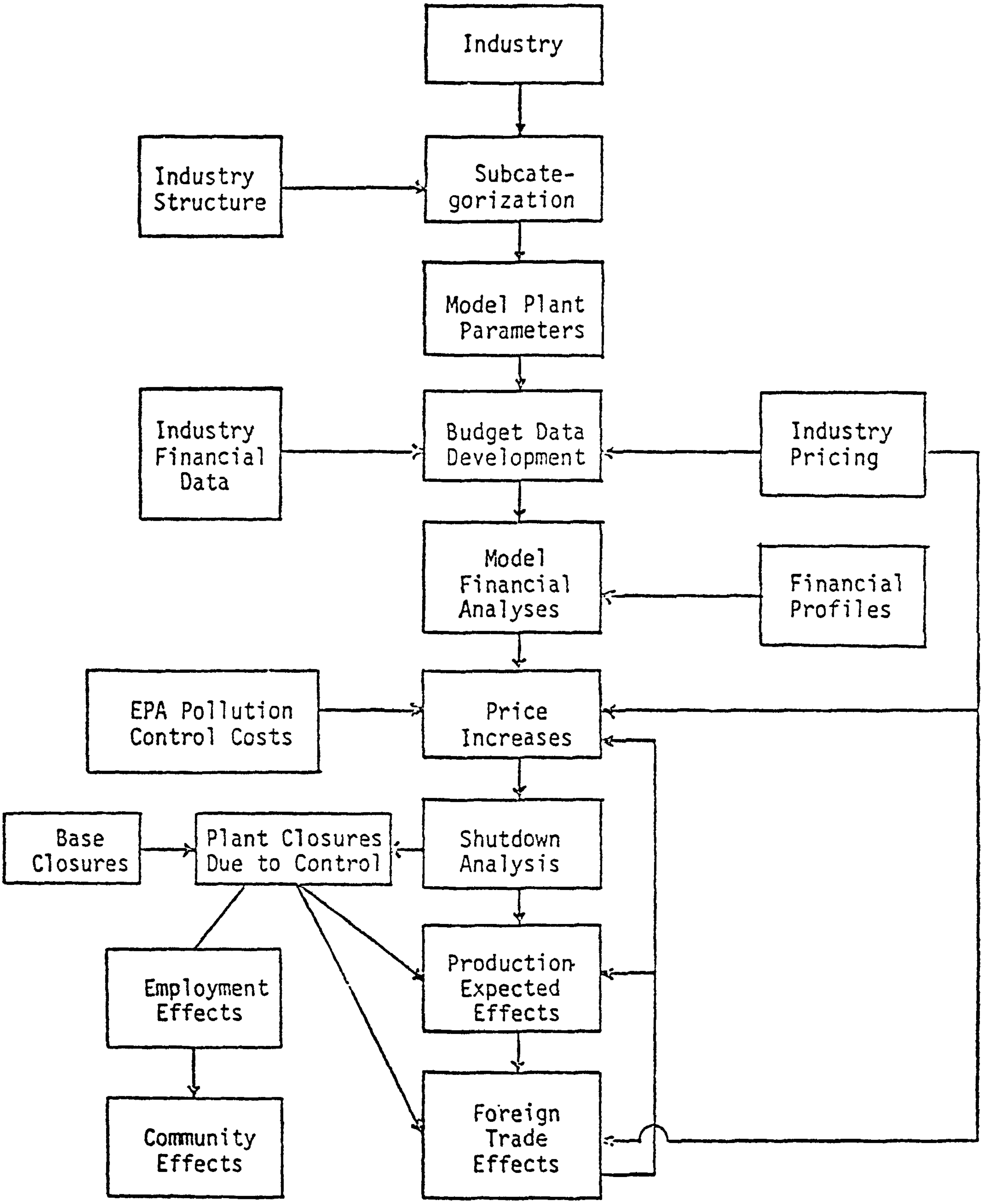


Exhibit II-1. Schematic of economic impact analysis of effluent control guidelines

Key financial statistics included after-tax profit as a percent of sales, after-tax profit as a percent of invested capital, sales to total assets ratios, sales per employee, assets per employee, and after-tax profit to net worth. Other financial factors were studied with respect to the ability of firms to generate funds to finance investment for effluent management, either internally through cash flow or externally through new debt or equity issues. The data compiled in this phase of the analysis provide an information base useful for projecting key technical and economic factors and for carrying out subsequent economic impact analysis.

C. Model Plants

The model plant analysis used was a systematic framework within which to assess likely economic impacts on individual types and sizes of actual plants within the industry. Usually more than one model plant was required for an industry in order to represent various types and sizes of existing plants or plants which are likely to be constructed after the promulgation of effluent control guidelines.

The model plant profiles represent a variety of financial, economic, and technical variables such as sales, investment, fixed and variable costs, profits, size, and type of process. The profiles were constructed from information and data gathered in the industry characterization phase of the analysis. This information was generally obtained from an industry survey, plant visits, discussions with industry representatives, trade publications, other secondary data sources, and from engineering cost-synthesis methods.

In developing the model plants, the best data source was the industry surveys which provided detailed financial data from the various types and sizes of existing firms. However, data from the industry surveys were checked with published financial data to assure the reliability of the data contained in the surveys. Also data from published sources are available annually which allow historical trends to be considered as well as enabling the industry's financial situation to be updated without resurveying the industry.

Thus, the model plants are developed utilizing an eclectic approach which considers data from both primary and secondary sources. In a typical development of a model plant, key economic/financial data (e.g. sales, production costs, margins, asset structure) are collected from numerous sources and converted to a common base. These data are, in turn, analyzed and compared, considering also nonquantifiable aspects of the industry, to determine the appropriate parameter to use for the particular model plant. The consolidation of the various parameters results in the depiction of the key economic and financial components in the form of a representative model plant.

The applicability of utilizing model plant data for assessing expected economic impacts of pollution controls rests principally on the representativeness of the selected model plant(s). For example, the economic concept of "economies-of-scale" in production is often present in processing plants, e.g., average unit costs of production are usually lower for large plants than for medium or small plants of the same type. Furthermore, there are expected economies-of-scale in waste treatment, which, in effect, will compound the economies-of-scale relationships among differing sizes of plants.

In general, economies-of-scale relationships in pollution control costs have been demonstrated, and this alone would necessitate multiple model plant analyses to evaluate differential economic effects. Other processing factors, e.g., type of manufacturing process employed (technology) may also affect processing costs and wasteflows. This again may necessitate a further segmentation of an industry and the inclusion of additional model plants for a more comprehensive analysis.

D. Pricing Patterns

The analysis of pricing patterns in the textile industry focused on factors determining supply and demand. Market structure and the nature of competition were evaluated, a step which, for the textile industry, involved the inclusion of the influence that international markets and competition assert on the domestic industry's prices. Finally, the ability of impacted plants to recover the increased costs of pollution controls were assessed.

E. Waste Treatment Technological Options and Costs

Waste treatment options and their associated costs are obviously instrumental in the assessment of the economic impacts of water pollution controls. In general, basic technical and cost data were developed specifically for various types and sizes of model plants using the appropriate discharge method (direct or indirect). This analysis also examined model plants reflecting new facilities which were projected most likely to be built after the promulgation of the guidelines. In determining appropriate options and costs, it was necessary to specify 1) the points of final disposition of discharge in each industry segment, and 2) the types and proportions of effluent systems in place. This information was primarily obtained from EPA, Effluent Guidelines Division through the technical contractor.

Cost data from the technical contractor usually included estimated investment costs for various treatment options for each model plant and their respective estimated annual operating and maintenance costs based upon normal operating rates or annual production capacity.

F. Other Regulatory Costs

In addition to regulations pertaining to water pollution control, plants are also subject to other federal regulatory requirements which depend upon the industry and the nature of its processes and/or products. These regulations can pertain to product quality, air pollution, solid waste disposal, occupational safety and other areas.

Unfortunately these other regulations are not uniformly required or enforced. Also, data reflecting the costs of compliance to these regulations are not often available. To the extent possible, the impact analysis considered the costs associated with these other regulations.

G. Analysis of Economic Impacts

This study's economic impact analysis required the establishment of a basecase of industry conditions that would prevail without pollution controls in order to estimate the consequent economic impact of pollution controls by showing the change from this basecase attributable to their imposition. Thus, in this study a "dynamic basecase"--a projection of the industry structure in terms of the number of its plants, production, employment and other parameters over time--was used as opposed to a "static" basecase descriptive of current industry conditions.

Fundamentally, the impact analysis was similar to that usually required for any capital budgeting study of new investments in which the problem is one of deciding whether a commitment of time or money to a project is worthwhile in terms of the expected benefits. The analysis was complicated by the fact that benefits and investments will accrue over a period of time and that, in practice, the analyst cannot reflect all of the required imponderables which, by definition, must deal with future projections. In the face of imperfect and incomplete information and of time constraints, the industry segments were described in the form of financial budgets of model plants. Key non-quantifiable factors were considered in the interpretation of the quantified data. Actual financial results deviated from the model results; however, these variances were considered in interpretating the findings based on model plants.

The analysis of anticipated economic impacts of water pollution controls are described as follows.

1. Fundamental Core Methodology

The fundamentals for analysis are basic to all impact studies. The core methodology is described here as a unit with the specific impact analyses discussed under the appropriate headings following this section.

a. Model Plant Impact Analysis

The core analysis for this study was based upon synthesizing the physical and financial characteristics of the various industry segments through representative model plant projections. Estimated financial profiles and cash flows are presented in the model plant chapter. The primary factors involved in assessing the financial and production impact of pollution control were profitability changes--a function of the cost of pollution control and a plant's ability to pass along these costs in the form of higher prices. In reality, closure decisions are seldom made on a set of well-defined and documented economic rules. They include a wide range of personal values, external forces such as the inability to obtain financing, or the relationship between a dependent production unit and its larger cost center whose total costs must be considered.

Such circumstances include but are not limited to the following factors:

(1) Inadequate accounting systems or procedures. This is especially likely to occur in small, independent plants which do not have effective cost accounting systems.

(2) Inefficient production units. This is particularly true of plants where the equipment is old and fully depreciated, and the owner has no intention of replacing or modernizing it. Production continues as long as labor and materials costs are covered until the equipment fails entirely.

(3) Personal values and goals associated with business ownership that override or constrain rational economic rules. This complex of factors may be referred to as the value of psychic income.

(4) Production dependence. This is characteristic of a plant that is a part of a larger integrated entity which either uses raw materials being produced profitably in another of the firm's operating units or supplies raw materials to another of the firm's operations where the source of supply is critical. When the profitability of the second operation more than offsets the losses in the first plant, the unprofitable operation may continue indefinitely because the total enterprise is profitable.

(5) Temporary unprofitability. This may be found whenever an owner-operator expects that losses are temporary and that adverse conditions will change. His ability to absorb short-term losses depends upon his access to funds through credit or personal resources not presently utilized.

(6) Low (approaching zero) opportunity costs for the fixed assets and for the owner-operator's managerial skills labor. As long as the operator can meet labor and materials costs, he will continue to operate. He may even operate with gross revenues below variable costs until he has exhausted his working capital and credit.

7. Plant-site appreciation. This factor is important in those situations where the value of the land on which the plant is located is appreciating at a rate sufficient to offset short-term losses.

These factors are generally associated with proprietorships and closely held enterprises rather than with publicly held corporations.

Although the above factors are present in and relevant to business decisions, they are not always susceptible to quantifiable analysis. This study's analytical techniques are sufficient, however, to provide useful and reliable insight into such potential business responses to required investment and operating costs for pollution control facilities. Accordingly this analysis of the model plants' impacts was primarily based on the determination of the model plants' net present values (NPV) both before and after expenditures for controls. This NPV analysis was then combined with considerations for unique influencing factors (such as those listed above) so that its assessment of impacts reflects, as accurately as possible, the responses actual businesses will make.

The computation of the net present values in such an analysis involves the discounting of the models' cash flows over some period of time (in this analysis 21 years) through the discounting function:

$$NPV = \sum_{n=1}^{t} A_n (1+K)^{-n} - I_o$$

where:

NPV = net present value
A_n = the cash flow in the n^{th} year
K = discount rate (after-tax cost of capital)
n = number of the conversion period, i.e., year 1, year 2, etc.
t = total number of conversion periods (years)
I_o = value of facility for nonconforming uses (salvage value for existing facilities and initial investment for new source facilities)

The resulting net present value indicates the excess of the present value of projected cash flows for an operating facility over the present value of what the equity holders could earn if they liquidated in year zero and invested the resulting money plus any additional investments they would normally be expected to invest to maintain the facility in operation during the time period (in this case twenty-one years) at the firm's estimated cost of capital. Thus, if the NPV is positive, the equity holders are earning a return which is greater than the model's cost of capital. If the NPV is negative, then the equity holders are earning less than the cost of capital, and in such a situation, they would be better off liquidating, realizing the salvage value in cash,1/ and reinvesting it at least at the firm's (industry) cost of capital.

1/ Salvage value is defined here as the liquidation value of fixed assets plus working capital, i.e. sold for nonconforming uses.

Model plant NPV's are determined both without and with expenditures for pollution controls. Comparison of the base case (without controls) and the impacted case (with controls) allows the net effects of the controls to be determined. These effects in combination with other relevant economic considerations enable overall impacts to be determined.

b. Construction of the Model Plant Cash Flow and Capital Outlays

The cash flow and capital outlays used in this analysis of pollution control costs were constructed in the following manner:

(1) The cash flows were presented in current dollars thus requiring the use of different cash flows for each of the respective years.

(2) For existing model plants, the initial investment, taken in year t_0, was considered to be outlays for the model fixed assets (salvage value) and working capital.

(3) The after-tax cash proceeds were taken for years t_1 to t_n. These were adjusted annually for inflation.

(4) Annual reinvestment for replacement of depreciated assets was estimated for year t_1 and was adjusted annually to compensate for inflation and the net between reinvestment and depreciation.

(5) Terminal value of the model was taken in year t_n and reflected the salvageable assets plus the net working capital.

(6) Capital outlays for pollution controls, when applicable, were added to the models' total assets in increments during years t_1 to t_6.

(7) Annual pollution control expenses were incurred incrementally between years t_1 and t_6 reflecting the stages of construction completion for the capital outlays. After year t_6, expenses were adjusted annually for inflation.

(8) Depreciation of depreciable assets was computed utilizing rapid depreciation techniques for tax computations and the straight-line method for the pro forma income statements. Replacement investments of pollution control equipment began in year t_{11}.

(9) No terminal values of the pollution facilities were computed as it was anticipated there would be few, if any, salvageable assets in year t_n.

Base case cash flows consisted of Steps 1 through 5 and excluded investments and annual costs associated with pollution controls. Impacted cash flows consisted of Steps 1 through 9 and reflected the model plant after the imposition of environmental requirements.

In the construction of the cash flow for the net present value analysis, after-tax cash proceeds were defined as:

(1) After-tax income = $(1 - T) \times (R - E - I - D)$

(2) After-tax cash proceeds = $(1 - T) \times (R - E - D) + D$

where

T = tax rate
R = revenues
E = expenses other than depreciation and interest
I = interest expenses
D = depreciation charges

Depreciation was included only in terms of its tax effect and was then added back to obtain after-tax cash proceeds.

There is a temptation to include outlays for interest payments when computing the cash proceeds of a period. Cash disbursed for interest should not affect the cash proceeds computation. The interest factor is taken into consideration by the use of the present-value procedure. To also include the cash disbursement would result in double counting. The effect of interest payments on income taxes is also excluded from the cash proceeds computation. This was brought into the analysis when computing the effective rate of interest of debt sources of capital, which is used in the determination of the cost of capital.

A tax rate of 20 percent on the first $25,000 income, 22 percent on the second $25,000 income, and 48 percent on amounts over $50,000 was used throughout the analysis. Investment credits and carryforward and carryback provisions were not used due to their complexity and special limitations. The annual inflation rate used for this analysis was 6.0 percent. This rate reflects, approximately, the annual rate for the past ten years based on the historical implicit price deflators for the gross national product. A period of twenty-one (21) years was selected for the length of time to discount models' cash flows because this period of time was determined to be representative of the useful economic life of actual industry facilities. The important consideration in this length of time is the length of service of machinery and equipment. Building life for a facility typically is considerably longer than 21 years. However, building costs are small relative to the costs of production equipment. Furthermore, the 21 year period is sufficiently long enough to allow for business cycles and fluctuations to balance out.

While profitability is an important input to the net present value analysis, the overall assessment of a model plant's viability was not totally dependent upon the plant's level of profits. The NPV concept also considers the value of the model's equity to the equity holders as well as effects of the timing of the cash flows including consideration for depreciation schedules. A more common measure of profitability is return on investment (ROI) where after-tax income (as defined in Equation 1) is expressed as a percent of invested capital (book value) or as a percent of net worth. Such measures should not be viewed as necessarily different estimates of profitability when compared to the net present value concept; rather, these should be considered as entirely different profitability concepts. It should be noted the data requirements for ROI and NPV measures are derived from the same basic financial information, although the final inputs are handled differently for each.

c. Cost of Capital - After-tax

Return on invested capital is a fundamental notion in U.S. business. It provides both a measure of the actual performance of a firm as well as its expected performance. In the latter case, it is also called the cost of capital, and this, in turn, is defined as the weighted average of the cost of each type of capital employed by the firm--in general terms--equities and interest-bearing liabilities. Although no methodology yields the precise cost of capital, it can be approximated within reasonable bounds.

Equity capital. The cost of equity capital was estimated by two methods--the dividend yield method and the earnings stock price (E/P ratio) method. Both are simplifications of the more complex discounted cash flow (DCF) methodology. The dividend yield method is:

$$c = \frac{D_1}{P_o} + g$$

where:

c = cost of equity capital
D_1 = dividend per share expected at end of period 1
P_o = stock price at time o
g = growth of dividend per share

The earnings/price ratio method is:

$$c = \frac{E}{P}$$

where:

c = cost of equity capital
E = current earnings per share
P = current stock price

This latter method assumes that future earnings per share will be the same as the current earnings and that the dividend-payout ratio is 100 percent.

Debt Capital. The after-tax cost of debt capital was estimated by using an estimated cost of debt (interest rate) and multiplying it by 0.52 -- assuming a 48 percent tax rate.

$$d = .52\ i$$

where:

d = after-tax cost of debt capital
i = before-tax cost of debt (interest rate)

Weighted Cost of Capital. The sum of the cost of equity and debt capital weighted by the respective equity to equity plus debt and total debt to equity plus debt (where debt is long-term debt) ratios yields the estimated average cost of capital (k), after tax. This is depicted below.

$$k = \frac{\text{Equity}}{\text{Debt plus equity}} \times c + \frac{\text{Total debt}}{\text{Debt plus equity}} \times d$$

d. Investment Determination

In evaluating the feasibility of new plants, investment was thought of as outlays for fixed assets and working capital; however, in evaluating closure of an on-going plant, the investment basis was its salvage value (opportunity cost or shadow price).1/ For this analysis, salvage value was taken as the sum of liquidation value of fixed assets plus working capital (current assets less current liabilities) tied up by the plant. This same amount was taken as a negative investment or "cash out" value in the terminal year.

The rationale for using total shadow priced investment was that the cash proceeds do not include interest expenses which are reflected in the weighted cost of capital. This procedure required the use of total capital (salvage value) regardless of source. An alternative would have been to use as investment, net cash realization upon liquidation of the plant (total cash realized from liquidation less debt retirement). In the single plant firm, debt retirement would be clearly defined. In the case of the multiplant firm, the delineation of the debt by the plant would likely not be clear. Presumably this could be reflected in proportioning total debt to the individual plant on some plant parameter (i.e., capacity or sales). Under this latter procedure, interest and debt retirement costs would be included in the cash flows.

1/ This should not be confused with a simple buy-sell situation which merely involves a transfer of ownership from one firm to another. In this instance, the opportunity cost (shadow price) of the investment may take on a different value.

The two procedures will yield similar results if the costs of capital and the interest charges are estimated on a similar basis. The former procedure total salvage value was used as it gives reasonable answers and simplified both the computation and explanation of the cash proceeds and salvage values.

Replacement investment was considered to be equal to 100 percent times the annual depreciation. This corresponds to the operating policies of some managements and serves as a good proxy for replacement in an ongoing business.

Investments in pollution control facilities were determined from estimates provided by EPA. Only incremental values were used in order to reflect in-place facilities.

2. Price, Supply and Demand Impact Analyses

Price and supply and demand impact analyses necessarily have to proceed simultaneously. In order to evaluate these impacts, two types of analyses were used: one--the micro level--utilized the model plant as the basis of the analysis to arrive at required price impacts to maintain profitability levels; the other--the industry level--utilized supply and demand analysis.

Application of the preceding NPV procedure to these costs yielded the present value of pollution control costs (i.e., investment plus operating cost less tax savings). When this was known, the price increase required to pay for pollution control could readily be approximated by the formula:1/

$$X = \frac{(PVP)\ (100)}{(1-T)\ (PVR)}$$

where:

X = required percentage increase in price
PVP = present value of pollution control costs
PVR = present value of gross revenue starting in the year pollution control is imposed
T = average tax rate

The required price increase at the plant level was evaluated in light of the price elasticities of the commodity involved and the competitive structure of the industry. This represented the second approach using supply and demand analysis. The supply and demand analysis provided some insights into likely quantities and supply responses to different prices. This allowed a preliminary estimate of the production and price impacts of pollution control costs. Following this, further analysis at the micro level was

---

1/ The above procedure is conceptually correct where an average tax rate is used. However, to insure accuracy in the machine program where the actual tax brackets were incorporated, a more detailed iterative process was required.

performed to obtain a more detailed insight into the plants' responses to expected price changes, cost absorption, or plant closure (the plant closure criteria are discussed in Section G-4, below). The indicated plant shutdowns were then aggregated to test whether or not the lost production could be absorbed by the remaining capacity or whether such curtailments would increase prices.

3. Financial Impact Analysis

The financial impact analysis involved the preparation of pro forma income statements and cash flow statements (including computations of the models' net present values) following the assessment of the likely price change. The analysis provided estimates of profitability with and without pollution control costs and also provided information relative to the ability of the industry to finance this investment and estimated financial requirements. The ability to finance plant investment for pollution control could have a definite bearing on judgments and estimates with regard to likely plant closures.

4. Plant Closures and Production Effects

Plant closures may result from the inability of less profitable plants to adequately recover required pollution abatement cost through increased product prices, decreased input prices, or improvements in economic efficiency. Often closures can be anticipated among older, smaller and less efficient plants as a result of economies of scale in pollution control which would lower the overall costs to competing larger operations. Since the larger plants, whose unit pollution control costs are usually much less, will be able to afford to sell at a lower price than the smaller high-cost plants, the high-cost plants will have no recourse other than to sell at the long run equilibrium price set by the low-cost plants. Consequently, the older, smaller, less efficient plants would probably and eventually yield to the dominance of the larger,more efficient units. However, in the short run, a plant may continue to operate even when economic considerations indicate closure, especially when the smaller, high cost plants are protected by regional markets and other non-price impediments to competition from the larger low cost plants.

Most firms would cease operations if they could not adequately absorb the required wastewater control expenditures. The most obvious measurement of a firm's ability to absorb the costs is its ability to maintain a positive income or cash flow after incurring control expenditures. If incomes are negative, some firms would remain in operation as long as they cover variable costs (positive cash flows); however, the requirements for overhead expenses would eventually cause such firms to cease.

The remaining situation that could arise would be one in which firms maintain positive incomes and generate net present values (NPV of their cash flows at their cost of capital) which are positive. This indicates that these firms are earning a return on their operation which exceeds their cost of capital. If their NPV's are negative then the firms would liquidate, realize salvage value in cash, and reinvest in a more financially viable investment (one which would earn at least their cost of capital).

A review of the potential financial effects of the imposition of wastewater controls on the models results in some confusion in the determination of which plants would be forced to close due to an inability to absorb the control expenditures; a confusion which can result from a large number of models and wastewater control treatment alternatives applicable to each model. Accordingly, for this analysis, formalized closure criteria were developed. In the development of these criteria, certain necessary assumptions were made to simplify the interpretation of the impact results.

The closure criteria utilized are depicted below. These criteria basically represent the models' abilities to continue operations after incurring expenditures for wastewater controls.

Model's Viability	Net Present Value	Annual Cash Flow
Viable	Positive	Positive
Marginal	Slightly Negative 1/	Slightly Negative 1/
Closure	Negative	Negative

Based on the above criteria, closure decisions are made for each model at each treatment level. The number of existing facilities associated with the representative models which will cease operations due to wastewater control expenditure requirements are projected utilizing the following methodology.

(1) Based on the NPV closure criteria described previously, the subcategories and associated models projected to close are identified.

(2) Once identified, the following factors are considered in the determination of the number of actual existing plant closures associated with each projected model plant closure.

  (a) The number of existing facilities associated with the model.

  (b) The degree to which existing facilities already have at least some of the treatment controls in-place.

  (c) Historical trends for existing facilities within the subcategory as well as projections of the subcategory's future expectations (helps establish the base case).

  (d) The severity by which the model's financial data are reduced. Are the financial data substantially reflective of closure or are the data reflective of a borderline situation?

1/ The criterion utilized here was that the positive cash flow must be greater than the amount by which the NPV was negative or a positive NPV must be greater than the amount by which the cash flow was negative. If not, then the plant was projected to close.

(e) Review of data utilized (both published and survey data) to develop models. This allows the determination of the probable distribution of the financial profiles of existing facilities when compared to the financial profile of the closing model plant.

(f) Consideration of the reliability of the data utilized in the development of the model plants.

(3) Based on the above, the number of existing facilities projected to close are made. These projections are determined qualitatively, based on the analyst's knowledge of business and economic principles as well as the analyst's knowledge of the industry.

The determination of the production effects resulting from the plant closures is made by applying the projected number of existing facility closures to production quantities associated with the applicable model plant. This is then viewed from the perspective of whether or not the remaining facilities have the capability to absorb the lost production and if not, whether the lost production will be absorbed by increased foreign impacts or whether it will not be absorbed at all.

5. Employment Impact Analysis

This analysis was concerned with estimating likely employment losses due to curtailed production or plant closures as a result of pollution controls. If the actual plants which are expected to curtail production or to close could be identified, their employment impacts could be estimated directly. When, however, they cannot be identified, the employment impact analysis must involve the application of estimates of employment changes by model plants. Employment changes in model plants would then be generalized according to the number of actual plants represented by the model plant and aggregated to derive an estimate of total employment effects for the industry. Employment dislocations are noted as appropriate.

6. Community Impact Analysis

The community impact analysis identified the potential impacts on local community economies when the impacted plant represented a major source of employment and income. This anlaysis was based on a knowledge of the location of plants, particularly threatened plants, and a general understanding of the economic base of those communities and the relative importance of threatened plants to local economies.

7. Dislocation Analysis

The analysis of the dislocational effects of control requirements addressed the possibility of plants closing their existing facilities to move to other locations offering better opportunities either for control compliance or production or market efficiencies. The potential for dislocation was particularly true for plants required to install control technologies which were land intensive where the plants were limited in their respective availability of land. This analysis was based on a general knowledge of trends in the industry, the availability of land for the industry's plants, and the land requirements of the treatment technologies.

8. Balance of Trade Impact Analysis

Balance of trade impact analysis dealt with those products that have competitive import and export positions. The analysis considered whether or not the estimated price changes would hinder the products competitive positions with regard to exports or increases in foreign imports. Where important, estimates on the amount of trade that potentially could be impacted and total trade levels are presented.

9. Other Impact Analysis

Other potential impacts may be created by the imposition of pollution control guidelines. These are unique to given industries and require a case-by-case approach. An illustration of such an impact would be a plant that produces a critical intermediate, an input for other industries. The loss of this plant or large price increases could produce serious backward or forward effects on producers or consumers. To the extent additional impacts were as important, they are noted.

III. THE STRUCTURE OF THE INDUSTRY

The textile industry is comprised of a diverse group of establishments varying in size, process, and product. The general characteristics of the industry establishments range from small family-owned mills utilizing traditional manufacturing and managerial practices to large multi-mill corporations who rely on the latest managerial and sophisticated process practices available. The final products produced by textile establishments range from twine, sandpaper, and tire cords to carpets, blankets, lace, hosiery, and fabrics for apparel.

The characterization of the textile industry structure is difficult because of the diversity of establishments and their varying levels of integration. The most common structural depiction of the industry is the Standard Industrial Classification (SIC) system utilized by the U.S. Bureau of the Census. This classification system, which groups establishments according to similar end products produced, is useful in that much of the published data concerning the industry are presented according to SIC groupings. However, the SIC groupings are often relatively large and thus represent a variety of types of establishments within a specific SIC grouping.

Another approach to the structural characterization of the industry is to categorize establishments according to the manufacturing functions performed at the facility. This functional approach is considerably more applicable to the industry and because wastewater characteristics are predominately dependent upon the process functions performed at a facility, it enables the industry establishment to be grouped into categories with similar wastewater characteristics.

The limiting factor of the functional categorization of the industry is that there are very limited published data corresponding to the specific functional categories. Accordingly, both categorization approaches are utilized in this chapter to describe the industry structure. When possible, attempts will be made to mesh the two approaches so the industry structure is adequately represented.

A. Subcategorization of the Industry

The textile industry consists of establishments which typically create and/or process textile related materials for further processing into apparel, home furnishings, or industrial goods. While the SIC groupings are primarily based on the final product shipped from the establishments, actual industry facilities are more realistically classified according to the functions performed at each establishment.

The following material in this section discusses the subcategorization of the textile industry using two taxonomies: (1) SIC industry groups, and (2) categorization of plants by manufacturing process.

1. Conventional Industry Subcategories

According to the Bureau of the Census, the United States textile/apparel industry is characterized as being comprised of two distinct industry groups with one group manufacturing textile products such as fabric and carpets and the other group manufacturing apparel. The Census, through its SIC system, categorizes these two industry groups as the Textile Mill Products Group (SIC 22) and the Apparel and Other Textile Products Group (SIC 23), respectively.

The Textile Mill Products Group, or the textile industry, includes 30 separate industries which manufacture approximately 90 classes of products. These establishments are principally engaged in receiving and preparing fibers; transforming these materials into yarn, thread, or webbing; converting the yarn and web into fabric or related products; and finishing these materials at various stages of production. Many of these establishments produce final consumer products such as thread, yarn, bolt fabric, hosiery, towels, sheets, carpets, etc., while the rest produce transitional products for use by other establishments in both SIC Groups 22 and 23.

The Apparel and Other Textile Products Group, or the apparel industry, includes 33 separate industries which manufacture some 70 classes of products. The establishments in this group are principally engaged in receiving woven or knitted fabric for cutting, sewing, and packaging for consumer purchase.

The processes associated with the textile industry are numerous and some result in the generation of wastewaters. The processes associated with the apparel industry are generally considered dry and do not result in the generation of wastewater. Consequently, the facilities in the apparel industry (SIC 23) do not have, nor do they require, wastewater discharge regulations. Accordingly, an economic impact evaluation of SIC 23 will not be necessary and thus this group has been eliminated from further discussion in this report.

Under the SIC system, the textile industry includes establishments engaged in performing any of the following operations: (a) preparing fiber and subsequent manufacturing of yarn; (b) manufacturing broad woven fabric, narrow woven fabric, knit fabric, and carpets and rugs from yarn; (c) dyeing and finishing fiber, yarn, fabric, and knit apparel; (d) coating and waterproofing fabric; (e) the integrated manufacturing of knit apparel; and (f) the manufacturing of felt goods, lace goods, nonwoven fabrics, and miscellaneous textiles.

The SIC system also divides the textile industry into nine 3-digit industry groups and thirty 4-digit SIC industries. At the 3-digit level the overall industry includes four groups of Weaving Mills (SIC 221-224) with a single

4-digit SIC industry classified under each of the groups. Also at the 3-digit group level are the Knitting Mills (SIC 225), Textile Finishing (SIC 226), Floor Covering Mills (SIC 227), Yarn and Thread Mills (SIC 228), and Miscellaneous Textile Goods (SIC 229).

The major characteristics of the 3-digit groups are described below:

1. Weaving Mills (SIC 221, 222, 223, 224) - this classification covers establishments constructing fabric by interlacing yarns of wool, cotton or man-made fibers. These materials can be woven into broad woven (greater than 12 inches) or narrow (12 inches or less) fabrics.

2. Knitting Mills (SIC 225) - this classification contains establishments constructing fabric by connecting yarns of cotton, wool or man-made fibers. Knit production is more flexible and faster than weaving and accordingly knitting machinery allows for rapid pattern changes. The SIC system subclassifies knitting mills into groups including hosiery, knit outerwear and circular knit fabrics.

3. Textile Finishing--Except Wool (SIC 226) - this classification consists of establishments involved in the dyeing and treating of cotton and man-made fabrics and yarn. Fabrics are dyed by different methods, depending on the desired effect, and can be treated to resist wrinkles and static, inhibit flames, repel water, or any number of other qualities.

4. Floor Covering Mills (227) - this classification encompasses mills producing a variety of carpets and rugs including woven and tufted fabrics.

5. Yarn and Thread Mills (SIC 228) - this classification includes establishments spinning yarn from fibers of cotton or wool or producing yarns from man-made fibers.

6. Miscellaneous Textile Goods (SIC 229) - this classification covers establishments utilizing a variety of processes to produce numerous products such as non-woven felt, lace goods, padding and upholstery filling, tire cords and cordage, and twine.

Table III-1 lists the respective 4-digit industries corresponding to the above 3-digit industry groups and describes their primary operations.

Selected 4-digit industry groups can be further classified according to their respective type of organization. These industry groups, which are predominately associated with finishing operations, can be classified as one of the following: 1) manufacturer; 2) commission mills; or 3) contractor. Typically the manufacturer processes fabrics and apparel utilizing their own raw materials while the commission and contractor firms process fabrics owned by others. The selected 4-digit industries and their respective types of organizations are depicted in Table III-2. It should be noted that while the organizational distinction is not particularly important from a wastewater point-of-view, it is economically significant as the financial profiles of the various organizations would differ.

Table III-1. Textile mills products (Standard Industrial Classification)

Group No.	Industry No.	Industry title	Description of primary operations
221		BROAD WOVEN FABRIC MILLS, COTTON	
	2211	Broad Woven Fabric Mills, Cotton	Weaving fabrics over 12 inches in width, wholly or chiefly by weight of cotton.
222		BROAD WOVEN FABRIC MILLS, MAN-MADE FIBER AND SILK	
	2221	Broad Woven Fabric Mills, Man-Made Fiber and Silk	Weaving fabrics over 12 inches in width, wholly or chiefly by weight of silk and man-made fibers including glass.
223		BROAD WOVEN FABRIC MILLS, WOOL (INCLUDING DYEING AND FINISHING)	
	2231	Broad Woven Fabric Mills, Wool (Including Dyeing and Finishing)	Weaving fabrics over 12 inches in width, wholly or chiefly by weight of wool, mohair, or similar animal fibers; dyeing and finishing all woven wool fabrics or dyeing wool, top or yarn.
224		NARROW FABRICS AND OTHER SMALLWARES MILLS: COTTON, WOOL, SILK, AND MAN-MADE FIBER	
	2241	Narrow Fabrics and Other Smallware Mills: Cotton, Wool, Silk, and Man-Made Fiber	Weaving or braiding fabrics, 12 inches or narrower in width of cotton, wool, silk, and man-made fibers, including glass fibers; producing fabric covered elastic yarn or thread.
225		KNITTING MILLS	
	2251	Women's Full Length and Knee Length Hosiery	Knitting, dyeing or finishing womens' and misses' full length and knee length hosiery, both seamless and full-fashioned, and panty hose.
	2252	Hosiery, Except Women's Full Length and Knee Length Hosiery	Knitting, dyeing, or finishing hosiery other than those produced in SIC industry 2251.
	2253	Knit Outerwear Mills	Knitting outerwear from yarn, or manufacturing outerwear from knit fabric produced in the same establishment.
	2254	Knit Underwear Mills	Knitting underwear and nightwear from yarn, or manufacturing underwear and night wear from knit fabric produced in the same establishment.
	2257	Circular Knit Fabric	Knitting circular (tubular) fabric, or dyeing or finishing this type fabric.
	2258	Warp Knit Fabric Mills	Knitting, dyeing, or finishing warp (flat) knit fabric.
	2259	Knitting Mills, Not Elsewhere Classified	Knitting gloves and other articles, not elsewhere classified.
226		DYEING AND FINISHING TEXTILES, EXCEPT WOOL FABRICS AND KNIT GOODS	
	2261	Finishers of Broad Woven Fabrics of Cotton	Finishing purchased cotton broad woven fabrics, or finishing such fabrics on a commission basis. Operations include bleaching, dyeing, printing, and other mechanical finishing.
	2262	Finishers of Broad Woven Fabrics of Man-Made Fiber and Silk	Finishing purchased man-made fiber and silk broad woven fabrics or finishing such fabrics on a commission basis. Operations include bleaching, dyeing, printing, and other mechanical finishing.
	2269	Finisher of Textiles, Not Elsewhere Classified	Dyeing and finishing textiles, not elsewhere classified, such as bleaching, dyeing, printing and finishing of raw stock, yarn, braided goods, and narrow fabrics, except wool and knit fabrics.

Continued--

Table III-1. (continued)

Group No.	Industry No.	Industry title	Description of primary operations
227		FLOOR COVERING MILLS	
	2271	Woven Carpets and Rugs	Weaving and finishing carpets and rugs from any textile yarn.
	2272	Tufted Carpets and Rugs	Tufting and finishing carpets and rugs from any textile fiber.
	2279	Carpets and Rugs, Not Elsewhere Classified	Manufacturing rugs, carpets, and squares, floor mattings, needle punch carpeting, and door mats and matting from twisted paper, grasses, reeds, coir, sisal, jute.
228		YARN AND THREAD MILLS	
	2281	Yarn Spinning Mills: Cotton, Man-Made Fibers and Silk	Spinning yarn wholly or chiefly by weight of cotton, man-made fibers, or silk.
	2282	Yarn Texturizing, Throwing, Twisting, and Winding Mills: Cotton, Man-Made Fibers and Silk	Texturizing, throwing, twisting, winding, or spooling yarn wholly or chiefly by weight of cotton, man-made fibers or silk
	2283	Yarn Mills, Wool, Including Carpet and Rug Yarn	Spinning, twisting, winding or spooling yarn (including carpet and rug yarn) and thread wholly or chiefly by weight of wool, mohair, or similar animal fibers.
	2284	Thread Mills	Manufacturing thread from natural or man-made fiber except flax and wool.
229		MISCELLANEOUS TEXTILE GOODS	
	2291	Felt Goods, Except Woven Felts and Hats	Manufacturing pressed felt.
	2292	Lace goods	Manufacturing lace machine products.
	2293	Paddings and Upholstery Filling	Manufacturing batting, padding, wadding, and filling for upholstery, quilted pillows, and apparel.
	2294	Processed Wastes and Recovered Fibers and Flock	Processing textile mill waste for spinning, or other uses.
	2295	Coated Fabrics, Not Rubberized	Manufacturing coated and impregnated textiles.
	2296	Tire Cord and Fabrics	Manufacturing cord and fabric for use in reinforcing rubber tires, industrial belting, fuel cells, and similar uses.
	2297	Nonwoven Fabrics	Manufacturing nonwoven fabrics by mechanical, chemical, thermal or solvent means or by a combination of these means.
	2298	Cordage and Twine	Manufacturing rope, cable, cordage, twine, and related products from fiber.
	2299	Textile Goods, Not Elsewhere Classified	Manufacturing textile goods, not elsewhere classified, processing textile fibers to prepare them for spinning, such as wool scouring and combing.

Source: U.S. Department of Commerce, Office of Federal Statistical Policy and Standards, Standard Industrial Classification Manual, 1972.

Table III-2. Type of organizations in the textile industry

SIC no.	SIC Industry	SIC suffix	Type of Organization
2231	Weaving and finishing, wool	11	manufacturers
		51	jobbers, commission weaving
2253	Knit outerwear mills	11	manufacturers
		22	converters
		33	contractors
2257	Circular knit fabric mills	11	manufacturers
		22	converters
		33	contractors
2258	Warp knit fabric mills	11	manufacturers
		22	converters
		33	contractors
2261	Finishing plants, cotton	11	finishing own fabrics
		51	commission finishing
2262	Finishing plants, man-made	11	finishing own fabrics
		51	commission finishing
2269	Finishing plants, NEC	11	finishing own yarn
		51	commission finishing
2282	Throwing and winding mills	11	manufacturers
		51	commission mills

Source: U.S. Department of Commerce, Bureau of the Census

2. Subcategorization of Mills by Type of Process

While the SIC system categorizes establishments according to their end product, it has been determined within most SIC groups, substantial differences in wastewater characteristics occur. The reason for these differences is that while the general end products of different establishments are similar, establishments may differ in the methods of producing the end product. An example of this would be a fully integrated facility producing a finished textile product being in the same SIC grouping as an establishment which contracted or commissioned another firm to do the majority of the processing but yet who retained title to the finished product and who was responsible for shipping the final product. Therefore, the SIC system is not an effective means of segmentation of the industry with respect to manufacturing processes and waste characteristics.

Because of its structure, combinations of end products, fiber composition, and manufacturing and finishing processes, the textile industry required considerable study to develop well defined groupings with similar waste characteristics. Factors that had to be considered were raw materials used, products, manufacturing processes, size and age of mill and equipment, waste control technology, treatment costs, energy requirements, and solid waste generation and disposal requirements. A number of approaches have been used in the past in addition to the SIC system; however most had serious drawbacks regarding subcategorization.

Categorization for the most recent studies on textile waste water characteristics and treatment has been based on raw materials, further identified by product lines and associated effluents. One of the most extensive studies is contained in the 1974 Development Document on Textile Mills Point Source Category. It categorized first on the basis of a very important raw material distinction, the processing of wool versus other textile fibers (primarily cotton and synthetics). It then categorized wool and other textile fibers based on products that relate by types of wastes. Using this approach, the subcategories discussed below were developed by the Technical Contractor for the purpose of dividing the industry into segments with similar discharge characteristics while maintaining a logical and manageable system.

The nine subcategories and a brief description of the type of facilities which would be classified in each subcategory are presented below.

Subcategory

(1) Wool Scouring. This subcategory covers facilities that scour natural impurities from raw wool and other animal hair fibers as the majority of their processing. Integrated mills that perform wool scouring and other finishing operations fall within Subcategory 2 (discussed below). Wool scouring is separated from other

subcategories because wool and other animal hair fibers require extensive preliminary cleaning resulting in raw wastes considerably stronger than those of other subcategories.

(2) Wool Finishing. This subcategory covers facilities that finish fabric, a majority of which is wool, other animal hair fiber, or blends containing primarily wool or other animal hair fibers, by employing any of the following processing operations on at least five percent of their total production: carbonizing, fulling, bleaching, scouring (not including raw wool scouring), dyeing and application of functional finish chemicals. Mills that primarily finish stock or yarn of wool, other animal hair fibers, or blends containing primarily wool or other animal hair fibers and that perform carbonizing are included in this subcategory and wool stock or yarn mills that do not perform carbonizing and scouring are covered under Subcategory 7, Stock and Yarn Finishing. The processes comprising a typical wool finishing operation include carbonizing, fulling, fabric scouring, and dyeing. Wool finishing is differentiated from other finishing categories because of the manufacturing processes (principally carbonizing and fulling) and dyes and other chemicals associated with wool operations. As a result, wool finishing operations generate high volume wastes with pH fluctuations and oil and grease.

(3) Low Water Use Processing. Low water use processing operations include establishments primarily engaged in manufacturing greige goods, laminating or coating fabrics, texturizing yarn, tufting and carpet backing, producing tire cord fabric, and similar activities in which either cleanup is the primary water use or process water requirements are small, or both. These operations were excluded from analysis since the process-related wastewater generated and discharged from each facility is comparatively small.

(4) Woven Fabric Finishing. This subcategory covers facilities that primarily finish fabric, a majority of which is woven, by employing any of the following processing operations on at least five percent of their production: desizing, scouring, bleaching, mercerizing, dyeing, printing, or application of functional finish chemicals. Integrated mills that finish a majority of woven fabric along with greige manufacturing or other finishing operations such as yarn dyeing are included in this subcategory and total finishing production should be applied to the applicable Woven Fabric Finishing effluent limitations to calculate discharge allowances. Denim finishing mills are also included in this category. Woven fabric composed primarily of wool is covered under Subcategory 2 - Wool Finishing.

A wide variety of processes are used in finishing woven fabric, and, in terms of cumulative flow this subcategory is the largest. Processes that may be employed include desizing, scouring, bleaching, mercerizing, dyeing, printing, and application of functional finish chemicals.

Desizing results in a major difference in waste characteristics of woven fabric finishing facilities, and the amount of desizing practiced is responsible for differences in the waste characteristics within the Woven Fabric Finishing subcategory as well. In addition, the number of processes performed at a particular mill may vary from merely scouring or bleaching to all of those previously listed. Consequently, it is important to further subdivide this subcategory.

(a) Simple Processing. This Woven Fabric Finishing subdivision covers facilities that perform fiber preparation, desizing, scouring, functional finishing, and/or one of the following processes applied to more than five percent of total production: bleaching, dyeing, or printing. This subdivision includes all Woven Fabric Finishing mills that do not qualify under either the Complex Processing or Complex Processing Plus Desizing subdivisions.

(b) Complex Processing. This Woven Fabric Finishing subdivision covers facilities that perform fiber preparation, desizing of less than 50 percent of their total production, scouring, mercerizing, functional finishing, and more than one of the following, each applied to more than five percent of total production: bleaching, dyeing, and printing.

(c) Complex Processing Plus Desizing. This Woven Fabric Finishing subdivision covers facilities that perform fiber preparation, desizing of greater than 50 percent of their total production, scouring, mercerizing, functional finishing, and more than one of the following, each applied to more than five percent of total production: bleaching, dyeing, and printing.

(5) Knit Fabric Finishing. This subcategory covers facilities that primarily finish fabric made of cotton and/or synthetic fibers, a majority of which is knit, by employing any of the following processing operations on at least five percent of their production: scouring, bleaching, dyeing, printing, and application of lubricants, antistatic agents, and functional finish chemicals. Integrated mills that finish a majority of knit fabric along with greige manufacturing or other finishing operations such as yarn dyeing are included in this subcategory.

Basic knit fabric finishing operations are similar to those in the Woven Fabric Finishing subcategory and may include scouring, bleaching, dyeing, printing, application of lubricants, antistatic agents, and functional finish chemicals. Knitting is performed in conjunction with finishing at most of these facilities. Desizing is not required in knit fabric finishing and mercerizing is uncommon in practice. The generally lower waste loads of the subcategory can be attributed to the absence of these processes.

As with woven fabric finishing, the number of processes performed at a mill may vary considerably. In addition, hosiery manufacture is distinct in terms of manufacturing and raw wastewater characteristics. Consequently, internal subdivision is required for this subcategory.

(a) Simple Processing. This Knit Fabric Finishing subdivision covers facilities that perform fiber preparation, scouring, functional finishing, and/or one of the following processes applied to more than five percent of total production: bleaching, dyeing, or printing. This subdivision includes all Knit Fabric Finishing mills that do not qualify under either the Complex Processing or Hosiery Products subdivisions.

(b) Complex Processing. This Knit Fabric Finishing subdivision covers facilities that perform fiber preparation, scouring, functional finishing, and/or more than one of the following processes each applied to more than five percent of total production: bleaching, dyeing, or printing.

(c) Hosiery Products. This Knit Fabric Finishing subdivision covers facilities that are engaged primarily in dyeing or finishing hosiery of any type. Compared to other Knit Fabric Finishing facilities, Hosiery Finishing mills are generally much smaller (in terms of wet production), more frequently employ batch processing, and more often consist of only one major wet processing operation. All of these factors contribute to their lower water use and much smaller average wastewater discharge.

(6) <u>Carpet Finishing</u>. This subcategory covers facilities that primarily finish textile-based floor covering products, of which carpet is the primary element, by employing any of the following processing operations on at least five percent of their production: scouring, bleaching, dyeing, printing, and application of functional finish chemicals.

Integrated mills that finish a majority of carpet along with tufting or backing operations or other finishing operations such as yarn dyeing are included in this subcategory. Mills that only perform carpet tufting and/or backing are covered under Subcategory 3 - Low Water Use Processing. Carpet finishing is a distinct segment of the textile industry because of the lower degree of processing required and the typically weaker wastes that result.

(7) Stock and Yarn Finishing. This subcategory covers facilities that primarily finish stock, yarn, or thread of cotton and/or synthetic fibers by employing any of the following processing operations on at least five percent of their production: scouring, bleaching, mercerizing, dyeing, or application of functional finish chemicals. Thread processing includes bonding, heat setting, lubrication, and dressing, but these processes are basically dry and do not generate much wastewater. Facilities finishing stock, or yarn, principally of wool also are covered if they do not perform carbonizing as needed for coverage under Subcategory 2 - Wool Finishing. Denim finishing is included under Subcategory 4 - Woven Fabric Finishing.

Typical stock and yarn finishing may include scouring, bleaching, mercerizing, dyeing, or functional finishing. Stock dyeing is basically tub dyeing, but yarn or thread dyeing may include any of the following methods: skein, package, space, or beam. As a result of process differences, the concentrations of the pollutants in the raw wastewater in this subcategory are lower than those found in most other subcategories.

(8) Nonwoven Manufacturing. This subcategory covers facilities that primarily manufacture nonwoven textile products of wool, cotton, or synthetics, singly or as blends, by mechanical, thermal, and/or adhesive bonding procedures. Nonwoven products produced by fulling and felting processes are covered in Subcategory 9 - Felted Fabric Processing.

The Nonwoven Manufacturing subcategory includes a variety of products and processing methods. The processing is dry (mechanical and thermal bonding) or low water use (adhesive bonding) with the major influence on process-related waste characteristics resulting from the cleanup of bonding mix tanks and application equipment. Typical processing operations include carding, web formation, wetting, bonding (padding or dipping with latex acrylic or polyvinyl acetate resins) and application of functional finish chemicals. Pigments for coloring the goods are usually added to the bonding materials.

(9) Felted Fabric Processing. This subcategory covers facilities that primarily manufacture nonwoven products by employing fulling and felting operations as a means of achieving fiber bonding.

Wool, rayon, and blends of wool, rayon, and polyester are typically used to process felts. Felting is accomplished by subjecting the web or mat to moisture, chemicals (detergents), and mechanical action. Wastewater is generated during rinsing steps that are required to prevent rancidity and spoilage of the fibers.

The major relationships between the functional categories and the SIC system are shown in Table III-3. The table indicates those SIC industries in which each of the functions are being performed. Conversely it points out for each of the functional categories the SIC industries under which plants or mills may be classified.

For example, the Wool Finishing subcategory includes mills classified under three SIC industries: SIC 2231 (woven fabric wool), SIC 2269 (yarn finishing), and SIC 2283 (wool yarn).

Woven Fabric Finishing includes mills classified under five SIC industries: SIC 2211 (woven cotton), SIC 2221 (woven man-made), SIC 2241 (narrow fabrics), SIC 2261 (cotton fabric finishing), and SIC 2262 (man-made fabric finishing).

Except in the case of SIC 2261, 2262, and 2269, mills classified under each of the SIC industries will fall either in the "low water processing category" or one of the finishing subcategories. Mills classified under SIC 2269 will fall for the most part, in the Stock and Yarn Finishing subcategory. All of the mills classified under SIC 2261 or 2262, should fall within the single subcategory - Woven Fabric Finishing.

For purposes of the impact analysis, the textile industry will be segmented according to the functional classification system described in this section. This segmentation will serve as the basis for the development of representative economic model plants discussed in Chapter VI.

It should be noted for the remainder of the discussions of this report, an attempt will be made to portray information according to the functional categorization scheme. Unfortunately, however, much of the published data are not organized in this scheme but rather are based on the SIC system. As such, some report sections are necessarily depicted on a SIC basis.

B. Plant Characteristics

Characterization of establishments in the textile industry is somewhat difficult due to the diverse nature of textile mills. While many textile mills are still small, family owned operations utilizing older traditional manufacturing processes, there also exist numerous larger, multi-plant corporation owned operations who have the latest in textile manufacturing equipment. In this section the major characteristics of these diverse mills will be discussed.

Table III-3. Comparison of functional subcategories and SIC groups and industries

Subcategory	SIC INDUSTRY GROUPS (221-224) Weaving Mills: cotton & man-made fibers	(221-224) Weaving Mills: wool	(225) Knitting Mills: warp & circular fabric	(225) Knitting Mills: knit goods	(226) Textile Finishing: cotton & man-made fiber fabrics	(226) Textile Finishing: yarn & thread	(227) Floor Covering Mills: woven	(227) Floor Covering Mills: tufted	(228) Yarn & Thread Mills: spinning & texturizing	(228) Yarn & Thread Mills: wool	(229) Miscellaneous
	--------SIC industries in which functions are being performed--------										
1 Wool scouring											2299
2 Wool finishing		2231								2283	
3 Low water use processing	(all industries, except textile finishing 2261, 2262, 2269)										
4 Woven fabric finishing	2211 2221 2241				2261 2262						
5 Knit fabric finishing			2257 2258	2253 2252							
5c Hosiery products 1/				2259 2251 2252							
6 Carpet finishing							2271	2272			
7 Stock & yarn finishing						2269			2281 2282 2284	2283	
8 Nonwoven manufacturing											
9 Felted fabric processing											2297 2291

1/ Hosiery products is a subdivision of the knit fabric finishing subcateory.

Source: Development Planning and Research Associates, Inc. Compiled from information available in the Development Document and information available from the U.S. Department of Commerce, Bureau of the Census.

1. Ownership Characteristics

In the early 1900's, the textile industry was characterized by a large number of small, family-owned, highly specialized plants. About 1925, modernization began to bring about significant changes in the ownership characteristics with a trend towards concentration into larger, publicly owned corporations. By 1974, the 100 largest corporations in the industry accounted for over 60 percent of the industry's assets while the 20 largest accounted for about 45 percent, according to data contained in the Source Book of Statistics of Income (IRS). The concentration has resulted in the reduction of the number of small, privately-held firms; many of which have been acquired by larger firms. In 1969, over 30 percent of all of the textile companies were non-corporate enterprises, including 2,300 proprietorships and 800 partnerships. A year later, one-third of these had disappeared either as a result of acquisitions, closures, or incorporations. According to the Census less than 700 noncorporate firms were in operation in 1972. About 60 percent of these were single proprietorships and 40 percent were partnerships. Unfortunately no later data are available.

The types of operation and legal forms of organization for selected segments of the textile industry are shown in Table III-4 for 1972 (the latest year for which these data have been published). Of the 7,203 establishments in the industry, close to 6,500, or 90 percent, were organized as corporations, either as single plant or parts of multi-unit companies. The remaining 700 establishments were organized as noncorporate entities, predominantly as single unit companies. The greatest corporate concentration occurred within the yarn and thread segment with 96 percent of the establishments incorporated. The least concentration occurred within the carpet and rug industry with 82 percent organized as corporations.

According to the Census data the noncorporate establishments were generally smaller mills within the industry with close to 85 percent of the noncorporate firms operating with less than 20 employees per plant. Approximately 30 percent of the corporate firms were in this employee-size category. The small size of noncorporate companies is also apparent in a comparison of shipments; while the noncorporate firms accounted for about ten percent of the total mills in the country, they produced less than one percent of the industry's output.

The largest publicly held corporation presently is Burlington Industries with over one hundred plants in the U.S. and about 70,000 employees. The second largest is J. P. Stevens with close to 45,000 employees and an estimated 70 plants. The twenty largest publicly held corporations (as contained in The Value Line) are estimated to own close to 500 mills and plants. The largest privately held corporation is Deering Miliken with an estimated 50 plants, based on data contained in Davison's Blue Book.

Table III-4. Type of operation and legal form of organization for establishments in the textile industry (numbers of establishments), 1972

	Weaving		Finishing		Knitting		Carpets		Yarn		Total 1/	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total	1,293	100.0	655	100.0	2,723	100.0	529	100.0	807	100.0	7,203	100.0
Legal form												
Corporate	1,189	92.0	616	94.0	2,410	88.5	434	82.0	775	96.0	6,489	90.1
Noncorporate	104	8.0	39	6.0	313	11.5	95	18.0	32	4.0	714	9.9
Type of Operation												
Multi unit												
Corporate	642	49.6	234	35.7	669	24.6	157	29.7	425	52.7	2,463	34.2
Noncorporate	2	0.2	3	0.5	1	2/	3	0.6	3	0.4	16	0.2
Single unit												
Corporate	547	42.3	382	58.3	1,741	63.9	277	52.3	350	43.3	4,026	55.9
Noncorporate	102	7.9	36	5.5	312	11.5	92	17.4	29	3.6	698	9.7

Source: U.S. Department of Commerce, Bureau of the Census, Census of Manufactures.

1/ Includes establishments in Miscellaneous Textile Goods (SIC 229).

2/ Less than 0.05 percent.

Many of the largest publicly held companies are closely held according to information contained in The Value Line. Close to 90 percent of the stock in the Barwick Corporation is owned by its directors and officers. Over 70 percent of Spring Mill's stock is owned by insiders. Between 40 and 50 percent of the stock is controlled by insiders in companies such as Belding Heminway, Cone Mills, Lowenstein and Sons, Martin Processing, and Reeves Bros. Over 40 percent of Fieldcrest Mills' stock is owned by the Amoskeag Company, a Dutch based organization.

Although most of the mills in the industry are owned by corporations primarily engaged in textile manufacturing, many are owned by other types of enterprises which have logical footholds in the textile industry. All of the largest tire manufactures have mills specializing in the fabrication of tire cord and fabrics (SIC 2296). Many of the chemical companies producing man-made fibers for the industry have extended their operations to include the manufacture of yarns and fabrics. About 30 percent of the sales of Owens-Corning Fiberglas are in textile products. Dupont not only produces man-made fiber but also is involved in the manufacture of fabrics and finishes. GAF, with revenues in chemicals and building material exceeding one billion dollars, manufactures felts. Armstrong-Cork which is one of the largest manufacturers of resilient flooring owns a mill manufacturing tufted carpets. Standard Oil (Indiana) has a textile subsidiary manufacturing synthetic fabrics as an extension of its chemical operation.

Recreation industries involved in the manufacture of sporting goods have often entered the textile and apparel area. Brunswick owns a subsidiary engaged in carpeting activities. Industries involved in the production of household and personal care items have also moved into textile activities. Colgate-Palmolive produces nonwoven fabrics including bandages, towels, and disposable diapers. Parke-Davis manufactures surgical materials in its textile operations.

Ownership characteristics are diverse and changing. Understanding of each segment's ownership characteristics is important as it may be a consideration in the determination of each segment's ability to generate capital necessary to meet the proposed effluent discharge limitations. This determination of ability to finance capital expenditures is discussed in detail in Chapter IV.

2. Single vs. Multiplant Operations

According to the Census Data, 34 percent of all of the plants (or mills) in the industry operate in multiplant companies (99 percent of these are incorporated). These plants account for about 77 percent of the industry shipments and employ over 80 percent of all textile workers. The parent companies vary in size from the large Burlington Industries (over 100 plants) to the relatively small 2 and 3 plant operations. The operating and financial characteristics of these "multiplant operations" (as used in this discussion, the term means a single plant which is part of a multiunit company) differ not only from the single plant operations but also among the other multiplant operations. The differences which are relevant to this study involve differences in sizes, type operations, and financial profiles.

The single plant operations are predominantly smaller than the multiplant. The Census of Manufactures estimates the number of small plants having less than 20 employees for each of the 4 digit SIC industries. From these estimates, approximately 2900 plants or 37 percent of the plants in the industry are identified as small. Over 90 percent of these small establishments are single plant operations. Table III-5 shows the percentage of small plants in the total industry and in selected SIC industries. In addition it compares the percentage of small plants in each of the two categories: single and multiplant operations. SIC industries with a relatively large number of small plants are wool finishing, circular knit, carpet tufting and cotton textile finishing, each with about 40 percent of the total plants classified as small. The percentages of small plants among the multiplant operations in these industries range from 8 percent in wool finishing and carpet tufting to 20 percent in textile finishing (cotton). In the single plant operations in each of these industries, the percentages of small plants exceeds 50 percent. The two SIC industries with the lowest percentages of small plants are the man-made weaving mills and the yarn mills each with less than 20 percent. The percentage of small plants in the multiplant operations of these industries are 3 and 4 percent, respectively. The percentages of small plants in the single plant operations are 43 percent for the weaving mills and 36 percent for the yarn mills. For the total textile industry, 8 percent of all multiplant operations are small as opposed to 52 percent of the single plant operations.

Table III-6 illustrates the relatively small size of the single plant operations from a different perspective. In the table, the average size in terms of value of shipments of the large plants in each of the two categories are compared. In this case the large plants are those with an employment level of 20 or more employees. The largest average sizes are found in weaving (SIC 2211 and 2221) and textile finishing (man-made - SIC 2262) with average shipments exceeding $13 million. In these SIC industries, the average size of the multiplant operations is approximately 3 times as great as that of the single plant operations. In the multiplant category, the smallest plants are found in wool weaving and finishing (SIC 226), wool yarn mills (SIC 2283) and felt processing (SIC 2292) with shipments averaging between $5 and $6 million.

The smallest sizes in single plant operations are found in hosiery (SIC 2251), knit fabric (SIC 2257 and 2258) and wool yarn (SIC 2283). Shipments in these industries average less than $2 million. The average of all plants in the multiplant category is $10 million which is 4 times as great as the $2.3 million average for the single plant operations. The least differences between averages of the two categories occur in wool weaving and finishing, carpet tufting, yarn mills and felt processing.

In addition to being characterized by size, single plant operations can be characterized by type of plant within segments (types of plant include commission, finishers of own fabric, and integrated mills). Table III-7 shows the percentage of single plant operations in the various segments by types of plant; these percentages are based on the survey of the industry

Table III-5. Small plants in selected SIC industries -- (Plants with less than 20 employees)

SIC	SIC Industry	Total small plants as a percent of all plants	Small multiplants 1/ as a percent of all multiplants	Small single plants as a percent of all single plants
2211	Weaving mills cotton	38	3	62
2221	Weaving mills man-made fibers	21	3	43
2231	Weaving and finishing mills wool	48	8	54
2251	Women's hosiery	30	2	44
2257	Circular knit fabric mills	43	9	54
2258	Warp knit fabric mills	35	7	37
2261	Finishing plants cotton	54	20	52
2262	Finishing plants man-made fibers	33	11	36
2269	Finishing plants (n.e.c.)	51	14	51
2272	Tufted carpets and rugs	44	8	55
2281	Yarn mills, except wool	19	4	36
2283	Wool yarn mills	42	10	48
2291	Felt	43	11	67

1/ Multiplants represent plants that are a part of multiplant companies.

Source: Census of Manufactures, 1972 and 1977.

Table III-6. Plant shipments of selected SIC industries
(Average shipments of plants with 20 or more employees)

SIC	SIC Industry	Multiplants	Single plants
		---------($1,000,000)-----------	
2211	Weaving mills cotton	13.5	4.2
2221	Weaving mills man-made fibers	13.9	3.0
2231	Weaving and finishing mills wool	5.5	2.2
2251	Women's hosiery	7.9	1.3
2257	Circular knit fabric mills	11.0	1.9
2258	Warp knit fabric mills	10.3	1.4
2261	Finishing plants cotton	8.9	2.2
2262	Finishing plants man-made fibers	13.4	4.3
2269	Finishing plants (n.e.c.)	7.2	2.1
2272	Tufted carpets and rugs	11.8	5.2
2281	Yarn mills, except wool	7.1	3.6
2283	Wool yarn mills	5.6	1.7
2291	Felt	5.2	3.7
SIC 22 Total	Textile Mill Products	10.0	2.3

Source: Census of Manufactures, 1972.

Table III-7. Single plant operations in segments by type plant
(Plants responding to industry survey)

Type plant	Segment	Percent of plants in segment
commission	wool scouring	75
	wool finishing	100
	woven fabric finishing	70
	knit fabric finishing	100
	stock & yarn finishing	100
finishers, own textiles	woven fabric finishing	20
	hosiery finishing	60
	stock & yarn finishing	50
integrated mills	wool finishing	70
	woven fabric finishing	40
	knit fabric finishing	40
	hosiery finishing	60
	carpet finishing	35
	stock & yarn finishing	50

Source: Development Planning and Research Associates, Inc.

done as a part of this economic analysis. The largest portion of all commission mills are single plant operations. Based on the survey results, all of the commission mills found in three segments (wool finishing, knit fabric, and yarn finishing) were single plant operations. In wool scouring and woven fabric finishing about 70 percent of the commission mills were single plant operations. Among finishers of their own textiles, the percentage of single plant operations varied widely between the three segments involved. In the woven fabric finishing segment, only 20 percent of the plants were found to be single plant operations. In hosiery and yarn finishing, the percentages were 60 and 50 percent respectively. Among the integrated mills, the percentages of single plant operations varied from a low of 35 percent in carpet finishing to a high of 70 percent in wool finishing.

As can be expected from the difference in sizes and type plants, there are significant differences in the financial profiles of single and multiplant operations as reflected in Table III-8. The table compares value of shipments and cost of materials (both expressed as percentages of value shipments) and the inventory turnover ratios between the single and multiplant operations in selected SIC industries. With one exception, the value added (percent) of single plant operations of all industries is greater than that of multiplant operation while the cost of materials is less. This relationship indicates primarily the economies of scale which can be attributed to differences in sizes. The greatest differences in value added occur in the knit fabric mills (SIC 2257 and 2258) and the man-made textiles finishing plants (SIC 2262). Relatively minor differences occur in several of the SIC industries. In man-made weaving (SIC 2221) and textile finishing (SIC 2269) the difference in the value added amounts to only a percentage point between the two categories. The inventory turnover (the ratio of value of shipments to inventories) for single plant operations is generally higher than that of multiplants. This can be attributed to a combination of factors. Significant considerations are the specialized markets and products with which the single plant operations can be expected to be involved.

While the most significant differences in financial profiles stem from the size and type plant characteristics of each category, difference also result from the financial accounting systems inherent in the two categories. The economic viability of a single plant operation can be directly measured by its income statement and balance sheet. There is relatively no flexibility in accounting for increased costs associated with pollution control. Reduction in profits because of the imposition of controls will directly reflect a change in viability of the plant. However, the viability of the multiplant operations is tied in with the profitability of the parent company. The financial accounting is more flexible and the impacts of controls can not be as easily discerned. However, the degree of flexibility still depends to a great extent on the type organization of the parent company. Exhibit III-1 shows the basic corporate organizational structures found in the industry: (1) parent-subsidiary and (2) corporate headquarters - division.

Table III-8. Financial characteristics of single and multiplant operations--selected SIC industries

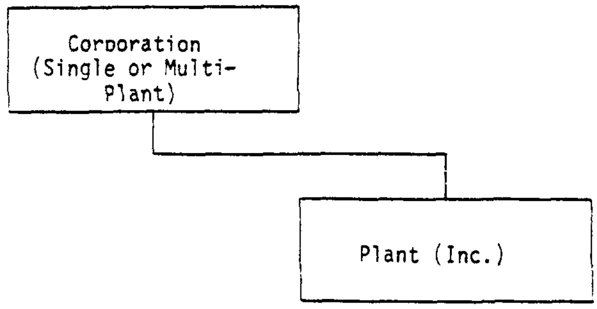
SIC	SIC Industry	Plant Operations	Value Added	Cost of Material	Inventory Turnover[1/]
		----(as a % of shipments) ----			(ratio)
2211	Weaving mills cotton	Multi-	40	60	6.8
		Single	49	52	11.6
2221	Weaving mills man-made fibers	Multi-	47	53	6.8
		Single	53	47	7.5
2231	Weaving and finishing mills wool	Multi-	51	51	4.5
		Single	58	43	6.1
2251	Women's hosiery	Multi-	43	55	5.2
		Single	50	50	7.9
2257	Circular knit fabric mills	Multi-	35	67	7.8
		Single	46	54	11.3
2258	Warp knit fabric mills	Multi-	29	73	5.6
		Single	52	49	9.3
2261	Finishing plants cotton	Multi-	51	50	9.6
		Single	54	46	13.2
2262	Finishing plants man-made fibers	Multi-	33	67	9.2
		Single	60	40	21.9
2269	Finishing plants, (n.e.c.)	Multi-	42	58	12.9
		Single	43	57	15.1
2272	Tufted carpets and rugs	Multi-	31	70	5.4
		Single	42	62	6.5
2281	Yarn mills, except wool	Multi-	38	62	9.4
		Single	43	58	8.7
2283	Wool yarn mills	Multi-	41	63	5.6
		Single	45	56	7.4
2291	Felt	Multi-	56	44	5.3
		Single	51	49	8.9
Total SIC 22 Textile Mills Products		Multi-	40	60	6.8
		Single	49	52	11.6

1/ Shipments divided by inventory
Source: Census of Manufactures, 1972.

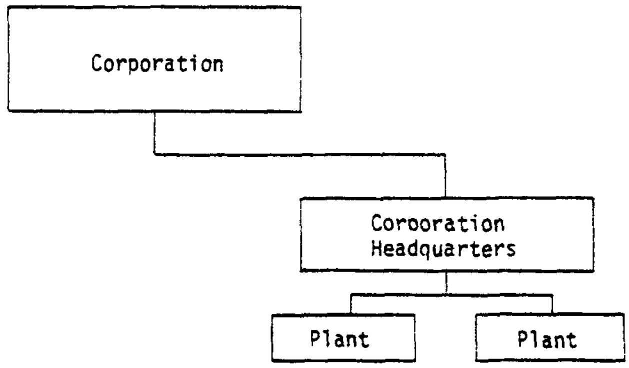
Exhibit III-1. Multiplant corporations.

PARENT-SUBSIDIARY

(Single plant subsidiary)

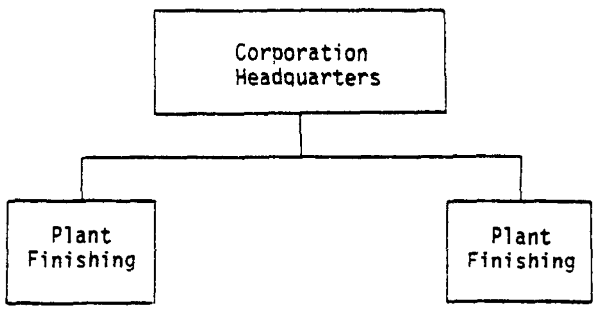


(Multiplant subsidiary)

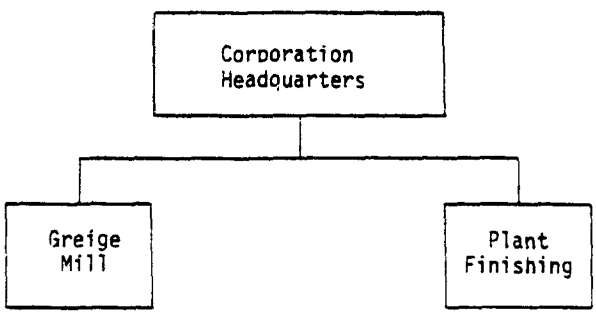


CORPORATE HEADQUARTERS & DIVISIONS

(Divisions horizontally integrated)



(Divisions vertically integrated)



Source: Development Planning and Research Associates, Inc.

In the parent-subsidiary organizations, the accounting system for separately incorporated plants is very similar to single plant operations with very little flexibility. The income statement may be consolidated with the parent corporation; however, separate systems are usually maintained. The impacts of pollution control costs on these plants would be about the same as on single plant operation. Corporate headquarters - division organizations have considerably more flexibility in the accounting systems and consequently, a much greater viability may be portrayed when compared to single plant operations. Accounting systems used in these organizations may incorporate cost or profit centers. With the use of these centers, the viability of individual plants can not be easily discerned. Consequently, the impacts of pollution control costs will be felt only at the corporate level. With horizontally integrated companies (one or more wet processes) the impact is going to be relatively great since all plants can be expected to be subjected to increased costs. Although the impacts are great they are not as severe as those of single plant operations since the indirect costs can be reduced by allocation to two or more centers. In the case of vertical organizations, this allocation of costs is much more flexible and the viability of a given plant is much less apparent.

In the cost center system, profits are not normally identified with the plants. Consequently, the impacts of pollution control can be ascertained only at the corporate level. A corporation with greige mills and finishing operations can absorb costs more readily than either single plant operations or horizontally organized multiplant operations. Under profit center systems, the profits between plants are normally allocated on a cost basis. Consequently, the costs will in effect be absorbed both by the greige mill and the finisher. This amounts to a partial price pass through.

3. Number of Plants and Firms

The number of plants and firms in the textile industry is discussed in this section. The section is divided into two parts. The first part describes the industry in aggregate form according to Census data. The second part of this section concentrates on the number of textile mills which are believed to be wet processors, that is, those facilities which are capable of generating wastewaters.

a. The Aggregate Industry

The aggregate number of establishments (mills and plants) and companies comprising each of the SIC industry groups (3 digit level) within the textile industry are shown in Table III-9 for the period 1963-1977. During this period, the total number of establishments remained fairly stable, fluctuating between 7,100 and 7,200. However, the total number of companies declined from over 6,300 in 1963 to approximately 6,100 in 1972 (data is not available for 1977), revealing a trend towards greater concentration within the industry. While the total number of textile mills has remained stable,

Table III-9. The textile industry, number of firms and establishments (SIC Industry Group--3 digit level)

SIC Groups		Firms 2/			Establishments			
		1963	1967	1972	1963	1967	1972	1977
221 1/	Weaving Mills	1,160	1,097	947	1,507	1,483	1,293	1,228
225	Knitting Mills	2,719	2,530	2,462	2,848	2,698	2,727	2,670 3/
226	Textile Finishing Except Wool and Knit	587	601	570	621	641	656	665
227	Floor Covering Mills	326	342	476	349	385	529	590
228	Yarn and Thread Mills	594	605	594	712	768	810	793
229	Misc. Textile Goods	978	984	1,089	1,067	1,105	1,193	1,151 3/
	TOTAL	6,364	5,773	6,138	7,104	7,080	7,204	7,103 3/

1/ Includes SIC 222, 223, and 224.

2/ 1977 data are not available.

3/ Estimated.

Source: Bureau of the Census, U.S. Department of Commerce.

the numbers within the various industry groups have been somewhat more volatile. It should be noted that, to a great extent, this volatility represents reclassifications under the SIC system based on changes in the product mixes produced by the mills. It does not necessarily reflect the actual plant closings and openings. The greatest change among the industry groups occurred in the weaving mills with the number of establishments declining from over 1,500 in 1963 to below about 1,200 in 1977. The knitting mills (SIC 225) showed a slight decrease with the number of mills going from over 2,800 in 1963 to about 2,700 in 1977. The greatest increase occurred in the floor covering mills (SIC 227) with the number of mills growing by 70 percent; an increase from 349 mills in 1963 to about 600 in 1977. The remaining industry groups saw moderate increases in their number, varying between 5 and 15 percent.

Table III-10 depicts the number of establishments for each of the SIC industries during the period 1963-1977. In Industry Group 221 (Weaving Mills), the most significant change involved the wool weaving and finishing mills which experienced a 60 percent decline during the period with the total number of mills dropping from 361 in 1963 to 157 in 1977. The total number of broad woven mills (SIC 221 and 222) remained fairly constant with a decrease of less then 20 mills which amounted to a 3 percent decline. However, among the two type industries there were wide fluctuations. The number of cotton mills (SIC 221) decreased by about 25 percent while the man-made fiber mills (SIC 222) increased by about the same percentage. As pointed out previously, this reflects more a change in classification of mills than it does in mill openings and closings.

In Industry Group 225 (knitting mills), the total number of hosiery, underwear, and outerwear mills decreased by about 25 percent during the period 1963-1977. The number of mills producing gloves and other products (SIC 2259) fluctuated between 60 and 80 during the period 1963-72 and then increased dramatically between 1972 to 1977, rising from 73 to 189. The bulk of the increase can be attributed to a 250 percent increase in the number of small plants (those that employ less than 20 workers) which climbed from 40 to 141. The number of knit fabric mills increased from 518 in 1963 to over 900 in 1972. In 1972, the knit fabric mills were reclassified into two separate SIC industries: circular (SIC 2257) and warp (SIC 2258).

Between 1972 and 1977, the number of circular knit fabric mills decreased about 200 mills with the total number dropping from 716 to 518. The number of warp knit fabric mills increased from 203 mills in 1972 to 233 in 1977.

The total number of plants in Industry Group 226 increased by about 7 percent with the number climbing from 621 in 1963 to 668 in 1977. The number of plants finishing woven fabric (SIC 2261 and 62) increased by about 10 percent going from 443 to 485. Within these two SIC industries, the changes between the cotton and the man-made fiber plants paralleled those within the weaving industries. That is, in 1963, the cotton plants outnumbered the man-made fiber plants; however, in 1977 the man-made fiber plants outnumbered the cotton plants.

Table III-10. The textile industry, number of firms and establishments (SIC Industries-4 digit level)

SIC	Industries	Firms 1963	Firms 1967	Firms 1972	Establishments 1963	Establishments 1967	Establishments 1972	Establishments 1977
221	WEAVING MILLS							
2211	Weaving Mills Cotton	229	218	190	407	393	307	308
2221	Weaving Mills Man-Made Fibers	227	272	256	355	396	412	437
2231	Weaving & Finishing Mills-Wool	304	262	178	361	310	198	157
2241	Narrow Fabric Mills	350	345	323	384	384	376	326
	TOTAL	1,160	1,097	947	1,507	1,483	1,293	1,228
225	KNITTING MILLS							
2251	Womens Hosiery	363	302	256	411	355	312	(NA)
2252	Hosiery (n.e.c.)	504	423	375	528	448	415	414
2253	Knit Outerwear Mills	1,175	1,156	882	1,185	1,179	917	(NA)
2254	Knit Underwear Mills	104	99	74	118	113	87	(NA)
2256	Knit Fabric	487	489	--	518	541	--	--
2257	Circular Knit Fabric Mills	--	--	629	--	--	716	518
2258	Warp Knit Fabric Mills	--	--	174	--	--	203	233
2259	Knitting Mills (n.e.c.)	86	61	72	38	62	73	189
	TOTAL	2,719	2,530	2,462	2,848	2,698	2,723	2,670 1/
226	TEXTILE FINISHING EXCEPT WOOL AND KNIT							
2261	Finishing Plants, Cotton	220	202	181	238	216	196	213
2262	Finishing Plants, Man-Made Fiber	193	212	200	205	233	259	272
2269	Finishing Plants (n.e.c.)	174	187	189	178	192	201	180
	TOTAL	587	601	570	621	641	656	665
227	FLOOR COVERING MILLS							
2271	Woven Carpets and Rugs	56	55	64	64	61	65	72
2272	Tufted Carpets and Rugs	167	210	334	181	244	381	446
2279	Carpet and Rugs (n.e.c.)	103	78	78	104	80	83	72
	TOTAL	326	342	476	349	385	529	590
228	YARN AND THREAD MILLS							
2281	Yarn Mills Except Wool	234	256	264	317	377	426	455
2282	Throwing and Winding Mills	165	159	177	180	181	212	194
2283	Wool Yarn Mills	136	127	92	144	135	99	74
2284	Thread Mills	59	63	61	71	75	73	70
	TOTAL	594	605	594	712	768	810	793
229	MISC. TEXTILE GOODS							
2291	Felt Except Woven Felts and Hats	28	33	38	36	40	47	44
2292	Lace Goods	145	134	99	152	142	105	70
2293	Padding and Upholstery Filling	168	133	119	183	151	132	119
2294	Processed Textile Wastes	137	134	102	141	141	106	97
2295	Coated Fabrics Not Rubberized	149	157	184	162	178	202	196
2296	Tire Cords and Fabrics	12	12	9	20	20	18	21
2297	Nonwoven Fabrics	64	65	66	69	68	82	94
2298	Cordage and Twine	148	147	134	167	169	156	171
2299	Textile Goods (n.e.c.)	127	189	338	137	196	345	(NA)
	TOTAL	978	984	1,089	1,067	1,105	1,193	1,157 1/
TOTAL		6,364	5,773	6,138	7,104	7,080	7,204	7,103 1/

Source: U.S. Department of Commerce, Bureau of Census, 1972 Census of Manufactures, and 1977 Preliminary.

1/ Estimated

The total number of mills in Industry Group 227 (carpets) increased significantly going from 349 in 1963 to 590 in 1977. The increase reflects the dramatic jump in the number of tufted carpet mills which ran from 181 in 1963 to 446 in 1977. The number of woven carpet mills remained fairly constant varying between 60 and 70 mills. Other carpet mills (Industry 2279) experienced a substantial decline with a decrease in the total number from 104 to 72 during the period.

The total number of mills in Industry Group 228 (yarn) increased from 712 in 1963 to 810 in 1972; it then dropped to 793 in 1977. In this group the yarn mills (SIC 2281) have shown a continued increase going from 317 to 455 during the period. The wool yarn mills (SIC 2283) have shown a significant and continued decrease dropping from 144 in 1963 to 74 in 1977. The other industries in the group have experienced a relatively stable level in their total numbers during the period.

In Industry Group 229 (miscellaneous), the total number of plants has remained relatively stable, fluctuating between 1000 and 1200. Several of the SIC industries have shown significant decreases including lace goods (SIC 2292), padding (SIC 2293) and processed textiles (SIC 2294). Industries showing appreciable increases in their total number include nonwoven fabrics (SIC 2297) and textile goods (n.e.c.) (SIC 2299).

In the knitting mills group, the number of mills producing knit apparel underwent a substantial decrease; these mills include those fabricating hosiery, outerwear, underwear, and gloves. In contrast, the mills producing knit fabric experienced a dramatic increase reflecting the large production of double knit goods during the early 1970's. In 1963, the total number of mills producing knit fabric was just a little over 500. By 1972, the number had almost doubled to over 900 mills. It should be noted that between 1963 and 1972, the knit fabric segment (SIC 2256) was split into two separate industries under the SIC system: circular knit (SIC 2257) and warp knit (SIC 2258) fabric mills. As a consequence, the dramatic increase may have resulted to a degree from a reclassification of small mills and, as pointed out previously, it does not necessarily represent the actual opening of 500 new mills.

During the period 1963-1972, the number of textile finishing plants increased by close to 5 percent. The changes in the number of plants finishing cotton fabric and those finishing man-made fabric primarily reflects the change in the production of the two types of fabrics as discussed for the weaving mills. The actual number of finishing plants in operation changed only slightly increasing by about 40 plants.

The dramatic change in the number of floor covering mills occurred because of a doubling of the number of tufting mills (SIC 2272) from about 180 in 1963 to close to 380 in 1972. There was very little change in the number of mills producing woven carpets (SIC 2271). The other type of mills (SIC 2273) experienced a significant decline in its number.

b. "Wet" Processors

Because the textile industry is comprised of a diverse group of establishments, many which are essentially dry and thus would not be affected by wastewater regulations, the Technical Contractor conducted a major survey of the facilities in SIC 22. The survey resulted in the development of a master list of those textile mills believed to have wet production operations. This master list was developed based on information from several sources including the Standard Industrial Classification (SIC), the Census of Manufacturers, data collected during previous textile industry studies, information from trade associations, and information contained in a commercial directory, Davison's Textile Blue Book.

As a result of this effort the technical contractor developed a master list consisting of 1,777 wet production facilities. Table III-11 depicts these facilities according to their respective functional subcategories. It should be noted there were 1,165 mills classified in the nine functional subcategories which were considered to be wet processors. Additionally there were 612 mills classified as low water use processing operations. These low water use operations are predominately greige mills with weaving and slashing operations.

4. Size of Plants and Firms

Information used to indicate mill size can be obtained from the Census of Manufactures. Using the number of employees as a basis for mill size, the textile industry was grouped into four size levels. Included as divisions were: small, medium, large, and extra-large mills. The mills which form the small category employed 1 to 19 workers, those in medium-sized mills engaged 20 to 99 employees, 100 to 999 were classified as large, while extra-large mills were defined as employing over 1,000. Table III-12 depicts the four size levels for each SIC industry group and provides totals for each level in the textile industry as of 1972 (later data is not available). In the aggregated industry, 2,698 (37 percent) of the 7,203 mills were classified as small mills, 32 percent were defined as medium, 29 percent fit into the large category with the remainder (2 percent) employing greater than 1,000 workers. It can be determined from this data that the majority of the mills are relatively small. Specifically, 70 percent of all the textile mills employed less than 100 employees in 1972.

When the groups were analyzed on an individual basis, it was determined each varies independently of the others. The weaving mills, for example, reported that of 1,293 mills, 500 (39 percent) employed 100 to 999 workers. The small level accounted for 30 percent of the mills, 27 percent were at the medium level, and 5 percent operated at the extra-large employment level.

Table III-11. Wet processors, in the textile industry

Functional category	Total mills listed
Wool scouring	17
Wool finishing	37
Low water use processing	612
Woven fabric finishing	336
Knit fabric finishing	282
Hosiery products	160
Carpet finishing	58
Stock and yarn finishing	217
Nonwoven manufacturing	38
Others (felted fabric processing)	20
TOTAL	1,777

Source: Sverdrup and Parcel and Associates, Inc.

Table III-12. Total number of establishments by classification, by size

	Weaving Mills	Knitting Mills	Floor Covering Mills	Yarn & Thread Mills	Dyeing & Finishing Mills	Miscellaneous Textile Goods	Total
Total establishments	1,293	2,723	528	810	656	1,193	7,203
Small (1-19 employees)	391	998	248	174	223	664	2,698
Medium (20-99 employees)	343	1,043	138	206	232	369	2,331
Large (100-999 employees)	500	661	132	413	197	154	2,057
X-large (1,000-over employees)	59	21	10	17	4	6	117

Source: U.S. Department of Commerce, Census of Manufactures, 1972.

The remaining industry groups are discussed below based on data depicted in Table III-12.

a. Knitting Mills (Industry Group 225)

Knitting mills were evenly distributed among small and medium firms. The small mills accounted for 37 percent of the total, 2,723 mills, whereas the medium-sized mills amounted to 38 percent. Collectively, the small and medium levels comprised 75 percent of all knitting mills. In addition, 24 percent of the mills maintained an employment level of 100 to 999 workers, while the remaining one percent of the knitting mills were classified as extra-large.

b. Floor Covering Mills (Industry Group 227)

Mills in this group were relatively small in comparison to the mills in the other groups of the textile industry. Floor covering mills accounted for 528 mills of which 248 mills, or 47 percent, employed less than 20 workers. Twenty-six percent of the mills were of medium size. Grouping the small and medium employment levels together resulted in 73 percent of the floor covering mills maintaining employment levels of less than 100 workers. The large and extra-large mills accounted for the remaining 25 percent and 2 percent respectively.

c. Yarn and Thread Mills (Industry Group 228)

This group consisted of a total of 810 mills. Among the yarn and thread mills, large mills predominated, the employment level of 100 to 999 employees with 51 percent, or 413 mills. The small and medium levels comprised an additional 21 percent and 25 percent respectively. Similar to the other groups in this industry, the number of mills employing over 1,000 workers was small as only 2 percent of the mills in the yarn and thread category reported this level of employment.

d. Dyeing and Finishing Plants - Excluding Wool (Industry Group 226)

This group differed from the other groups in its distribution of employees. In the dyeing and finishing plants, the small, medium, and large employment levels were about the same size. Specifically, the small level accounted for 34 percent of the mills, 35 percent were at the medium level, and 30 percent were classified as large. This was the only group in the industry with such an even distribution of employment levels. Only one percent of the mills in this category employed over 1,000 workers.

e. Miscellaneous Textile Goods (Industry Group 229)

The great diversity between mills in this group accounted for the majority (56 percent) of the total 1,193 mills reporting employment figures in the small size level. An additional 31 percent classified as medium-sized mills resulted in 87 percent of the miscellaneous textile goods mills maintaining employment levels of less than 100 workers. Only 13 percent of the mills were large while one percent were in the extra-large size division.

f. Size of Plants by Functional Subcategories

While the above text and data presented in Table III-12 presents the plant sizes according to Census employment groupings, size information was also obtained for a majority of the facilities believed to be "wet" processors which appeared on the master list developed by the Technical Contractor. Table III-13 presents the total number of facilities for each "wet" functional category, the number of facilities which either did or did not furnish production information, and for those who did provide information, their respective responses by production size ranges. As shown in Table III-13, the majority of the respondents produced less than 13 kkg/day. This was also true for most of the functional categories with the notable exceptions being the wool scouring, low water processing, and carpet finishing categories.

It should be noted data in Table III-13 were based in terms of wet production which is dependent on the weight of the material found in the final product. Thus mills producing light weight products such as hosiery and other sheer knit goods occupy the smaller production ranges while mills manufacturing heavy weight woven goods (upholstery and drapery fabric) and carpet occupy the larger production ranges.

5. Location of Plants (Mills)

Textile mills were among the first types of industrial plants established in this country. As a result, the early centers of the industry were in the New England and Southern states. While textile mills are geographically distributed throughout 37 states according to the 1972 Census, the heaviest concentrations remain in the Northeast and South. Table III-14 shows that five states, New York, New Jersey, Pennsylvania, North Carolina and Georgia, comprise 62% of the 7,203 mills operating in the United States in 1972. The textile industry is divided into four geographic regions; Northeast, South, North Central, and West. These regions are subdivided into two or three divisions consisting of several states each. The Northeast region is the largest area of concentration accounting for 3,409 of the total 7,203 mills. Within this region, the Middle Atlantic division contains 76% of the area total. The majority (1,328) of the plants are located in New York. The Northeast region is closely followed by the South region in terms of total mills. This region consists of 43% of the total in comparison to 47% in the Northeast. The heaviest concentration is found in the South Atlantic area, specifically North Carolina. The North Central and West region provide relatively few mills, amounting to 8% of the total figure. These extremities in geographical distribution of textile mills provide for one of the most fragmented industries in the United States (Exhibit III-2).

Table III-14 also depicts the geographic location of the mills by the Standard Industrial Classification system (SIC codes) and into plants which employ twenty or more workers. Regarding the plants with twenty or more employees, the South accounts for 51% of the total and the Northeast 42%; therefore, while the Northeastern region has more total plants, the South region has larger plants.

Table III-13. Production ranges of responding mills on master list

Functional category	Total no. wet mills	Mills for which no data rcvd.	Mills for which data provided	Percent of respondents by production ranges (kkg/day)				
				0-4	4-13	13-34	34-68	above 68
Wool scouring	17	1	16	31	6	38	25	0
Wool finishing	37	4	33	52	33	9	6	0
Low water use processing	612	504	108	16	28	41	11	5
Woven fabric finishing	336	96	240	26	25	23	13	13
Knit fabric finishing	282	59	223	31	28	31	7	3
Hosiery products	160	24	136	88	11	1	0	0
Carpet finishing	58	8	50	8	20	26	26	20
Stock and yarn products finishing	217	19	198	40	29	23	7	2
Nonwoven manufacturing	38	13	25	24	24	32	16	4
Other (felted fabric processing)	20	5	15	73	20	0	7	0
All categories	1,777	733	1,044	37	25	23	9	6

Source: Sverdrup & Parcel and Associates, Inc.

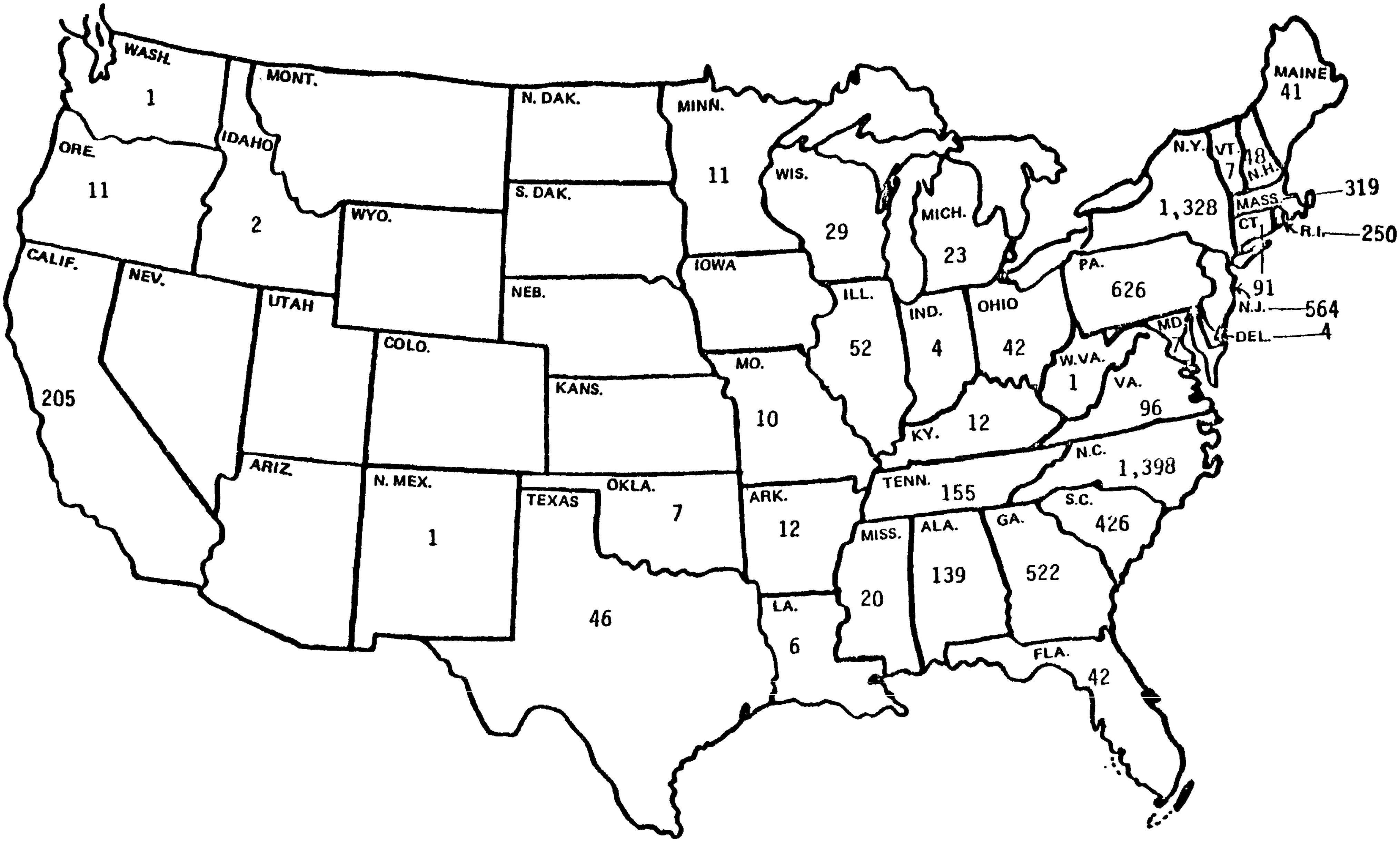
Table III-14. State and regional location of textile mills, 1972

Geographic location	Weaving Mills (SIC 221)		Knitting Mills (SIC 225)		Floor Covering Mills (SIC 227)		Yarn and Thread Mills (SIC 228)		Dyeing and Finishing Textiles, exc. wool (SIC 226)		Misc. Textile Goods (SIC 229)		Total	
	total	20 or more emp.	total	20 or more emp.	total	20 or more emp.	total	20 or more emp.	total	20 or more emp.	total	20 or more emp.	total	20 or more emp.
Northeast Region	596	337	1,463	852	69	32	248	155	390	249	643	264	3,409	1,889
New England Division	252	171	95	74	22	11	102	69	110	77	242	110	823	512
Maine	23	21	3	1	*	*	10	6	*	*	5	4	41	32
New Hampshire	27	19	10	10	1	1	4	3	3	2	3	3	48	33
Rhode Island	91	63	16	11	8	4	26	17	35	24	74	29	250	143
Massachusetts	74	46	43	34	5	3	34	24	51	36	112	54	319	197
Connecticut	26	18	14	13	*	*	11	10	19	14	21	16	91	71
Vermont	4	3	3	2	*	*	*	*	*	*	*	*	7	5
Middle Atlantic Division	344	166	1,362	777	47	21	146	86	230	172	401	154	2,580	1,376
New York	125	43	833	451	8	2	37	17	122	66	203	72	1,328	651
New Jersey	84	38	233	119	2	2	18	8	110	78	117	45	564	290
Pennsylvania	135	85	294	206	27	15	64	55	41	28	65	29	626	418
South Region	597	521	1,094	774	368	205	503	469	208	162	330	161	3,127	2,292
South Atlantic Division	509	449	934	653	321	176	459	403	176	143	227	112	2,626	1,936
Virginia	34	32	34	30	3	3	12	11	11	10	2	2	96	88
West Virginia	*	*	1	1	*	*	*	*	*	*	*	*	1	1
North Carolina	184	156	738	506	38	10	275	252	81	71	82	48	1,398	1,043
South Carolina	183	170	70	60	25	16	63	54	43	37	42	23	426	360
Georgia	83	74	35	25	237	145	100	81	23	18	44	20	522	363
Maryland	5	4	*	*	*	*	2	2	*	*	*	*	7	6
Florida	5	3	37	18	*	*	*	*	*	*	*	*	42	21
Delaware	*	*	3	2	*	*	*	*	1	1	*	*	4	3
East South Central Division	71	62	139	106	29	18	61	59	23	16	51	30	374	291
Tennessee	19	15	82	64	18	9	15	14	14	8	7	5	155	115
Alabama	45	41	32	23	6	6	41	40	3	3	12	9	139	122
Mississippi	2	2	15	13	1	1	1	1	*	*	1	1	20	18
Kentucky	*	*	5	5	3	2	3	3	*	*	1	1	12	11
West South Central Division	14	9	18	13	15	11	6	5	6	2	45	18	104	58
Arkansas	1	1	4	4	4	4	1	1	1	1	1	1	12	12
Texas	13	8	5	4	3	2	3	2	*	*	22	9	46	25
Louisiana	*	*	2	2	*	*	*	*	*	*	4	2	6	4
Oklahoma	*	*	*	*	5	4	2	2	*	*	*	*	7	6
North Central Region	43	22	64	45	22	8	11	7	24	12	125	65	289	159
East North Central Division	29	11	47	33	17	7	11	7	21	11	93	56	218	125
Illinois	9	4	9	4	4	3	2	1	11	5	17	10	52	27
Ohio	7	5	12	9	*	*	1	1	1	1	21	15	42	31
Wisconsin	1	1	19	17	*	*	5	4	*	*	9	4	29	25
Indiana	*	*	*	*	1	1	*	*	*	*	3	2	4	3
East North Central Division	29	11	47	33	17	7	11	7	21	11	93	56	218	125
Illinois	9	4	9	4	4	3	2	1	11	5	17	10	52	27
Ohio	7	5	12	9	*	*	1	1	1	1	21	15	42	31
Wisconsin	1	1	19	17	*	*	5	4	*	*	9	4	29	26
Indiana	*	*	*	*	1	1	*	*	*	*	3	2	4	3
Michigan	*	*	*	*	*	*	*	*	1	1	22	12	23	13
West North Central Division	14	11	10	9	NA	NA	NA	NA	NA	NA	14	5	38	25
Missouri	1	1	1	1							8	3	10	5
Minnesota	2	2	7	6							2	2	11	10
West Region	28	13	95	53	56	35	11	5	22	7	60	30	272	143
Pacific Division	26	13	87	48	53	34	10	5	19	7	52	27	247	134
California	17	6	76	41	52	33	9	5	18	7	33	21	205	113
Washington	1	1	*	*	*	*	*	*	*	*	*	*	1	1
Oregon	7	5	4	4	*	*	*	*	*	*	*	*	11	9
Mountain Division	NA	NA	3	3	NA	NA	NA	NA	NA	NA	NA	NA	3	3
Idaho			2	2									2	2
New Mexico			1	1									1	1
Utah			*	*									*	*
Other mills not specified individually	29	9	7	1	13	--	10	--	12	3	35	9	106	22
TOTAL	1,293	902	2,723	1,725	528	280	810	636	656	433	1,193	529	7,203	4,505

* Not applicable NA Not available Source: U.S. Department of Commerce, Bureau of the Census, Census of Manufactures, 1972.

(Data are not available for 1977 Census)

Exhibit III-2. Geographical location of textile mills 1/



1/ Geographical location for 106 mills was unspecified.

Source: Census of Manufactures - 1972

As has been discussed previously, the SIC system categorized the textile industry into six industry groups. Included as industry groups are: Weaving Mills (SIC 221-224), Knitting Mills (SIC 225), Floor Covering Mills (SIC 227), Yarn and Thread Mills (SIC 228), Dyeing and Finishing Textiles - excluding Wool (SIC 226), and Miscellaneous Textile Goods (SIC 229). The locational characteristics of each of these major groups are discussed below.

a. Weaving Mills

The mills in the weaving mills groups are almost equally divided into the Northeast and South regions. The South makes up 597 of the 1,293 total plants in this segment while the Northeast accounts for 596 mills. The combination of these regions supplies the textile industry with 92% of the total weaving mills. Specifically, North Carolina, South Carolina, New York, and Pennsylvania contain the majority of plants in these regions, maintaining 184 and 183 mills respectively in the southern two states, and 135 and 125 respectively in the two northern states. Five percent of the weaving mills are found in the North Central and Western regions, leaving the remaining 3% unclassified.

For the weaving Mills groups, 902 establishments of the segment's 1,293 total mills employed 20 or more employees. The location of these weaving mills reporting twenty or more employees is similar to the total weaving mills geographic distribution. For example, 521 of the total 902 mills are located in the Southern region. Within this Southern region, South Carolina is the major contributor of woven goods, with 170 mills having 20 or more employees. The Northeast region represents 37% (337 establishments) of the larger mills, while the North Central and West regions supply the remaining portion.

b. Knitting Mills

The Northeast region represents 54% of the total knitting mills. The second largest locational area of knitting mills is the South which accounts for 40% of the 2,723 mills in this category. The remaining knitting mills are found in the West and North Central regions which contain 3% and 2%, respectively, of the mills.

Within the total knitting mill group, 63% of the knitting mills (1,725 establishments) employ twenty or more workers. This indicates that the majority of the mills are relatively large. The greatest concentration of these larger mills are located in the Northeast region. This area accounts for 852 mills, or 49% of the total 1,725 mills. The South region represents 774 mills, while the North Central and West regions collectively account for 98 mills.

c. Floor Covering Mills

The floor covering mills group consists of 528 mills. The location of 70% of the floor covering mills is in the South region. Georgia alone accounts for 45% of the total floor covering mills, with the remainder distributed throughout the region. The northeast plays a minor role in this group, accounting for only 13% of the mills. The West region is comparable to the Northeast amounting to 10% of the category.

Although the number of mills within this group is relatively small, 53% of the mills maintain a payroll of twenty or more employees. Here again the South is accountable for the majority of the plants. Specifically, 73% of the larger mills (205 mills) are located in this area. The West region plays a slightly more significant part than the Northeast in this group. The larger mills in the West region represent 13% of the total in comparison to 10% accounted for by the Northeast. The remainder of plants are found in the North Central region.

d. Yarn and Thread Mills

The South region is credited with having the most yarn and thread mills in the United States. This area represents 62% (503 mills) of the total 810 mills now manufacturing yarn and thread. North Carolina alone accounts for 275 mills, with South Carolina and Georgia totaling 163 plants. In the Northeast, yarn and thread mills are sparse, amounting to 31% of the mills in this segment. The North Central and West regions are equally paired with 11 mills each.

The yarn and thread group represents a significant number of mills with 20 or more employees, having 636 mills in that classification. The mills are geographically distributed similarily to the total yarn and thread mill segment distribution. The majority of the mills are found in the South region, followed by the Northeast, North Central, and West regions.

e. Dyeing and Finishing Plants - Excluding Wool

The dyeing and finishing group consists of the fewest establishments found within any group of the textile industry. In this group, 390 of the 656 plants are distributed within the Northeast region. Within this region New York and New Jersey have plants totaling 232, which is over one-third of the total number of plants in the group. The South region accounts for 208 plants, or 32%, with the North Central and Western regions providing 4% and 3% respectively.

The majority (66%) of dyeing and finishing plants employ at least 20 workers This represents a total of 433 plants with 249 in the Northeast, 162 in the South, 12 in the North Central, and 7 in the West regions.

f. Miscellaneous Textile Goods

This group is the most diversified of those within the textile industry and it is the third largest, accounting for 1,193 mills. Fifty-four percent (643 mills) of the 1,193 mills are in the Northeast region. New York accounts for 203 of the 643 mills within this region; Massachusetts is next with 112 mills. The South contains 330 mills followed by 125 in the North Central region, and 60 mills in the west.

The majority of the mills represented in the miscellaneous textile goods group employ fewer than 20 employees. Only 44% of the mills reported more than 20 workers, the greatest portion of which were located in the Northeast region. The South accounts for 30% of the larger mills while the North Central and West regions collectively account for 18%.

g. "Wet Processors"

The geographical distribution of the "wet processors" is shown in Table III-15. As shown, the distribution is very similar to that based on the Census data. Over half of the wet production facilities are located in the southeast (EPA Region IV), particularly the Carolinas and Georgia. Another 25 percent are in the Northeast (New England, New Jersey, and New York). Less than 5 percent of the "wet processors" are located in the west (EPA Regions VI through X).

6. Level of Technology

During the past twenty years significant changes in technology have affected all of the textile industry groups. While each segment has experienced unique changes, the generally accepted cause for many of the changes for all categories was developments in man-made fibers. In a recent study by the Department of Treasury 1/, the major textile technological changes were identified and assessed. While the objective of the Treasury study was an evaluation of capitalization rates in the industry, it did provide an overview of the technological changes experienced by each of the groups. These are summarized below.

a. Weaving

Significant changes in weaving technology began during the early 1950's with the introduction of shuttleless looms and developments to increase operating efficiency of the older conventional shuttle looms. As shown in Table III-16, the number of conventional looms has declined consistently since 1950 from 650,000 looms to 280,000 in 1974. While much of this decline is a result of the exit of weaving mills from the industry, portions of the decline are attributable to increased operating efficiency of existing looms and the introduction of shuttleless looms. Shuttleless looms were originally introduced during the mid-1950's but the number was relatively insignificant due to the limited capabilities of the early machines.

1/ U.S. Department of the Treasury, The Textile Industry, 1976.

Table III-15.
Geographical distribution - mills on master list

Manufacturing Subcategory	EPA Region[1/] I	II	III	IV	V	VI	VII	VIII	IX	X	All Regions
Wool Scouring	6	1	3	3	0	3	0	0	0	1	17
Wool Finishing	20	2	4	3	1	1	1	1	0	4	37
Low Water Use Processing	60	75	72	390	6	7	0	0	2	0	612
Woven Fabric Finishing	69	54	34	155	11	3	1	2	7	0	336
Knit Fabric Finishing	27	58	45	134	9	1	2	0	6	0	282
Hosiery Products	2	2	9	139	5	2	0	0	0	1	160
Carpet Finishing	0	1	4	39	1	4	0	0	9	0	58
Stock & Yarn Finishing	33	19	31	120	6	3	1	0	4	0	217
Nonwoven Manufacturing	10	3	4	11	7	2	0	0	1	0	38
Felted Fabric Processing	7	2	3	3	2	0	0	0	3	0	20
All Subcategories	234	217	209	997	48	26	5	3	32	6	1777

[1/] EPA Regions represent the following states:
- I Conn., N.H., Maine, Mass., R.I., Vermont
- II Del., N.J., N.Y., Puerto Rico, Virgin Islands
- III MD, PA, VA, W. VA
- IV Ala., Fla, GA, Miss., N.C., S.C., Tenn.
- V Ill., Ind., Mich., Minn., Ohio, Wisc.
- VI Ark., La., N.M., Okla., Texas
- VII Iowa, KS, MO, Neb.
- VIII Colo., Mont., N.D., S.D., Utah, Wyoming
- IX Ariz., Calif., Guam, Hawaii, Nev.
- X Alaska, Idaho, Oregon, Washington

Source: Sverdrup & Parcel and Associates, Inc.

Table III-16. Broad woven looms in place, United States

Year	Conventional	Shuttleless	Total	Output (Million linear yds)
1950	650,000	NA	650,000	NA
1957	613,000	NA	613,000	12,114
1959	499,000	NA	499,000	12,412
1961	459,000	NA	459,000	11,863
1963	464,000	NA	464,000	12,104
1965	495,000	NA	495,000	13,430
1967	415,000	NA	415,000	12,785
1968	386,000	NA	386,000	12,923
1969	377,000	9,000	386,000	12,591
1970	349,000	11,000	360,000	11,454
1971	329,000	13,000	342,000	11,147
1972	310,000	20,000	330,000	11,292
1974	280,000	30,000	310,000	10,721

Sources: American Textile Reporter, Textile World, GATT, U. S. Department of Commerce

By 1969, improvements in the design of shuttleless looms made them more attractive to the industry. Accordingly, shuttleless looms began to replace conventional looms either in existing mills or were used in lieu of conventional looms in new mills. Although the initial cost for shuttleless looms was considerably higher (up to four times) than conventional looms, their speed and efficiency made their purchase attractive. One additional factor contributing to the attractiveness of the shuttleless looms is their ability to operate at reduced noise levels. This is presently a significant factor as the industry is being required to reduce noise levels in weaving mills.

b. Knitting

In the knitting group, the major advances in technology have been associated with women's hosiery and double knit fabrics. Technological advances in this group have included developments in man-made fibers and the evolution of new machinery which was necessary to handle the man-made fibers.

Following World War II, nylon almost totally replaced silk and rayon in the production of women's hosiery because of its strength and capability of being drawn in fine deniers. With the dominate use of nylon, narrow guage knitting machines became practical and thus nylon hosiery began to replace full fashion hosiery (silk). These trends are illustrated in Table III-17 which depicts the declining number of full fashion machines and the increasing number of circular knit machines. Table III-17 also depicts the technological advancements in developments of the circular machines which is illustrated by the increasing number of multi-feed machines. These multi-feed machines have all but replaced the less efficient single feed machines. These advances in machinery coupled with developments in stretch yarns, have resulted in the introduction of tubular hosiery and panty hose which have completely dominated the hosiery market.

The development of textured polyester fibers during the late 1950's enabled the creation of the double-knit market in the early 1960's. As shown in Table III-18, the number of double-knit machines rapidly increased from 1963 to 1973. Also, as the double-knit markets grew, the industry replaced older, smaller machines with larger, more efficient machines (larger number of feeds). In 1974, the total number of machines declined because of a peak in the demand for double-knit fabrics and the trend for the larger multi-feed machines.

c. Dyeing and Finishing

With the developments in man-made fibers and changes in the fashion industry, significant changes in technology have occurred in the dyeing and finishing segment. With the increased requirements for versatility in dyeing and finishing operations, the segment has replaced older relatively simple

Table III-17. Hosiery knitting machines, 1950-1972

Year	Number of full fashioned machines	Circular machine			
		1 feed	2 feed	4 feed	6, 8 feed
1950	2,575	-	-	-	-
1953	2,830	-	-	-	-
1956	2,190	-	-	-	-
1960	1,310	35,394	5,092	-	-
1963	520	43,037	28,618	5,270	-
1966	140	37,932	42,516	49,915	6,690
1969	20	30,642	53,488	54,300	76,940
1972	5	11,588	55,444	63,855	84,140

Source: Dept. of Treasury, The Textile Industry.

Table III-18. Double knit machines in place, 1963-1964

Year	Number of Machines	No. of feeds (% of Total) 24	36	48 and over
1963	1,800	65	34	1
1966	3,400	58	38	4
1970	10,000	50	35	18
1972	22,000	25	45	30
1973	24,000	20	45	35
1974	23,000	18	43	37

Source: Dept. of Treasury, The Textile Industry.

equipment with modern sohpisticated equipment. Table III-19 illustrates this trend as the older style roller printing machines have been replaced by the newer, more versatile, more efficient machines. With respect to changes in the level of technology associated with dyeing operations, Table III-20 illustrates the decrease in the more traditional methods and the increase of the newer, higher temperature dyeing methods.

d. Yarn

Two significant advances in technology associated with this segment are the development of texturized yarn and the automation of open-end spinning systems. The developments of texturized yarns were necessitated by the increased utilization of man-made fiber yarns. Since the early 1960's, throwsters have crimped and stretched man-made fibers to produce yarn similar to qualities of natural fiber yarns. With the increased utilization of man-made yarns, there was a need for the development of faster, more efficient machinery capable of creating this false twist texturing characteristic. This need was met by the development of extremely fast spindles. Table III-21 illustrates the development and implementation of these faster spindles. As shown, in 1956 there were 20,000 spindles in place operating at speeds of 40,000 RPM. By 1973, these had all been replaced with machines operating at considerably higher speeds (over half a million spindles operating at 400,000 RPM alone).

The second technological advance for the yarn group was the automation of open-end spinning. This type of spinning, which handles only selected yarn counts, is capable of producing two to five times more yarn per pound per machine than conventional ring spinning.

e. Carpet Milling

The major technological advances in carpet milling have involved tufting. Tufting, which produces carpets at a speed of about six times faster then weaving, was first introduced into the industry in the early 1950's. However, tufting did not gain a dominant share of the market until 1958, when bulked continuous filament nylon was developed for commercial use. Table III-22 shows both how tufting has virtually taken over the carpet market and how the use of face yarns has shifted to nylon and other man-made fibers.

f. Miscellaneous Textile Products (Nonwoven fabrics)

In the 1960's, production of nonwoven fabrics was primarily limited to interlinings and disposable products such as towels and diapers. Since then, these type fabrics have made significant inroads into other markets. Technological advances are numerous and, as the demand for such products continues to increase, additional advances are expected.

Table III-19. Printing machines in place, U. S.*
for selected years

	1963	1965	1973
Roller Printing Machines	460	450	394
Screen Printing Machines			
Flat Bed, Screen	310	300	211
Flat Bed, Rotary Screen	-	20	136
Transfer Printing Machines	-	-	77
Stripe Printing Machines	-	-	16

*Does not include carpet equipment.

Source: Dept. of Treasury, The Textile Industry.

Table III-20. Piece goods dyeing machines in place, U.S.*
(units)

Year	Jet Dyeing Machs.	Pressure Dyeing Machs.	Atmo-spheric Dyeing Machs.	Jig Dyeing Machs.	Padder Dyeing Machs.	Con-tinuous Dyeing Ranges
1960						
1963	6	34	5,000	3,800	650	
1964	7	56	4,980	3,680	648	
1965	12	65	4,902	3,510	646	200(30)**
1966	33	98	4,880	3,480	644	
1967	67	160	4,790	3,460	642	
1968	117	230	4,750	4,208	640	
1969	201	400	4,602	2,804	638	
1970	374	650	4,510	2,440	636	
1971	599	750	4,350	2,208	634	
1972	758	810	4,150	2,110	632	
1973	858	810	4,048	1,957	630	295(132)**

*Non-carpet machines.
**(Thermosol-pad steam ranges).
Source: Dept. of Treasury, The Textile Industry.

Table III-21. Number equivalent false twist spindles in place by RPM, U.S.

Mid Year	40,000 RPM	120,000 RPM	240,000 RPM	345,000 RPM	400,000 (Single & Double Heater)
1956	20,000				
1957	25,000				
1958	28,000	2,000			
1959	11,000	25,000			
1960	11,000	27,000			
1961	11,000	31,000			
1962	11,000	36,000			
1963	11,000	40,000			
1964	11,000	42,000	10,600		
1965	11,000	52,000	32,000		
1966	9,000	53,000	52,000		
1967	8,000	53,000	60,000	13,000	
1968	6,000	53,000	66,000	32,000	
1969	4,000	53,000	66,000	102,000	
1970	-0-	50,000	66,000	114,000	70,000
1971	-0-	46,000	66,000	124,000	149,000
1972	-0-	40,000	66,000	130,000	309,000
1973	-0-	38,000	66,000	140,000	556,000

Source: Department of Treasury, The Textile Industry.

Table III-22. The relationship between the growth of tufted carpet manufacturing and the use of man-made fibers between 1954 and 1974

Year	Tufted carpets as a percent of total broadloom shipments	Percentage of face yarns used in the manufacture of tufted carpets by type			
				Man-made fibers	
		Cotton	Wool	Rayon & acetate	Nylon & other MMF
1954	32.6%	74.3%	0%	24.7%	0%
1958	58.1	13.0	22.5	45.2	19.3
1967	88.8	3.6	5.5	15.6	74.4
1974	97.5	0.2	0.8	0.4	98.6

Source: Bureau of the Census, U. S. Department of Commerce Census of Manufactures, 1954 thru 1974.

C. Employment Characteristics

The textile industry employs approximately five percent of all manufacturing industry workers. The characteristics of textile employees, with emphasis on the number of workers and the wages for each SIC industry group, are discussed in this section.

1. Industry Employment

Between 1966 and 1974, the employment level of the industry varied between 950,000 and a million except in 1969 and 1973 when it exceeded the one million mark (Table III-23). In 1975 the level dropped to slightly over 900,000 and has remained at about that level subsequently with a low of 897,000 occurring in 1976. Employment in the industry has amounted to just over 40 percent of the combined employment in both textiles and apparel with the percentage increasing from 41 percent in the 1960's to 42 percent in the early 1970's. In 1976 it dropped back to 41 percent.

As shown in Table III-24, over 300,000 workers or a third of all textile workers were employed in the weaving mills (Industry Group 221-224) in 1977. Seventy thousand or 8 percent of all textile workers were employed in dyeing and finishing (Industry Group 226). The combined employment in the two groups amounted to 42 percent of the total industry employment. The knitting mills group, which had twice as many establishments as the weaving mills groups, accounted for only 28 percent of the textile employment with about 260 thousand workers. There were 141 thousand workers employed in the yarn and thread mills group which amounted to about 16 percent of the industry employment. Over 55 thousand workers were employed in the floor covering mills group which was about 6 percent of the textile employment.

When viewing the trends of the individual groups, it is apparent that the number of employees in the weaving and knitting mills experienced a decline from 1967 to 1973 while the number in the other segments generally showed an increase as shown in Table III-25. After 1973 all groups have shown a decline in their total levels although the trends have stabilized in the last two years. The employment level in the weaving group has decreased from 380,000 in 1967 to about 300,000 in 1977. Employment in this group reached a low in 1975 dropping below the 300,000 level. Employment in the knitting mills group increased from 240,000 in 1967 (not shown in the table) to over 275,000 in 1972; later data is not available for the entire group. The knit fabric industries (SIC Industry 2257 and 2258) showed a significant drop of about 20,000 employees from 1972 to 1977. Since then the levels have stabilized at around 75,000 employees. Employment in the dyeing and finishing plants (Industry Group 226) has remained at relatively consistent levels around 72,000 employees. The maximum level was reached in 1973 with over 80,000 workers while a low occurred in 1977 with the level dropping below 70,000. The employment level in the floor covering group increased from 44,000 in 1967 to over 60,000 in 1973. Since 1973 it dropped to 49,000 in 1975 and 1976. In 1977 it climbed back to a level in excess of 55,000. The trend in employment in the yarn and thread mills group was similar to that of floor covering. The level climbed from under 120,000 in 1967 to close to 160,000 in 1973 and then declined to 147,000 in 1977.

Table III-23. Total employment in all manufacturing, textile, and apparel (in thousands)

Period	All Manufacturing Industries	Textiles and Apparel	Textile Industry 1/	Textile Mills as a Percent of Textiles and Apparel
				(%)
1965	18,062	2,271	925.6	41
1966	19,214	2,365	963.5	41
1967	19,477	2,357	956.7	41
1968	19,781	2,400	993.9	41
1969	20,168	2,412	1,002.5	42
1970	19,351	2,341	976.1	42
1971	18,406	2,304	958.5	42
1972	19,089	2,369	994.2	42
1973	20,069	2,432	1,026.4	42
1974	20,480	2,336	988.2	42
1975	18,347	2,137	901.4	42
1976	18,958	2,199	897.0	41
1977	19,563	2,200	900.2	41

1/ Total employment in the textile industry represents 5 percent of the employment in all manufacturing industries during the period 1965-1976.

SOURCE: Bureau of Labor Statistics

Table III-24. Number of employees and production workers--
Textile Industry, 1977

Industry Groups	SIC	All employees		Production workers	Production workers as a percent of all employees
		Number	Percent of total		
		(1,000)	(%)	(1,000)	(%)
Weaving Mills	221-224	302.3	34	271.2	90
Knitting Mills	225 1/	259.4	28	226.9	87
Dyeing and Finishing	226	72.4	8	60.1	83
Floor Covering Mills	227	55.6	6	44.0	79
Yarn and Thread Mills	228	140.8	16	132.9	94
Miscellaneous Textile Goods	229 1/	71.5	8	58.3	82
TOTAL 1/		900.2	100.0	793.4	88

1/ Figures are estimates; 1977 data are incomplete.

Source: Census of Manufactures

Table III-25. Number of employees--textile industry, 1967-1977
(in thousands)

Industry Groups	SIC	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Weaving mills	221-224	379.4	378.4	367.1	347.1	325.6	317.5	325.6	319.9	292.0	306.5	302.3
Knitting Mills[1/]	225	204.4	217.7	223.0	204.4	192.4	186.4	NA	NA	NA	NA	NA
Knit Fabric Mills[2/]		NA	NA	NA	NA	NA	90.1	93.1	86.0	75.7	75.2	73.4
Dyeing and Finishing	226	73.7	73.8	74.5	72.5	73.5	79.7	80.5	74.6	68.0	71.9	72.4
Floor Covering Mills	227	43.6	49.5	55.0	54.7	53.0	59.9	60.7	57.0	48.6	49.2	55.6
Yarn and Thread Mills	228	119.1	125.8	130.1	128.8	133.4	147.8	157.2	150.7	131.3	145.3	147.1
Miscellaneous Textile Goods	229	72.5	NA	NA	NA	NA	71.5	NA	NA	NA	NA	NA

1/ Excludes knit fabric mills (Industries 2257 and 2258)
2/ Industries 2257 and 2258.

Source: Census of Manufactures, 1972 and 1977.

While employment trends among the groups generally followed similar patterns (i.e., increasing to 1973 and then decreasing), trends within the groups among the SIC industries often varied appreciably (Note: data within groups are not shown in the tables). In the weaving mills group, the cotton mills (SIC 2211) had an 80,000 employee reduction while the man-made fiber mills (SIC 2221) experienced a 40,000 increase during the period 1967-1972. In actuality, this represented a shifting of employment figures between the industries to accommodate the reclassification of plants to reflect the increasing trend towards man-made fiber products. The overall reduction in the employment level among the broad woven fabric mills (both SIC 2211 and SIC 2221) was about 40,000. The employment in the woolen fabric mills was cut in half during the period dropping from over 40,000 in 1967 to under 20,000 in 1972. Since 1977, employment level in the cotton mills has remained just short of 120,000 while that of the man-made fiber mills has fluctuated between 150,000 and 160,000.

As previously discussed, the overall upward trend in the knitting mills group reflected a significant increase in employment. However, this 50,000 worker increase was experienced in the knit fabric mills (warp and circular) industries only, with a jump from 36,000 in 1967 to 90,000 in 1972. All of the other knit groups (knit apparel-hosiery, outerwear, and underwear) declined, losing 20,000 employees. Since 1972 employment in the fabric mills has declined from 90,000 to just over 70,000.

In the dyeing and finishing group, employment in plants finishing cotton fabrics lost 10,000 employees while plants finishing man-made fabric experienced a 10,000 increase July 1967-1972. As pointed out in the case of the weaving mills, the difference, in actuality, represents a shifting of employee figures associated with reclassification of mills because of the dramatic increase in the production of man-made fabrics. Since 1972, both type plants have seen reductions of around 2,000 employees in each of the two SIC industries.

In the yarn and thread mills group, all industries experienced increases with the exception of wool yarn mills. Employment within this industry dropped from over 11,000 in 1967 to 8,500 in 1972. Employment in those mills spinning cotton and man-made yarns increased close to 40 percent, rising from 93,000 in 1967 to 127,000 in 1972. Since 1972, this employment has dropped off.

In the floor covering mills group, employment in the tufting mills has shown a dramatic rise increasing from just over 30,000 in 1967 to over 50,000 in 1972. The employment level in woven carpet mills experienced a gradual decline of about 2,000 workers during the same period and had dropped another 2,000 by 1977. In 1977, the level in the tufted mills was 50,000 about the same as 1972.

In the miscellaneous textile goods group, slight decreases occurred in most of the industries during 1967-1972. However, in the nonwoven fabrics industry, the employment level doubled during the period increasing from about 5,000 in 1967 to over 10,000 in 1972. Since 1972, it has remained at about the same level.

As measured by the proportion of production workers to total employment within the industry, the textile industry is the most labor intensive group among the non-durable goods, as shown in the 1977 data below. The percentage of production workers in the textile industry exceeded 87 percent as opposed to about 72 percent for the composite of non-durable goods. Apparel was the next most intensive industry with close to 86 percent production workers.

Industry	Percentage of Production Workers (1977)
Total Non-durable	72.3%
Food Processing	67.6
Tobacco	83.8
Textile	87.1
Apparel	85.7
Paper	75.1
Printing	57.4
Chemical	57.4
Petroleum	65.7
Rubber	78.3
Leather Tanning	85.1

Source: BLS Handbook of Labor Statistics.

Within the aggregate textile industry, the most labor intensive groups are in the weaving mills and yarn and thread mills group with percentages of production workers at 90 and 94 percent, respectively, as was shown in Table III-24. The least intensive are the floor covering mills and the miscellaneous textile goods industries, with 79 and 82 percent, respectively.

2. Industry Wage Levels

The average weekly hours of production workers in the textile industry are similar to the hours for all manufacturing industries, as shown in Table III-26. However, the average hourly earnings have been significantly lower. In 1977, textile employees averaged $3.97 per hour, which was $1.10 less than the average earnings in all nondurable industries. Between 1962 and 1977, the average earnings of textile industry workers was about 20 percent below the average wages for all nondurable industry employees. The least wage difference between textile workers and other manufacturing industry employees occurred in 1968. The relationship of the two rates are about the same now as it was in the early 1960's (78 percent).

Industry wage surveys have recently been conducted by the Bureau of Labor Statistics in the textile industry covering selected SIC industries. The following discussions are based on these surveys with each survey's results covered separately.

Table III-26, Average hourly earnings and weekly hours -- textile industry and all manufacturing

Period	Average weekly hours		Average hourly earnings		Wages of textile mills as a percent of total nondurable industries
	All manufacturing	Textile industry	Total nondurable industries	Textile industry	
	(hours)	(hours)	(dollars)	(dollars)	(percent)
1962	40.4	40.6	2.17	1.68	77
1963	40.5	40.6	2.22	1.71	78
1964	40.7	41.0	2.29	1.79	78
1965	40.2	41.8	2.36	1.87	79
1966	41.3	41.9	2.45	1.96	80
1967	40.6	40.9	2.57	2.06	80
1968	40.7	41.2	2.74	2.21	81
1969	40.6	40.8	2.91	2.34	80
1970	39.8	39.9	3.08	2.45	80
1971	39.9	40.6	3.26	2.57	79
1972	40.6	41.3	3.47	2.74	79
1973	40.7	40.9	3.68	2.95	80
1974	40.0	39.4	3.99	3.19	80
1975	39.4	39.1	4.35	3.39	78
1976	40.1	40.1	4.68	3.67	78
1977	40.3	40.4	5.07	3.97	78

Source: BLS Handbook of Labor Statistics

Survey Category	SIC	Date	BLS Publication
Textiles (Yarn and Weaving)	221, 222, 223, 228	1975	Bulletin 1948
Textile Dyeing and Finishing	226	1976	Bulletin 1967
Hoisery	2251, 2252	1976	Bulletin 1987

a. Textiles (May 1975) Survey

Straight-time average earnings were $3.08 per hour for yarn and weaving mills as reported in the May 1975 Survey. (Note: These earnings excluded overtime and consequently are not comparable with the earnings listed in Table III-26). As shown in Table III-27, the highest wages were paid in the Middle Atlantic states with an average hourly rate of $3.33. In the Southeast, where over 90 percent of the workers are located, wages averaged $3.07.

Wages were highest in the weaving mills, averaging $3.25, and lowest in the yarn mills, at $2.90 an hour. The difference was due in part to the higher skilled jobs in the weaving mills. Wages in mills employing 500 or more averaged $3.11 per hour which was about 3 percent higher than mills employing between 100 and 499; the survey excluded mills employing less than 100.

About one-sixth of the employees were in mills operating under labor-management contracts. The greatest union strength was in New England with about one-half of the employees covered by contract. The least concentration was in the South with about one-eighth of the work force under contract.

b. Textile Dyeing and Finishing (June 1976) Survey

The average wage of production workers in textile dyeing and finishing was $3.82 an hour according to this survey. The lowest rate was in the Southeast where two-thirds of the workers were employed; there the earnings were $3.66 an hour. The rate in New England was $3.97 and in the Middle Atlantic $4.45. One reason for the low average in the Southeast was the relatively high employment of women. Women make up over 30 percent of the workers in this industry in the Southeast with their wages amounting to about ten percent less than men. Another contributing factor was the effect of unionization. Workers covered by union contracts had wages close to 15 percent higher, nationwide, than those that were not covered by union contracts. In the Southeast less than 20 percent of the workers in this industry were covered by contracts. However, in the other regions as many as 90 percent of the work force was unionized.

c. Hosiery (July 1976) Survey

Production workers in all hosiery mills averaged hourly earnings of $3.02 in July 1976. The rate was lowest in the Southeast where 90 percent of the workers are employed; there the rate was $3.01 an hour. The rate was slightly higher, $3.13, in the Middle Atlantic.

Table III-27. Production workers and average straight-time earnings - yarn and weaving mills

Location	Total		Yarn Mills 2/		Weaving Mills 2/		Integrated 2/	
	Workers	Earnings ($)	Workers	Earnings ($)	Workers	Earnings ($)	Workers	Earnings ($)
New England	7,201	3.17	3,150	3.14	---	---	2,887	3.20
Maine and New Hampshire	2,150	3.03						
Southern New England	5,051	3.24						
Middle Atlantic	6,786	3.33	2,805	2.95	3,981	3.60	---	---
Southeast	267,967	3.07	79,876	2.89	23,232	3.19	164,839	3.14
Georgia	41,660	3.08						
North Carolina	102,959	3.01						
South Carolina	79,389	3.12						
Virginia	13,300	3.16						
Southwest	4,508	3.02	---	---	---	---	---	---
United States	288,462	3.08	88,079	2.90	28,607	3.25	171,776	3.14

1/ Include SIC Industries 2211, 2221, 2281, 2282, 2284
2/ Published data are not available for individual states by type mills.

Source: Bureau of Labor Statistics

Because the surveys discussed above were conducted at different times, comparison between the wages in the various groups is not feasible. However, the 1977 Census provides sufficient data to illustrate the wage differentials between the various type mills. The average hourly earnings of production workers for 1977 are listed in Table III-28.

The highest rates were generally earned in the less labor intensive industries in the miscellaneous group. Among the other groups, the highest rates were found in the finishing plants with an average rate of $4.47 and $4.61 in the cotton and man-made fiber finishing plants respectively. Other high rates were found in the man-made fiber weaving mills ($4.24), and the woven carpet and rugs ($4.27) industries. The lowest rates occurred in the labor intensive hosiery industry with $3.41 an hour and the knitting mills N.E.C. industry with $3.18 an hour.

Table III-28. Average hourly earnings of production workers -- textile industry--1977

SIC	Industry	Average Hourly Earnings
	Weaving Mills	
2211	Weaving mills, cotton	4.08
2221	Weaving mills, man made fiber	4.24
2231	Weaving and finishing mills, wool	4.05
2241	Narrow fabric mills	3.66
	Knitting Mills	
2251	Womens, hosiery	(NA)
2252	Hosiery, n.e.c.	3.41
2253	Knit outerwear mills	(NA)
2254	Knit underwear mills	(NA)
2257	Circular knit fabric mills	4.17
2258	Warp knit fabric mills	4.15
2259	Knitting mills, n.e.c.	3.18
	Dyeing and finishing	
2261	Finishing plants, cotton	4.47
2262	Finishing plants, manmade fiber	4.61
2269	Finishing plants, n.e.c.	4.07
	Floor covering mills	
2271	Woven carpets and rugs	4.27
2272	Tufted carpets and rugs	4.15
2279	Carpets and rugs, n.e.c.	4.07
	Yarn and thread mills	
2281	Yarn mills, except wool	3.86
2282	Throwing and winding mills	4.15
2283	Wool yarn mills	3.74
2284	Thread mills	3.85
	Miscellaneous Textile Goods	
2291	Felt goods	4.85
2292	Lace goods	3.91
2293	Paddings and upholstery filling	4.41
2294	Processed textile waste	3.68
2298	Coated fabrics	5.63
2296	Tire cord and fabric	4.90
2297	Nonwoven fabrics	4.74
2298	Cordage and twine	3.78
2299	Textile goods, n.e.c.	(NA)

Source: Census of Manufactures, 1977.

IV. INDUSTRY PROFILE

The production, marketing and financial situations of the textile industry have remained fairly stable, although individual establishments have experienced changes due to economic fluctuations, product popularity, technological improvements, and increased textile imports. Increasing incorporation and efficiency through integration have typically widened the sales and profit gap between small and large firms.

A. Production Profile

Total U.S. mill fiber consumption, an indicator of production, has increased during the last 15 years, although the predominant types of fibers have changed from wool and cotton to man-made. While production of broad woven fabrics has declined, its loss has been offset by significant increases in the production of knit goods and carpet and rugs. Capacity has increased at about the same rate as production, a result of increased efficiency in looms and a significant increase in the number of double knit machines put into operation.

Production, capacity and utilization closely parallel the general economy. In order to profit from rises and protect against recessions, the textile industry has increasingly consolidated, integrated and diversified within plants and among operations within multi-unit firms.

1. Production

Domestic production of the textile industry, represented by total fiber consumption, has increased at an average annual rate of about 3.5 percent during the last 15 years (Table IV-1). However, in the past five years, it has stabilized at a rate of less than two percent. While total production has been relatively stable, there has been a dramatic change in the type of fiber consumed. Less than one-third of the wool is now being consumed as compared to the early 1960's, declining from over 450 million pounds in 1965 to about 140 million in 1978. Cotton consumption has declined also, although not as dramatically as wool, from over 4 billion pounds in 1965 to 3.0 billion in 1978. Consumption of man-made fiber has nearly tripled during the same period, increasing from about 3.6 billion pounds to over 9 billion.

As measured by the Federal Reserve Board industrial production index (Table IV-2), production in the textile industry has increased at an annual rate of about 2.7 percent as compared to a 3 percent increase for total industrial production. The most significant increase occurred between 1971

Table IV-1. Fiber consumption--textile industry
(million pounds and percent)

Year	Man-made fiber & silk		Cotton		Wool		Total	
	(million pounds)	(%)	(million pounds)	(%)	(million pounds)	(%)	(million pounds)	(%)
1965	3,620.4	42.5	4,452.6	52.2	457.0	5.3	8,530.0	100
1966	3,994.7	44.2	4,621.0	51.1	427.9	4.7	9,043.6	100
1967	4,248.1	47.0	4,414.2	48.9	366.6	4.1	9,028.9	100
1968	5,309.5	54.2	4,104.1	41.9	378.4	3.9	9,792.0	100
1969	5,555.4	56.2	3,972.6	40.2	354.9	3.6	9,882.9	100
1970	5,502.7	57.6	3,773.6	39.5	273.3	2.9	9,549.6	100
1971	6,530.9	60.9	3,965.1	37.0	219.3	2.1	10,715.3	100
1972	7,567.8	64.9	3,849.8	33.0	246.9	2.1	11,664.5	100
1973	8,667.0	69.3	3,643.3	29.2	182.1	1.5	12,492.4	100
1974	7,700.6	69.2	3,306.1	29.7	116.5	1.1	11,123.2	100
1975	7,417.5	69.9	3,068.7	28.0	132.0	1.2	10,618.2	100
1976	8,055.3	69.5	3,389.0	29.2	145.9	1.3	11,590.2	100
1977	8,890.5	72.9	3,169.8	26.0	133.9	1.1	12,194.2	100
1978	9,237.2	74.4	3,040.4	24.5	141.6	1.1	12,419.2	100

Source: Textile Organon, March 1979.

Table IV-2. Index of industrial production - textile industry (1967 = 100)

Year	Total industrial production	Textile mill products	Cotton fabrics	Man-made fabrics	Wool fabrics	Knit goods	Fabric finishing	Carpeting	Yarn and misc.	Apparel products
1968	106.3	107.9	94.1	127.3	97.1	109.9	NA	119.3	NA	NA
1969	111.1	112.6	90.1	137.0	81.7	123.2	NA	130.0	NA	NA
1970	107.8	111.8	87.5	125.6	66.3	128.6	105.3	139.5	116.0	101.4
1971	109.6	116.5	90.8	118.9	47.6	135.3	110.0	149.1	130.3	104.7
1972	119.7	132.7	88.7	138.9	43.3	173.6	123.6	180.5	140.2	109.4
1973	129.8	142.9	83.5	167.8	56.0	194.0	135.4	194.3	145.4	117.3
1974	129.3	132.8	76.6	158.4	44.8	183.5	130.5	179.9	129.1	114.3
1975	117.8	122.3	70.7	141.0	44.8	175.0	119.5	157.7	116.8	107.6
1976	129.8	136.4	80.8	170.0	54.7	189.7	128.9	166.4	130.4	126.1
1977	137.1	137.1	76.5	163.2	49.9	194.3	NA	180.5	NA	12.40
1978	145.2	140.0	73.7	165.1	59.1	190.0	NA	168.5	NA	NA

Source: U.S. Federal Reserve Board

and 1972 for the textile industry when a 14 percent increase occurred. The highest level of production occurred during 1973 with an index of 142.9 (1967=100). Between 1973 and 1975 the production index declined by nearly 14 percent with the index dropping to 122.3 in 1975, reflecting the recession of that year. For 1976, the index increased to 136.4, and remained at about that level for the past two years.

As also shown in Table IV-2, the greatest increases in production among the industry group have occurred in the manufacture of knit goods where output has nearly doubled since 1968. Relatively high increases have also occurred both in the manufacture of man-made fabrics and carpeting, with the production of man-made fabrics increasing 70 percent since 1968 and carpeting increasing just slightly less with a 66.4 percent increase. Significant declines in production have occurred in the manufacture of cotton fabrics and wool fabrics. The production of cotton fabrics has decreased 20 percent since 1968 while the production of wool fabrics has decreased by about 50 percent.

Total production of broad woven goods measured in linear yards of material has been decreasing at an annual rate of 1.5 percent since 1967 from close to 13 billion yards in 1967, to about 11 billion in 1976 (Table IV-3). The production of woven cotton goods in this segment decreased from about 8 billion yards in 1967 to 4.0 billion in 1978. Man-made fiber woven fabrics increased from about 4 billion in 1967 to over 6 billion yards in 1978. Woolen and worsted woven goods decreased from about 240 million yards to less than 100 million during the same 1967 to 1978 period.

Because of a change in the reporting and classification systems by the Department of Commerce, it is not possible to construct a meaningful profile of knit fabric production between the 1960's and mid-70's. Prior to the fourth quarter 1973, data was collected on shipments which involved knit cloth physically shipped, including interplant transfers. Current data includes not only shipments but also "captive" production which represents the knit fabric produced in a plant that will be used for the manufacture of knit goods and apparel in the same plant. For the period since 1973, the knitting mills segment's production data are depicted in Table IV-4. The impact of the change is apparent in the comparison of 1973 shipment data with 1973 production data which shows that the production is approximately twice as great as the shipments. Between 1969 and 1973, total shipments increased from 800 million pounds to about 1.2 billion pounds. Since 1973, as reflected in production data, the output has declined slightly, decreasing from over 2 billion pounds in 1973 to 1.7 billion in 1978.

The production of carpets and rugs has nearly doubled since 1967, increasing from about 500 million square yards to over 1 billion in 1978 (Table IV-5). The manufacture of tufted carpets has more than doubled, increasing from about 400 million square yards in 1967 to over 1 billion in 1978. Woven carpets, which represent a minor portion of the total carpet production, incurred a significant decline with a 50 percent reduction between 1967

Table IV-3. Broad woven goods and fabric production (in millions of linear yards) 1/

Goods and fabrics	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
Cotton goods	8,278	7,477	6,965	6,246	6,148	5,614	5,086	4,714	4,095	4,718	4,356	3,986
Man-made fiber fabrics	4,269	5,204	5,395	5,028	4,886	5,551	6,109	5,923	5,278	6,087	6,224	6,603
Woolen and worsted goods	239	243	222	179	113	103	106	81	79	97	102	117
Total broad woven goods	12,788	12,923	12,360	11,453	11,147	11,248	11,301	10,718	9,452	10,902	10,682	10,707

1/ Data on Broadwoven Fabrics Finished available in Bureau of Census, Current Industrial Reports, MA-225.

Source: Standard & Poor's Industry Surveys-Textiles, 1979.

Table IV-4. Knit fabric shipments and production (in millions of pounds)

Type fabric	Shipments					Production					
	1969	1970	1971	1972	1973	1973	1974	1975	1976	1977	1978
Warp	294.0	322.8	364.8	340.0	345.5	427.0	425.2	427.7	387.3	399.6	394.7
Circular	510.9	527.7	624.1	793.9	819.4	--	--	--	--	--	--
Weft	--	--	--	--	--	1,503.0	1,465.2	1,419.9	1,339.6	1,315.8	1,255.7
TOTAL	804.9	850.5	988.8	1,134.0	1,165.0	2,070.8	2,011.3	1,960.4	1,828.2	1,715.4	1,650.4 1/

1/ Excludes knit garment length.

Source: Bureau of the Census, Current Industrial Reports, MQ-22K.

Table IV-5. Rugs and carpet production (million square yards).

Type of carpet	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
Woven	35.7	35.8	35.7	29.7	26.1	26.7	24.6	23.2	19.0	18.1	15.7	18.0
Tufted	432.2	511.0	562.7	604.0	680.9	856.9	994.3	866.0	783.7	890.3	977.1	1,027.9
Other	28.9	39.3	44.8	46.8	48.0	59.3	56.4	49.9	31.4	31.0	31.7	30.0
Total	496.8	586.2	642.6	680.5	755.2	943.0	1,025.4	939.1	834.0	939.3	1,024.6	1,075.9

Source: Bureau of the Census, Current Industrial Reports, MQ-22Q and 1978. Production of other carpets which include mats and other specialty items reflected only a slight increase during the same period. These latter type carpets and rugs constituted only a very minor portion of the carpet industry production representing approximately 2.0 percent of the 1978 total carpet and rug production.

2. Capacity and Utilization

Since 1967, total capacity in the textile industry has increased at an average annual rate of 2.7 percent (Table IV-6). Capacity is broadly defined as the greatest level of output an industrial plant can achieve within a normal work pattern. It reflects both the number of machines in place and modernization in the industry. The increase has primarily involved specific growth products, such as denim and certain knit fabrics. Capacity peaked at an index of 158.1 (58 percent above 1967 production) in 1974. This reflected an increasing efficiency in looms weaving man-made fabrics and a dramatic increase in double knit machines put into operation between 1967-1973. The abrupt drop in the capacity level between 1974 and 1975 was due to the closing of over 200 knitting mills as a result of the 1974-1975 recession. In the future, modernization in the industry, with the use of more high-speed equipment, is expected to maintain capacity at adequate levels to meet demand; however, no significant increases are anticipated in the near future similar to those which occurred prior to 1974.

During the 1967-1973 period, the average rate of capacity utilization, as shown in Table IV-6, for the textile industry was 87.0 percent, just slightly less than 87.6 percent recorded for the total nondurable manufacturing sector. Peak utilization rates for the industry occurred during the years of 1968 and 1973 reflecting the business cycles of those years. Troughs occurred during 1970 and 1975 with the business recessions. The low rate of 73.8 percent for 1975 was the lowest rate for the entire 10 year period. Quarterly data (not shown in the table) published by the Federal Reserve Board show a difference in the peak and trough utilization rate of all nondurable manufacturing to be 23.8 percentage points for the period 1967-1976 with rates varying from 93.9 percent to 69.9 percent. The variance in the textile industry was somewhat higher with the extreme rates being at 93.9 percent and 60.1 percent for a total variance of over 33 percentage points.

Utilization rates also vary considerably between the differently sized companies. Based on data in the Federal Reserve Bulletin covering the period 1965-1973, large companies in nondurable goods manufacturing (with assets $100 million and over) averaged utilization rates of about 9 percentage points higher than the small companies with assets under $10 million. Although no specific data are available for the textile industry, it is expected that the differences in utilization rates would be about the same.

Table IV-6. Output, capacity, and utilization -- textile industry

Year	Output (1967=100)	Capacity (percent of 1967 output)	Utilization rate (percent)	Excess capacity (percent)
1967	100.0	109.9	91.0	9.0
1968	107.9	116.9	92.3	7.7
1969	112.6	123.5	91.2	8.8
1970	111.8	130.0	86.0	14.0
1971	116.5	134.7	86.5	13.5
1972	132.7	147.6	89.9	10.1
1973	142.9	153.3	93.2	6.8
1974	132.8	158.1	84.0	16.0
1975	104.3	141.3	73.8	26.2
1976	114.5	139.4	82.1	17.9
1977	113.3	142.2	79.7	20.3
1978	117.3	144.4	81.2	18.8

Source: Federal Reserve Bulletin

Utilization rates for the various SIC industry groups within the industry for the fourth quarters of 1974 and 1975 are shown in Table IV-7. The highest rates shown for the two quarters are for the cotton weaving mills, with an 82 percent utilization rate recorded in 1974, increasing to 89 percent in 1975. The lowest rates occurred in the narrow fabric mills segment with a 61 percent in 1974 and 67 percent utilization rate a year later. The knitting mills segment maintained the most stable rate with an 80 percent rate in 1974 and 83 percent in 1975.

Loom activity is frequently considered a good measure of productivity in the industry and generally reflects changes in utilization rates. Table IV-8 lists the average hours looms operated for the cotton weaving mills. The greatest activity is shown for the years 1969, 1972 and 1973, corresponding with the high utilization rates recorded for those years. The least activity occurred during the 1975 recession. The operation of spindles is also a good measure of productivity. As shown in Table IV-9 peaks in activity occurred during 1968 and 1973 again corresponding closely to peaks in the utilization rates.

3. Importance of Integrated Facilities

Increasing concentration and greater industrial efficiency in the textile industry has been accompanied by a trend of increasing integration, both within plants and among operations within multi-unit firms. Many large plants combine all of the stages of processing from raw fiber to finished fabric (and apparel) and often include a variety of textile products. The degree of integration is illustrated in the findings of a survey conducted by the Treasury Department (as shown in Table IV-10).

Table IV-10 shows a number of plausible configurations of industry activities within plants representing both horizontal and vertical integration. For each of the major activities' categories, possibilities in vertical integration include:

- Yarn preparation -- greige milling + dyeing and finishing
- Weaving -- yarn preparation + greige milling + dyeing and finishing + cut and sew
- Knitting -- yarn preparation + greige milling + dyeing and finishing + cut and sew
- Carpet milling -- yarn preparation + greige milling + dyeing and finishing

In horizontal integration, feasible configurations include milling operations in weaving, knitting and carpet milling.

The highest level of integration is apparent in carpet and rug manufacturing. In those plants fabricating carpets, over 50 percent were involved in dyeing and finishing and about 20 percent were producing yarn. The

Table IV-7. Utilization rates: fourth quarter, 1974-1975

Industry Group	1974	1975
Weaving mills, cotton	82	89
Weaving mills, synthetic	78	89
Weaving and finishing mills, wool	74	78
Narrow fabric mills	61	67
Knitting mills	80	83
Textile finishing, except wool	74	84
Floor covering mills	62	71
Yarn and thread mills	69	84
Miscellaneous textile goods	68	72

Source: U.S. Department of Commerce, Survey of Plant Capacity, 1975 Supplement, MQ-C1(75)-2

Table IV-8. Loom hours operated - cotton broad woven goods (average hours per loom per week)

Period	Monthly average
1967	125.7
1968	124.4
1969	126.5
1970	125.4
1971	126.6
1972	128.5
1973	128.0
1974	120.9
1975	111.3
1976	125.0
1977	123.3

Source: American Textile Manufacturers Institute, Textile Highlights

Table IV-9. Cotton system spindle activity

Period	Cotton system spindles: Spindles (in thousands): In place	Active	Hours operated per active spindles	Percent active: On 100% cotton	On 100% man-made	On other fibers & blends	Spindle hours operated: Total	Weekly average	Index of cotton system activity (132 hour week)
							--(in millions)--		
1967	20,605	20,041	6,341	75.0	--	25.0	126 239	2,430	90.0
1968	20,513	19,996	6,352	67.6	9.3	25.5	128,004	2,466	91.0
1969	20,113	19,562	6,341	64.8	10.5	24.8	125,597	2,178	88.6
1970	19,559	18,599	5,904	62.6	10.7	26.7	113,019	2,178	83.1
1971	19,215	18,424	6,148	62.1	10.5	27.4	113,780	2,189	84.3
1972	19,089	18,301	6,334	59.0	12.1	28.9	115,818	2,225	88.2
1973	18,890	18,036	6,393	55.1	13.4	31.5	116,010	2,234	89.1
1974	18,606	17,255	5,927	52.2	13.7	34.1	106,277	2,082	82.2
1975	18,178	17,138	5,500	49.6	13.0	37.2	93,275	1,763	73.0
1976	17,879	16,747	6,259	45.4	12.9	41.7	105,577	2,033	85.4
1977	17,668	16,649	6,197	41.9	13.9	44.2	99,635	1,994	85.1

Source: American Textile Manufacturers Institute, Textile Hi-Lights.

Table IV-10. The degree of integration of selected categories (SIC Industries) within the same plant (percent of observations where each category was located in the same plant with other selected categories)

Categories Ranked by Level of Integration with Other Categories in the Same Plant SCD	Percent	Cordage	Carpets	Weaving	Dyeing and Finishing	Knitting	Nonwoven	Yarn Prep.	Cut and Sew	Percent of Observations Where Only One Activity is Located in a Plant
	(percent)									
Cordage	100	X	0	46.7	20.0	0	6.6	20.0	6.6	0
Carpets	87.7	0	X	5.3	50.9	5.3	5.3	17.5	3.5	12.3
Weaving	83.6	2.7	1.2	X	16.4	3.5	0.8	54.7	4.3	16.4
Dyeing & Finishing	77.4	1.2	11.9	17.3	X	14.0	2.5	21.8	8.6	22.6
Knitting	75.7	0	2.9	8.7	32.0	X	0	13.6	7.8	24.3
Nonwoven	72.7	4.5	13.6	9.1	27.3	0	X	9.1	4.5	27.3
Yarn Prep	72.1	0.1	3.1	43.3	16.4	4.3	0.1	X	13.6	27.9
Cut & Sew	68.4	1.3	2.5	13.9	26.6	10.1	1.3	12.6	X	31.6

Source: Department of the Treasury, The Textile Industry, 1976.

next highest level of integration occurred in weaving. Over 50 percent of these mills were producing yarn and between 15 and 20 percent were dyeing and finishing. In the knitting mills, about a third of the plants were dyeing and finishing and over 10 percent were spinning yarn. About twice as many of the knitting mills were involved in cut and sew operations as were weaving mills.

Since Table IV-10 focuses on type activities as opposed to type mills, the extent of integration involving the dyeing and finishing plants and the yarn mills is not clearly delineated. However an examination of production data contained in the 1972 Census provides some insight to the integration within these groups. Of the total production of yarn (cotton and man-made) spun in SIC Industry 2281 (yarn mills), about 50 percent was finished in the mills spinning the yarn while the remainder was shipped to plants in the SIC Industry Group 226 for finishing. Although this does not reveal the number of plants involved, it does point out that about half of the yarn spun (by spinning mills) is produced in mills in which greige milling and finishing is being accomplished as integrated processes.

In 1972, 10.1 billion linear yards of broad woven fabric were produced in the weaving mills. Close to 70 percent of this was finished on commission by SIC Industry Group 226. Only about 13 percent was finished in the same establishments in which the fabric was woven. The greatest portion of this fabric was produced in the largest 68 mills representing 10 percent of the total number of mills in the broad woven industry. This 10 percent figure corresponds roughly with the 16.4 percent contained in Table IV-10 revealing the approximate number of weaving mills which perform finishing as a part of their integrated operation.

Since knit fabric finishing can be accomplished without mercerization or desizing, integration of greige milling and finishing is much greater in this segment. However, the Census data do not facilitate an accurate comparison of how much fabric is finished in integrated facilities as opposed to separate facilities. According to the data, over 70 percent of the knitting mills were classified as producing finished fabric. However, the statistics do not reveal how many of these mills were engaged in finishing only. The Department of Commerce's Current Industrial Report (MQ-22K) indicates a total of 1.8 billion pounds of knit fabric was produced in 1976. Of this amount, 1.1 billion pounds, or 61 percent were shipped to other plants for finishing, leaving 39 percent to be finished in the knitting mills. This, again, corresponds roughly with the 31 percent integration shown in Table IV-10.

As shown previously in Table IV-10, over half of the weaving mills were involved in yarn preparation. However, on a production basis, the greatest portion of yarn consumed in the weaving process was produced within the weaving mills. The 1972 Census data show that over 3.6 billion pounds of fiber (raw cotton and staple and tow) were purchased directly by the weaving mills, while only about 600 million pounds of yarn were purchased.

4. Level of Diversification

The textile industry is not generally diversified at the mill level. Most plants specialize in one process; while types of fabric and fiber may differ, the general processes are similar. If the firm manufactures a variety of products, they are often handled in separate plants. Many large textile companies are multi-plant firms and do not depend on one type of fabric to carry the company. The Value Line mentioned one large but specialized company which manufactures mainly bottomweight fabrics, such as denim and canvas. Its narrow product line makes this company especially vulnerable to changes in style. Most of the larger textile companies guard against this risk by handling a diverse number of products. For example, two major companies manufacture furniture while others also produce foods and plastics. Following is a sampling of some large textile firms and their products:

Belding-Heminway	home sewing products, thread, zippers, buttons and engineering plastics
Burlington Industries	hosiery, sheets, pillowcases, drapes, and furniture
Chelsea Industries	narrow fabrics, dairy protein derivatives, shoe products and plastics
Collins & Aikman	woven, knitted and tufted fabric, wallpaper
Ludlow Corporation	floor mats, carpet cushions, furniture, packaging materials, and printing papers for graphic arts industry
Mohasco Corporation	carpets and rugs, one of 5 largest furniture companies in the U.S., and furniture rental
Spring Mills	woven fabrics for apparel, home furnishings and packaged frozen foods

Source: The Value Line

Some of the diversification is a result of company mergers, while other firms add new products. Occasionally these additions are an extension of an established specialty, such as primarily textile home furnishing industries manufacturing furniture or wallpaper. Other companies may manufacture seemingly unrelated items such as fabrics, foods and shoe products. A 1977 report in Textile World stated that diversified textile firms recovered more quickly and strongly from the recession than did non-diversified companies 1/.

1/ "Survey Shows Diversified Firms Lead 1976 Industry Comeback," Textile World, June 1977, 24 and 27.

B. Market Profile

The final market value of all textiles is estimated to be about 10 percent of disposable income. At a disposable income level of $1,309 billion in 1977, the textiles market value would approach $130 billion. Textile industry shipments were just under $40 billion in 1977, which amounted to a third of the final textile market. The major outlets for textile products include apparel, home furnishings, industrial fabrics, and exports (according to Textile Organon). The largest market for the textile industry is apparel fabrics, accounting for about 42 percent of mill output (these fabrics include those sold in home sewing stores). This market can be expected to fluctuate widely over a period of time; however, basic gains can be anticipated with the growing importance of fashion in clothing. The next largest market for mill products is home furnishings which consumes about 32 percent of all fiber processed. Products entering this market include carpet, draperies and upholstery, sheets, and towels. Of these, carpeting is the only area in which growth has occurred during the 1970's. In the other areas, the overall upgrading of product quality has caused a down-turn in sales volume both because of higher prices and an increase in product life. The industrial market ranks third in the amount of fiber utilized accounting for about 23 percent of the total fiber processed. Products showing growth in this market include medical products, belting, filtration fabrics, thread, and fish line. Finally, significant gains have occurred in international markets as a result of product improvement, more aggressive marketing, and devaluation of the dollar. In 1977, the international market accounted for about 4 percent of the fiber produced.

1. Domestic Market Description

In spite of a considerable trend towards integration of manufacturing activities, the textile industry continues to be characterized by a segregation of successive operations generally performed by separate firms. This is reflected by a series of intermediate markets and a separation of wholesale and retail distribution. The structure persists even though integrated firms may transfer goods directly from one operation to another without resource to the markets. The market channels lead through eight levels as listed below.

(a) Raw fiber markets
(b) Processed fiber markets
(c) Yarn markets
(d) Greige goods markets
(e) Finished goods markets
(f) Fabricated product markets
(g) Wholesale markets
(h) Retail markets

These market levels (except wholesale and retail) are identified with products which are closely related and produced from the same equipment or type of mill. Although the markets are clearly identifiable, considerable overlap exists between them. The flow of goods through the various channels and the interrelationships between markets are shown in Exhibit IV-1.

In the raw fiber market, the trading of cotton is characterized by large fluctuations in yield, a large number of sellers, and a certain amount of government control over the marketing process. Only a small amount of raw material is purchased directly by the mills from the growers. Most of the cotton enters the grower's market in which the raw cotton is assembled for ultimate distribution through central markets. In these markets, the cotton is traded between the commission merchants, shipper, factors, and other representatives of the growers (such as co-operatives) on one hand and the purchasers representing the mills, exporters, and other interests on the other hand. These central markets exist throughout the cotton belt; however, New Oreleans is the leader in spot pricing.

The market for man-made fibers is considerably different from that of natural fibers since it is a manufactured rather than an agricultural product. The basic difference in markets is that there are no intermediaries between the producers and mills, as in the case of cotton; therefore, the producers normally sell directly to the mills.

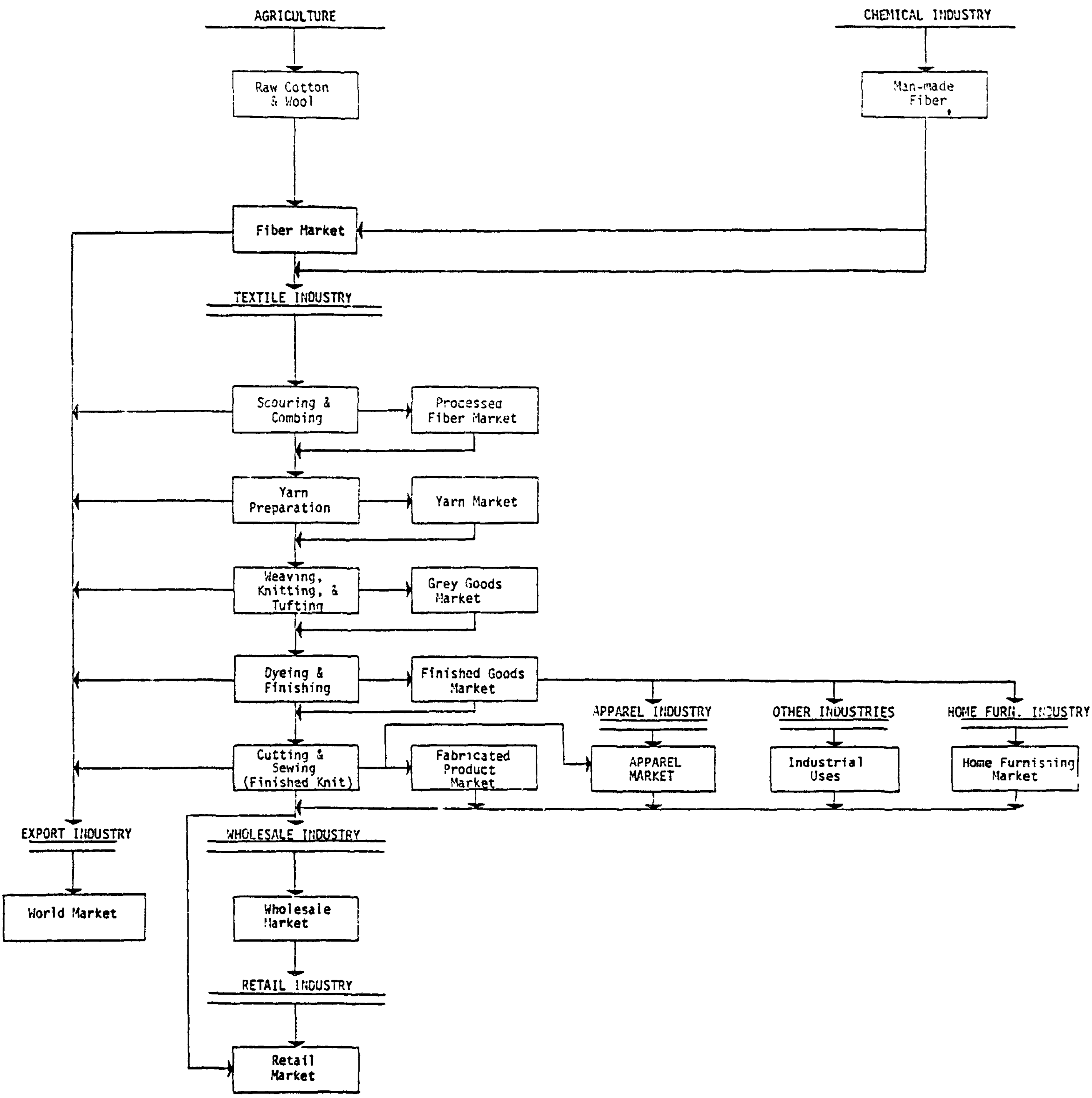
Processed fibers are those that have undergone processing beyond the raw fiber state but have not yet been spun into yarn. One of the chief products traded on this market is wool tops which are utilized in worsted mills.

Yarn production is generally integrated wherever possible with weaving, knitting and other manufacturing. However, a substantial amount is distributed through the yarn markets principally to the knitting mills, carpet mills, and small weaving mills. The relatively small size of the spinning mills has brought about a market organization in which selling is done through relatively few agents. The principal yarn markets are in the consuming areas. Yarn used in the knit apparel mills is usually sold through jobbers while the weaving yarns and yarns to the large knitting mills are sold directly by the spinner or his agent to the using mills.

In selling thread, there are two distinct markets: domestic and industrial. Industrial thread is sold similar to yarn, by the pound, on cones ranging from 3,600 to 30,000 yards each. On the other hand, thread entering the domestic market is sold on small thread spools.

The greige fabric market is concentrated in the hands of a few selling agents and brokers with main offices in New York City. In this market, quotations are made on a bid and ask basis; there are no list prices. Selling may be on either a spot or future delivery basis with widely used standard constructions sold for spot delivery and cloths of special construction sold for future delivery.

Exhibit IV-1. Textile marketing, flow of goods



Source: Development Planning and Research Associates, Manhattan, Kansas.

The finished goods market differs from the greige fabric market principally by type of customer served. While the greige manufacturers deal with processors within the textile industry, the finished goods producers sell their products outside of the industry to "cut and sew" operators in the apparel industry. The apparel customers are greatly influenced by the retail markets and are usually under-financed. The combination of these two factors contribute to an instability in the finished goods market.

Some of the instability is offset by the method of merchandizing used in the market. In the market, "lines" of goods are prepared comprising an assortment of fabrics, colors, and designs which contain some materials intended to appeal to all of the manufacturers customers. Part of the line is a carry over from previous seasons and part are goods introduced to the markets for a single season. In this system, the manufacturers are reluctant to change prices during a "season" and consequently prices tend to remain stable during the period.

Finished goods are purchased both for spot and future deliveries. However, the volatility in the retail markets tend to make selling on a future basis unsatisfactory since the purchasers are unable to anticipate which garment patterns will be selling. Textile manufacturers are usually unwilling to enforce the "blanket" orders associated with the future deliveries because of the risk of losing the goodwill of their major customers.

Finished goods are normally sold from list prices as opposed to selling by "market" quotations as is the case in the greige markets. As pointed out above, these prices usually remain stable during the season, dropping off at the end of the period on closeout goods that cannot be carried over into the next season.

Types of fabricated products included in the textile industry are:

(a) sheets, towels and blankets
(b) knitted underwear, outerwear, and hosiery
(c) carpets

Sheets, towels and blankets are produced by weaving mills and require only a minimum of fabrication. Fabrication usually consists of a simple cutting operation and hemming or binding of the edges. The markets for these products are similar to those of finished goods.

Knit apparel (hosiery, underwear, and outerwear) are end products and enter directly from the mills into the wholesale and retail distribution systems.

Carpets and rugs enter the broad home furnishings markets through the wholesale and retail marketing system.

Within the textile industry, competition is keen at most of the market levels, not only between type fibers used, but also between fabrics. The dramatic trends in the last decade towards the use of man-made fibers points out clearly the inter-fiber competition in the textile markets. However, it is important to note fibers compete with others for only a part of their uses. For example, cotton has very little competition in the manufacture of sheets and pillow cases. In contrast competition between fibers is considerably greater in dress goods. Competition also exists between fabrics. This competition is reflected in the substitution of double knit fabrics for woven fabrics in the manufacture of suits.

2. International Trade

International trade has had a significant influence on the U.S. textile markets. The considerable growth in the level of imported textiles and apparel has not been offset by increases of exports of U.S. produced textile and apparel products. Also efforts by the U.S. industry to limit the future growth rates of imports have not been successful. While this section will not attempt to analyze the pro's and con's of the trade situation, it will attempt to depict the trends in the levels of imports and exports as well as describe the basic trade agreements the U.S. currently has in effect.

a. Import market channels

The market channels for textile and related goods being imported to the U.S. are very similar to those associated with the domestically produced goods. Depending upon the level of manufacture of the imported good, the typical sequence of its entrance into the U.S. markets would begin with an import broker and from this step, the good would funnel into the normal market channels described in the previous section. As long as the imported good was of comparable quality, once it entered the domestic market channels, very few distinguishable attributes would be associated with it unless, of course, it was priced differently.

b. Level of imports

After more than doubling in the 1960's, U.S. textile imports reached a value of $5.9 billion in 1977, a 50 percent increase over the previous high of $3.9 in 1974 (Table IV-11). The value of these imports amounted to over 4 percent of all merchandise imported to the U.S.

As measured by the raw fiber equivalent of semi-manufactured and manufactured textiles, imports have doubled during the last 10 years with total pounds climbing from under 800 million in 1968 to close to 1,600 million in 1978 (Table IV-12). Products of man-made fiber more than tripled during the period jumping from about 200 million pounds to close to 650 million pounds. Cotton products increased from 473 million pounds to 845 million which amounted to an increase of 75 percent. Wool products dropped from 104 million pounds in 1968 to under 50 million in 1975 during the recession.

Table IV-11. U.S. textile trade
(millions of dollars)

Period	Imports	Exports	Deficit
1967	1,416	660	801
1968	1,818	694	1,124
1969	2,125	753	1,372
1970	2,402	776	1,626
1971	2,913	837	2,176
1972	3,411	993	2,418
1973	3,722	1,497	2,225
1974	3,952	2,168	1,787
1975	3,780	2,027	1,783
1976	5,269	2,480	2,789
1977	5,926	2,567	3,359

Source: American Textile Manufacturers Institute, Hi-Lights.

Table IV-12. Raw fiber equivalent of imports of manufactures (million pounds)

Year	Man-made	Cotton	Wool	Total
1968	193.3	473.8	104.3	771.4
1969	257.5	488.0	96.2	841.7
1970	329.3	463.1	85.9	878.3
1971	451.1	392.5	66.2	1,009.8
1972	480.5	610.7	63.0	1,154.2
1973	465.3	563.5	61.3	1,090.1
1974	371.3	502.7	53.3	927.3
1975	400.4	501.2	48.6	950.2
1976	479.5	708.6	66.7	1,254.8
1977	531.1	669.5	85.5	1,286.1
1978	642.6	845.4	92.2	1,580.2

Source: Textile Organon

It has subsequently climbed back to about its 1968 level. Over a third of the total imports in 1978 consisted of semimanufactured products (yarn and fabric) with the remainder made up of apparel, industrial and home furnishings. This is a significant change from the composition ten years ago when semimanufactured products amounted to over 50 percent of the total textile imports.

The trend towards trading in apparel products is revealed in the growth rate of the various products (Table IV-13). Broad woven fabric imports amounting to 5 percent of domestic production in 1967 rose to 8 percent by 1976. Knit fabric has remained under the one percent mark. In contrast, imports of sweaters rose from about 33 percent of U.S. production to over 100 percent during the same period. Imports of knit slacks showed even a greater growth by rising from 4 percent of production in 1967 to over 35 percent in 1976. Over half of the imports in 1976 (textile and apparel products) were shipped from the Far East: Hong Kong, Korea, Japan, and Taiwan. In the past several years, the share of imports among these countries has changed significantly. Korea's share has been increasing while that of Japan's has been decreasing.

While total textile imports amount to about 10 percent of the domestic textile products market, wool textile imports represent a substantially higher share of the wool products market. For the past ten years, wool imports have fluctuated between 20 and 25 percent of the market. The high occurred in 1968 with wool imports representing 25 percent of the market. The low occurred in 1975 with imports having less than 20 percent of the share. The level in 1976 was just over 23 percent.

In contrast to the growing textile imports discussed above, overall imports in rugs, carpets, and carpeting have not gained a significant share of the domestic markets, except in the case of wool carpets. The total imports in carpets (man-made, cotton, and wool) have shown a slight decline over the past ten years decreasing from about 3 percent of domestic production in 1967 to about one percent in 1976. However, wool carpet imports which have been accounting for about half of the total carpet imports in recent years have shown significant increases in the 1970's. In 1976, these imports were at a level of about 6 percent of the domestic production. With substantial yearly increases, imports reached 5.6 million square yards in 1976; this was close to two-thirds of total domestic production.

c. Level of U.S. exports

While imports in dollar volume have doubled during the early 1970's, textile exports have tripled, climbing close to $2.5 billion in 1976. However, since exports have been expanding from a much smaller base, a continuing deficit in textile trade exists. In 1976, the deficit reached $2.8 billion which represents 30 percent of the nation's $9.2 billion merchandise trade deficit. In exports of cotton and man-made textiles, shipments increased from just over 300 million pounds in 1968 to a record 798.1 million in 1977 (Table IV-14). Exports dropped off to under 700 million pounds during 1975. For the past several years, exports in cotton and man-made textile

Table IV-13. Import/production ratios--selected textile and apparel products

	Broadwoven fabrics							Carpets	
	Cotton & man-made	Wool	Fabric	Hosiery	Sweater	Slacks	Underwear	All	Wool
	(Percent)								
1967	4.9	16.7	0.9	0.5	32.9	3.9	0.8	2.6	9.4
1968	4.9	21.6	0.8	0.6	52.1	17.9	1.3	3.3	6.4
1969	5.6	21.0	1.0	0.6	72.2	43.2	1.5	3.1	6.1
1970	5.9	20.5	2.1	3.3	71.0	25.7	2.0	2.5	5.9
1971	6.4	15.3	5.1	2.3	88.7	53.5	3.1	2.1	7.1
1972	7.6	11.7	2.8	1.6	77.3	39.9	2.6	1.8	10.2
1973	7.2	13.2	1.6	1.6	74.8	40.0	2.2	1.4	19.8
1974	7.0	10.7	0.7	2.1	79.0	26.8	1.8	1.1	34.6
1975	6.2	10.1	0.6	1.6	90.7	31.5	1.7	1.1	43.7
1976	8.4	12.5	0.6	1.4	107.0	35.3	1.9	1.2	63.4

Source: U.S. Department of Commerce, U.S. Imports: Ratios of Textiles/Apparel, 1977

Table IV-14. Raw fiber equivalent of export of manufacturers
(million pounds)

Year	Man-made	Cotton	Wool	Total
1968	129.0	188.2	5.7	322.9
1969	146.2	232.1	5.2	383.5
1970	147.4	199.2	4.9	351.5
1971	146.7	226.3	9.4	383.4
1972	177.6	290.4	30.6	498.6
1973	288.2	325.2	30.8	644.2
1974	390.7	292.5	23.0	706.2
1975	322.4	353.7	19.2	695.3
1976	352.2	413.2	13.9	779.3
1977	367.6	369.5	11.5	798.1
1978	441.7	355.7	11.6	614.0

Source: Textile Organon

and apparel products have remained at about 7 percent of domestic production. In wool products, exports rose to a high of 30.8 million pounds in 1973; about 13 percent of the domestic production level. These imports dropped to about 6 percent of the production level in 1976.

While apparel products accounted for the greatest portion of the imports, piece goods accounted for the largest share of the exports. In cotton piece-goods, exports climbed from around 300 million square yards in the late 1960's to a record level of 527.3 million in 1976. During the same period, exports in man-made fiber piece goods increased from around 150 million square yards to close to 360 million square yards.

d. Trade restrictions

In order to prevent disruption of developed countries' textile industries by low-wage competition from exporting nations, textile imports in most countries are regulated by a series of international trade agreements. Of major importance to these textile trade regulations is the Tokyo Round Trade Agreement of the Multilateral Trade Negotiations (MTN). This trade agreement was negotiated under the auspices of the General Agreement on Tariffs and Trade, or GATT. As in all GATT talks, the Tokyo Rounds were conducted on the principle that any favorable concession granted to one country will be extended to all GATT members. This treatment, referred to as the Most-Favored-Nation principle (MFN), is usually granted to include non-GATT countries also. The U.S. is the one exception to this principle as it will not apply the MFN to countries or areas dominated or controlled by communism. The U.S. acceptance of the Tokyo Round was signed into law in July 1979, by President Carter after almost six years of strenuous negotiations. It is intended to harmonize existing U.S. laws with new international codes primarily dealing with tariff levels and five non-tariff barriers to trade. These are discussed below.

One of the most controversial issues of the Tokyo Rounds involved the reduction of tariffs which a country levies against the price of foreign goods being imported. As a result of the Tokyo Rounds negotiations, tariffs on textile products are to be reduced by an average of 21 percent. The textile products tariff reductions will be numerous and varied by product classification with approximately 3,500 different textile and apparel classifications considered in the negotiations. The current tariff rate, the proposed new rate, and the resulting reduction for selected textile products are depicted in Table IV-15. As shown in the table, proposed reductions range from relatively small decreases (5.9 percent for woven wool) to reductions of over one-half (60 percent for cotton furnishings). The projected economic ramifications of the industry's tariff reductions vary. According to William R. Cline, main investigator for the Brookings Institution's study on the effect of trade negotiations in the Tokyo Round, the major impact of the revised tariff levels will be on employment. Even so, Cline predicts only a 1.65 percent employment reduction in the industry, which is considered minimal. He also contends that some of the lost jobs will be regained by additional U.S. exports. Furthermore, initial tariff

Table IV-15. Proposed tariff reductions on major textile products

Product	Current tariff	Proposed tariff	Reduction
	--------expressed as a percent--------		
Wool yarns	13-23.4	9-15.0	30.77-35.90
Man-made fiber 1/ /wool blends	18.2	15.0	17.6
Man-made 1/ fabrics	24.5	17.0	30.6
Woven wool (over $9/lb)	44.4	33.0	25.7
Woven wool (less than $9/lb)	44.4	41.8	5.9
Cotton shirting	16.7	12.2	26.9
Cotton towels	14.0	10.5	25.0
Cotton corduroy	38.0	23.0	39.5
Cotton velveteen	22.5-30.0	16-20.0	33.3
Cotton terry	15.4	11.1	27.9
Cotton velveteen furnishings	30.0	12.0	60.0
Corduroy furnishings	38.0	15.2	60.0
Cotton terry furnishing	15.0	7.2	52.0

1/ Comprised of acetate, nylon, and/or polyester.

Source: Daily News Record, July 13, 1979.

cuts will not take effect until 1982, with additional liberalization over a period of eight to ten years. The American Textiles Manufacturers Institute (ATMI) have an opposing view of the impact of tariff reductions, however. They assert that total U.S. job losses due to the economic effect of the reductions, would decrease employment by 40 percent, or 800,000 workers. The ATMI predicts the smaller, family-owned manufacturers will be most severely impacted, while the larger, multi-corporations can more readily absorb the changes.

In addition to tariff reductions to promote international trade, the Toyko Round also legislated a series of codes to help eliminate the five major non-tariff barriers to trade. One of the codes involves regulation of government subsidies for exports of manufactured goods. The new code attempts to expedite the time required to make official investigations and determinations in countervailing and anti-dumping (flooding a market with specific imports) cases. The length of the investigations by the Treasury Department would be cut from six or nine months to 120 days. It would also reduce to 120 days the period of time the International Trade Commission (ITC) has to rule on whether or not the imported products were harming domestic industries. In addition, the Tokyo Round allows for the Treasury Department and ITC investigations to overlap, further reducing the time constraints. It also restricts the President to 30 days to act on ITC's suggestions instead of the 90 days allotted historically. Under previous trade agreements, the Treasury Department had a year to reach its final decision in countervailing duty cases; however, now the Department will have a total of 195 days to make its final decision. A major concession in the agreement provides that the U.S. cannot apply countervailing duties on subsidized products unless it can prove the domestic industry suffered injury as a result of the imports. The somewhat nebulous guidelines of determining injury entail that the U.S. must prove "harm which is not inconsequential, immaterial or unimportant" has taken place. The agreement also expands dumping duties to include the 3 months of imports before the preliminary dumping findings. Furthermore, a deposit of the estimated dumping duties will be required from the exporting country if injury is proved.

Another significant code aimed at reducing non-tariff barriers to trade, bars the use of arbitrary product standards to discourage imports. In the past, countries when faced with a surplus of domestic goods, would raise the products minimal requirements (e.g. health or technical) of imported goods while maintaining the original standards for domestic goods. The new code does not dictate what the standards must be, per se, but rather calls for open procedures in adopting standards, and sets up a review procedure for settling disputes.

A third code established in the trade agreement eliminates the numerous arbitrary methods that governments use to inflate the value of imports to calculate custom duties. As a result of the false value placed on the products, the goods are over-priced and not competitive with the domestic markets. Under the new code, countries that do not accept a manufacturer's invoice price must use an elaborate, carefully devised formula to establish a revised value.

The final two codes anticipated to have major impacts on breaking down trade barriers include regulation of official purchasing practices and import licensing. The revised purchasing practices allows countries to bid on foreign government's contracts. This results in not only a broader market for exporters, but also makes the bidding more competitive and efficient. In the past, import licenses have been difficult, if not impossible, to obtain for certain domestic products. This provided the manufacturers protection against lower-priced, imported goods. The establishment of this code insures licenses are available at a reasonable time after they are requested.

It is clear that while the Tokyo Round trade agreements will promote trade by reducing tariff levels and eliminating some of the major non-tariff barriers to trade, it will also have an adverse impact on the U.S. textile industry. Although the severity of the impact is argued by several special interest groups, the U.S. plans to strengthen existing legislation in order to assist the beleaguered industry. It is anticipated that the "Arrangement Regarding International Trade in Textiles," also referred to as the Multifiber Arrangement, will be one area of change. The Multifiber Arrangement (MFA) is an extension of the General Agreement on Tariffs and Trade. The MFA was originally negotiated by 50 major textile trading countries in December 1973, with its four year term scheduled to expire December 31, 1977. At that time, it was extended to December 31, 1981. The MFA regulates the importation of textile products manufactured from cotton, wool, or man-made fibers, and all blends among the 50 countries.

The basic objectives of the MFA entail expansion of trade, reduction of trade barriers, and progressive liberalization of world trade involving textile products. In addition, it ensures the orderly and equitable development of trade aimed at preventing disruption of individual markets. Other goals of the MFA include enhancement of the social development of developing countries, securing substantial increases in their export earnings from textile products, and providing the opportunity of a greater share in world trade.

Under the provisions of the MFA, the U.S. may restrain textile imports from particular countries by negotiating bilateral agreements with exporting countries or through unilateral actions. Currently, the U.S. has 18 bilaterals in force including agreements with all of the major exporting countries. These countries and the textile categories involved are presented in Table IV-16.

A significant feature of the MFA is that it calls for an annual six percent growth in the levels established by the bilaterals. Although the MFA provides the general framework for trade, specific restrictions are covered in the bilateral agreements. Under most of these bilaterals, aggregate limits are established for total imports (which may or may not conform with the six percent growth rate) and then quotas are set for each group of production to include textiles, apparel, and wool. Within these groups,

Table IV-16. The Textile Industry--countries with which the U.S. has bilateral agreements as allowed under the auspices of the Multifiber Arrangement

Country	Textile category involved
Arab Republic of Egypt	Cotton
Brazil	Cotton
Colombia	Cotton, wool and man-made fibers
Haiti	Cotton, man-made fibers
Hong Kong	Cotton, wool and man-made fibers
India	Cotton
Japan	Cotton, wool and man-made fibers
Korea	Cotton, wool and man-made fibers
Macao	Cotton, wool and man-made fibers
Malaysia	Cotton, wool and man-made fibers
Mexico	Cotton, wool and man-made fibers
Pakistan	Cotton
Philippines	Cotton, wool and man-made fibers
Poland	Cotton
Romania	Cotton, wool and man-made fibers 1/
Singapore	Cotton, wool and man-made fibers
Taiwan	Cotton, wool and man-made fibers
Thailand	Cotton, wool and man-made fibers

1/ This is the 2nd of 2 agreements negotiated by Romania.

Source: U.S. Dept. of Commerce

specific import quotas are set for specific items. Quotas generally reflect the market sensitivity of the specific product. U.S. bilaterals have provided for an annual one percent growth in the import of wool products because of the small size of the wool industry and because of market problems in this industry. Restrictive quotas also have been negotiated on more sensitive apparel products such as gloves, sweaters, and knit shirts.

There are also features of the bilaterals which permit import levels to increase over the 6 percent annual level established in the MFA. One such feature allows unused quotas to carry over from one period to the next. For example, if one country had an import level of 36 thousand tons of wool per year, but in a given year only 30 thousand tons were actually imported, the next period's import level would still be a 6 percent increase over the 36 thousand tons originally allowed (38.2 thousand tons of wool) plus the unused 6 thousand tons would be allowed to accumulate for the next period resulting in a total import level of 44 thousand tons in the second year. The following period's level of importation would then be 6 percent of 44 thousand tons rather than 6 percent of 38 thousand tons. Several periods of compounding growth in this manner can have a severe impact on importing countries.

The U.S. textile industry has strongly urged that drastic changes are needed in the Multifiber Arrangement. In the view of many, the MFA will lead to major disruption of the textile and apparel industries with resultant widespread reductions in employment. The view is also held that imports could grow to 50 percent of the textile markets by the late 1980's. To counter this, industry and labor are pressing for more restrictive regulations which would include a reduction of the six percent quota growth factor to come in line with growth in the domestic market which has been approximately three percent.

C. Financial Profile

Textile industry sales have increased at a rate of about seven percent annually over the last ten years. Domestic mills are facing a growing threat from foreign markets, which now dominate about one-fourth of U.S. sales. Operating costs for the textile industry have remained steady over the last ten years, always slightly higher than the average for all manufacturing industries. Depreciation levels are inadequate to permit the industry to keep abreast of its capital requirements since new machinery is two to four times as expensive as that being replaced. Long term credit is scarce in the industry and firms must rely on internally generated funds. Deficits have grown from 29 percent of the firms in the entire industry in 1972 to 38 percent in 1974; returns on sales, equity and assets continue to rank among the lowest compared to all other manufacturing industries.

1. General Trends in the Industry

While the quantities of textile products produced have grown at an average annual rate of 3.5 percent during the past ten years, the values of shipments of textile products have grown at an annual average rate twice the production growth rate, increasing from approximately $20 billion in 1967, to over $40 billion in 1978. The value of shipments for the textile industry during this period was approximately three percent of the total value of shipments from all manufacturing industries. However, the textile industry proportion declined during the ten year period from 3.3 percent in 1967 to 2.8 percent in 1976. Comparison of the textile industry with all manufacturing industries with respect to the share of sales and profits, reveals that while the textile industry accounted for three percent of the sales of all manufacturing industries, it accounted for only 1.9 percent of the aggregate industries' profits in 1971, with the share decreasing to only one percent in 1975.

2. Sales

According to data published in the FTC Quarterly Financial Reports, corporate sales within the textile industry have been increasing at an average rate of about 7 percent annually, rising from $18.7 billion in 1967 to over $37 billion in 1978 (Table IV-17). This annual increase is somewhat less than that of the Census' value of shipments which indicates a trend towards greater integration within the industry. In 1970, noncorporate sales represented about two percent of the total industry volume, including those of proprietorships and partnerships. However, in recent years, the sales of these noncorporate enterprises share represented less than one percent, reflecting the continuing trend towards closures and incorporations of the smaller operations.

The cyclical movements of the sales in the textile industry have generally paralleled the total sales in all manufacturing industries with peaks and troughs occassionally preceding trends in the overall economy. Although not apparent from Table IV-17, significant fluctuations in quarterly sales have occurred since 1970. In 1973, a peak occurred as a result of the accelerated buying associated with the threatening shortage during the Mideast oil embargo. This was quickly followed by a dramatic drop in sales reflecting the economic recession in 1975. Since that time, sales have recovered with a high in quarterly sales of over $9 billion during the second quarter of 1977.

Sales of textile products occur predominately in three markets: apparel, home furnishings, and industrial. The apparel market accounts for the greatest portion of the total sales, receiving an estimated 42 percent of the industry shipments. The second largest share of the industry sales occurs in home furnishings which represents about 32 percent. An estimated 23 percent of the industries sales occur in the industrial market. Overseas sales amount to about 4 percent of total sales.

Table IV-17. Financial Profile - textile industry[1/]

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
	million dollars											
Shipments (Textile Mill Products)	19,797	21,968	22,952	22,630	24,029	28,036	31,073	32,789	31,064	36,389	38,390	40,694
Corporate Sales (Textile Mill Products)	18,672	20,841	21,780	21,598	22,930	25,616	29,113	31,220	28,116	33,932	34,931	37,418
	Percent											
After tax return on sales:												
All manufacturing	5.0	5.1	4.8	4.0	4.2	4.3	5.0	5.5	4.6	5.3	5.3	5.4
Textile Mill Products	2.9	3.1	2.9	1.9	2.4	2.6	2.9	2.5	1.5	2.4	2.4	3.1
After tax return on total assets:												
All manufacturing	6.6	6.6	6.4	5.1	5.2	5.5	6.7	8.0	6.2	7.5	7.6	8.1
Textile Mill Products	4.5	4.9	4.5	2.8	3.7	4.0	4.7	3.8	2.2	4.2	4.5	5.9
After tax return on equity:												
All manufacturing	11.2	11.8	11.5	9.3	9.7	10.6	13.1	14.9	11.6	14.0	14.2	15.0
Textile Mill Products	7.5	8.5	7.9	5.1	6.6	7.5	9.6	8.0	4.4	8.0	8.6	11.5

1/ Data from Census of Manufactures

Source: Federal Trade Commission, Quarterly Financial Report

The long term outlook for sales can be expected to reflect very closely the projected trends in personal income as well as expenditures for apparels and home furnishings. The real growth rate is not anticipated to exceed the 2.5 percent of the past 10 years. However, cyclical movements in sales can be expected to occur and should parallel changes in general economic activity. Industry sales will be significantly influenced by imports of textile products into the United States. These imports, which have been restricted to an annual increase of 6 percent under the MFA, have been posing increasing problems to the domestic mills. This is apparent in considering that about one-fourth of the garments now sold in the U.S. come from abroad, principally from the Far East (Taiwan, Hong Kong, Japan, and Korea).

In addition to the FTC Financial Reports discussed above, financial statistics are also published by the Internal Revenue Service in its Source Book of Income Statistics. These statistics cover a different survey sample and are collected on a fiscal year basis beginning in July; consequently the data varies somewhat from that published by the FTC. The Source Book contains data not only for the total industry (major industry) but also for the three principal segments (minor industries): (1) weaving mills and textile finishing, (2) knitting mills, and (3) other textile mill products. This third industry includes the carpet and rug industry as well as yarn and thread mills. Table IV-18 depicts data for fiscal years 1967 to 1975 (1975 is the latest year for which statistics have been published). As shown in the exhibit, sales for the major industry increased from $18.5 billion in 1967 to over $30 billion in 1975. These statistics illustrate a drop in sales in 1971 reflecting that year's recession, which is not readily apparent in the FTC data. Sales in the weaving industry represent about 45 percent of total industry sales while those in the knitting mills account for about 20 percent. The other textile mills account for the remaining 35 percent of the sales. Although the weaving mills make up the largest portion of the industry sales volume, its sales have been increasing only at an average of 4 percent annually as opposed to a 6 percent increase for the remaining portion of the industry. The minor industry sales data reveal that the impact of the 1971 recession occurred at different times among the three industries with a low in sales occurring in 1970 (fiscal year) for the other textile product mills and a low for the weaving and knitting mills occurring in 1971.

3. Operating Costs

Financial data contained in the Standard and Poors Industry Surveys facilitate a comparison of operating costs between the textile industry and total industrials. These operating costs are listed below and include costs for labor, material, selling, and general and administrative expenses. Costs as a percentage of sales have remained fairly stable over the last ten years for the textile industry as well as all industrials. Total industrials have experienced a slight rise in costs from a low of 84.2 percent in 1967 to a high of 85.7 percent in 1976. The costs in the textile industry

Table IV-18. Financial profile 1/ -- textile industry (major and minor industries)

	1967	1968	1969	1970	1971	1972	1973	1974	1975
	million dollars								
Sales:									
Major industry (textiles)	18,523	19,379	20,822	22,053	21,454	23,164	26,889	29,409	30,639
Minor industry									
Weaving mills 2/	8,975	9,061	9,731	11,028	10,301	10,838	11,773	12,978	13,815
Knitting mills	3,352	2,647	3,703	4,073	3,908	4,793	5,448	5,848	5,585
Other	6,196	7,671	7,388	6,952	7,246	7,533	9,242	10,583	11,240
	percent								
Return on sales (before tax):									
Major industry (textiles)	5.5	4.4	5.3	4.3	3.6	3.6	3.5	4.0	2.5
Minor industry									
Weaving mills 2/	6.4	5.0	5.5	5.0	4.2	3.5	4.1	5.1	2.2
Knitting mills	3.8	4.3	5.0	3.4	3.7	3.3	3.8	2.2	0.6
Other	5.0	3.8	5.1	3.7	2.8	4.0	2.7	3.6	3.2
Return on assets (before tax):									
Major industry (textiles)	8.5	6.7	7.8	6.1	5.3	5.5	5.4	6.3	4.1
Minor industry									
Weaving mills 2/	8.9	6.6	7.3	6.4	5.4	4.6	5.8	7.1	6.1
Knitting mills	7.2	6.1	9.6	6.2	6.2	5.8	6.6	3.6	1.0
Other	8.5	7.0	8.0	5.4	4.4	6.9	4.3	6.7	2.7

1/ Financial data is based on fiscal year - July to June.
2/ Includes textile finishing plants, except knitting and wool processing.

Source: Internal Revenue Service, Source Book of Income Statistics.

have ranged from a low in 1968 of 87.9 percent to a high of 91.4 percent in both 1971 and 1975. The operating costs of the textile industry have remained about 3 to 5 percentage points higher than all industrials throughout the time period.

Operating Cost
(as a percent of sales)

Year	Textile Industry	Total Industrials
1976	88.9	85.6
1975	91.4	85.6
1974	88.4	84.6
1973	89.0	84.2
1972	90.4	84.9
1971	91.4	85.4
1970	89.9	85.5
1969	88.7	84.7
1968	87.9	84.2
1967	89.4	84.5

Source: Standard and Poors Industry Surveys.

These operating costs are discussed in detail, below. Material and labor costs were obtained from the Census of Manufactures while the remaining costs were derived from the Source Book of Statistics of Income, (IRS).

a. Costs of materials and labor

Costs of material and labor expressed as a percent of shipments (sales and interplant transfers) are shown in Table IV-19 for various SIC industry groups (3-digit level) and industries (4-digit level) paralleling to some extent the IRS Source Book minor industry break-out. Costs of material for the entire industry amount to about 60 percent of shipments while labor costs average about 20 percent. The weaving mills show the highest cost of labor with a rate of 27 percent, due primarily to the labor intensive narrow fabric and wool processing mills. The labor costs in the textile finishing mills were 21 percent. The combination of weaving and finishing mills, which constitutes the same coverage of mills as the Source Book in its minor industry break-out, indicate labor costs of 25 percent. The knitting mills had labor costs of 21 percent, slightly less than the combination of weaving and finishing mills. Within the knitting mills, labor costs vary widely among the subsegments. Mills manufacturing knit gloves had labor costs of 32 percent (not shown in the Table) which were the highest in the entire textile industry. On the other hand, mills producing knit fabrics had one of the lowest costs. Carpet and rug mills had the lowest labor costs of the entire industry with costs at 13 percent. This is due principally to the relatively labor efficient mills.

Table IV-19. Material and labor costs (1972)
(as a percent of shipments)

SIC	SIC Industry Group	Labor Costs	Material Costs
		percent	
221-224	Weaving mills	27	52
226	Textile finishing (weaving)	21	58
221-224, 226	Combined weaving mills and textile finishing	25	54
225	Knitting mills	21	59
227	Carpet and rug mills	13	67
228	Yarn and thread mills	20	62
Total Textile Mill Products		20	60

Source: Census of Manufactures.

As may be expected, material costs, when expressed as percentages of shipments, are essentially the opposite of labor costs. Those segments with high labor costs had relatively low material costs; conversely, those with low labor costs had high material cost (as a percent of shipments). The weaving mills and textile finishers had the lowest material costs at 54 percent. Carpet mills had the highest material costs at 67 percent.

b. Depreciation

A recent study conducted by the Treasury Department on the textile industry concludes depreciation levels are entirely inadequate to permit the industry to keep abreast of its capital requirements since new machinery costs from two to four times that being replaced. Depreciation, as shown below, remained between 2.8 and 2.9 percent of sales through 1975 and then dropped to 2.5 percent in 1976 where it has remained for the past three years.

The Textile Industry
(depreciation as a percent of sales)

1970	1971	1972	1973	1974	1975	1976	1977	1978
2.9	2.9	2.8	2.9	2.8	2.9	2.5	2.5	2.5

Source: FTC Quarterly Financial Report

Depreciation among the minor industries varied significantly as illustrated below. The weaving mills and textile finishing reported the highest depreciation at levels of about 3.5 percent of sales. The knitting mills reported fairly low depreciation of 2.8 percent in 1974. During the period 1972-1974, depreciation in this segment increased substantially from a low in 1972 and 1973 of 2.4 percent. During the same period, the remaining mills (other textile products) experienced a slight decline in levels going from 2.5 percent in 1972 to 2.1 percent in 1974. It should be pointed out that the minor industry levels, to a great degree, reflect the depreciation taken by the largest firms. For example, the depreciation for all of the weaving and finishing mills was shown as 3.5 percent. However, in that segment, firms with assets of less than $5 million (80 percent of this minor industry) had depreciation levels of less than 2.5 percent.

Depreciation as a Percent of Sales

	1972	1973	1974	1975
Weaving mills and textile finishing	3.6	3.6	3.5	3.4
Knitting mills	2.4	2.4	2.8	2.5
Other textile products	2.5	2.3	2.1	2.3

Source: Troy's Almanac

4. Interest Expenses

Because of low levels of profit, the textile industry has had to rely traditionally on internally generated funds for capital investment. The scarcity of long-term credit is evident in the relatively low interest expenses being paid by textile firms as illustrated below. During the period 1970-1974, interest paid by the industry averaged 1.4 percent of sales. This compares with a rate of 1.8 percent for all manufacturing industries for the same period. The interest expenses of the minor industries have fluctuated slightly over the past few years but in general have varied between 1.4 and 1.5 percent of sales. The relatively large increase in the percentage for knitting mills in 1974 may be explained by the fact that in 1974, the knitting boom peaked, thus it is probable many firms were forced to borrow funds to continue in operation.

The Textile Industry	Interest Expenses (as a percent of sales)					
	1970	1971	1972	1973	1974	1975
Major industry	1.4	1.4	1.4	1.4	1.5	2.0
Minor industry						
Weaving mills & finishings	1.7	1.7	1.5	1.3	1.5	1.8
Knitting	1.4	1.5	1.4	1.4	1.8	2.4
Other	1.8	1.6	1.3	1.4	1.4	2.0

Source: IRS Source Book of Income Statistics

5. Profitability

The relatively weak financial posture of the textile industry is reflected in the number of firms reporting deficits. In 1971, according to the Source Book, 1,776 firms out of a total of 6,221 1/ reported losses which amounted to 29 percent of the firms in the entire industry. By 1974, the total number of firms had declined to 5,769; however, the number reporting losses increased to 2,182, representing a total of 38 percent. The generally low levels of profits are apparent in comparing the profitability ratios in the textile industry with those of all manufacturing as was depicted in Table IV-17. As shown, the textile industry's profits have historically been 40 to 50 percent less than the profits of all manufacturing industries.

a. Returns on sales (industry)

Rates of return on sales, equity and assets have been traditionally low in the industry. During the last 10 year period, the return on sales (after tax) for the industry has fluctuated between 1.5 percent in 1975 and 3.1

1/ The number of firms reflect those categorized as textile operations by the Internal Revenue Service. The IRS number of firms does not compare equally to the number of firms reported by the Bureau of the Census.

percent in 1967 and 1978. During the same period, the returns for all manufacturing industries varied from 4.0 percent to 5.5 percent. Annual rates of return for the textile industry have typically been about 40 to 50 percent less than the composite rates of all manufacturing industries.

The return on sales for 1977 was 2.4 percent; the same as that of 1976 and essentially the same as the average since 1970 (2.3 percent) and the average of the past 11 years (2.5 percent).

While a review of the return on sales of the total industry indicates its condition relative to that of overall manufacturing, an examination of the rates of firms by asset size reveals the position of the small mills. As shown below, the return on sales before tax for firms having assets under one million dollars had a loss of 0.3 percent. Approximately 80 percent of the firms in the industry fell into this category. Firms with assets of between one and ten million dollars had a composite rate of return of 2.6 percent; these firms made up about 17 percent of the industry. The remaining large firms (amounting to less than 4 percent of the industry) had a rate of return of about 3.1 percent.

Return on Sales by Size of Firms-Textile Industry (1975)

Assets	Number of Firms as a Percent of the Total Industry	Return on Sales
Under $1,000,000	80%	-0.3
$1,000,000 to $10,000,000	17%	2.6
$10,000,000 to $25,000,000	2%	3.0
Over $25,000,000	Less than 2%	3.2

Source: IRS, Source Book of Income Statistics

As also shown in Table IV-18, the return on sales of the weaving mills and textile finishers have generally been the highest in the industry when compared to the other minor industries. Between 1967 and 1975, these mills averaged close to 5 percent as opposed to about 3.7 percent for the knitting and other mills. However, when viewing the return of sales of firms with assets under one million dollars, a different picture emerges. These smaller sized firms in both the weaving and knitting segments had less than a one percent rate of return. The same size firms in the other textile mill products segment had a composite rate of almost 3 percent.

b. Returns on sales (wet processors)

The returns on sales for the wet processors within the industry have remained significantly lower than the total industry. Based on survey data (discussed in Chapter II), the return of sales (before tax) have averaged 3.1 percent for the wet processors as opposed to 4.3 percent for the entire industry. As shown in Table IV-20, the rate of return for wet processors during the 1975 recession for wet processors fell to 1.4 percent while the total industry

Table IV-20. The textile industry, wet processors--
return on sales (before tax) 1/
(medians)

Subcategory	1973	1974	1975	1976	1977
Wool scouring	7.8	-0.3	-4.1	7.7	-0.1
Wool finishing	4.0	1.7	-3.4	2.7	0.5
Woven fabric finishing	5.8	2.8	2.2	4.0	1.4
Knit fabric finishing	3.3	3.3	2.3	1.6	2.5
Hosiery finishing	2.5	1.6	1.7	2.6	1.3
Carpet finishing	4.4	4.7	1.6	3.0	3.5
Yarn finishing	9.2	6.6	0.8	3.6	1.9
Nonwoven	3.2	4.6	0.0	0.7	4.3
Wet processors (composite) 2/	2.9	4.4	1.4	4.1	2.9
Total industry*	5.4	4.6	2.8	4.4	4.4

1/ Returns on sales of each of the subcategories consist of medians.

2/ Returns on sales for wet processors (composite) consist of the average of all surveys.

Sources: Development Planning and Research Associates, Inc. Industry Survey results.
* Internal Revenue Service, Source Book of Income Statistics.

rate dropped to 2.8 percent. In 1977, the rate for the wet processors was slightly less than 3 percent compared to 4.4 percent for the industry. An examination of the median rates from the survey data reveals wide fluctuations within and among subcategories. The lowest rates and the widest fluctuations occurred within wool scouring with returns varying between 7.8 and -4.1 percent during the 1973-77 period. The lowest overall rates occurred in wool finishing. The most stable returns have occurred in carpet finishing with the median remaining above 3.0 percent during the period except for 1975 when it dropped to 1.6 percent.

c. Return on assets

As was shown in Table IV-17, the difference between the return on assets of the textile industry and of all manufacturing industries is somewhat less than the difference between the corresponding return on sales. This primarily reflects the labor intensity of the industry and the relative obsolesence of plant and equipment.

In light of the low profitability levels discussed above, the industry requires substantial increases in productivity in order to maintain its viability. To gain this productivity, the industry has shown evidence of significant modernization. Capital expenditures were expected to reach $1 billion in 1977 with over 80 percent of this funneled into modernization. Less than 20 percent of the outlay will involve expansion in capacities. Although the expenditures will increase dramatically, the expenditures as a percent of sales are expected to remain between 2.5 percent and 3.0 percent. Even though the projected outlay is about the same as the current level of depreciation for the entire industry, modernization is required most extensively in the smaller mills where the capital requirements will exceed the depreciation.

d. Return on equity

Return on equity within the textile industry has been significantly low in relation to that of all manufacturing as shown in Table IV-17. Over the past ten years, the rate of return on all manufacturing industries has fluctuated from 9.3 to 14.9 percent while that of the textile industry has ranged from a low of 4.4 percent in 1975 to 9.6 percent in 1974. According to The Value Line Investment Survey, the return on equity has been consistently rated low in comparison with 29 of the major manufacturing industries as indicated below.

Return on Net Worth - Textile Industry Ranking
(Among 29 industries)

1973	1974	1975	1976	1977
25	25	22	24	28

Source: The Value Line

Among the 500 largest industrials surveyed by Fortune, the median rates of return on stockholder's equity within the textile industry was among the lowest major industrial rates of return in 1975 (23rd out of 24), in 1976, 23 out of 25, and 24 out of 25 in 1977.

The returns on equity of mills within the minor industries has fluctuated over the past years with the knitting mills generally having the higher rates (except in 1975) as indicated below.

Minor Industry	Return on Equity 1972	1973	1974	1975
Weaving and finishing	5.4%	4.6%	13.7%	5.6%
Knitting	10.4%	7.8%	19.7%	---
Other	9.5%	3.8%	20.2%	0.5

Source: Troy's Almanac

6. Financial Structure

a. Liquidity

The liquidity of the textile industry is somewhat more favorable than that of total manufacturing as reflected in the current ratios listed below. For the past ten years, the current assets to current liabilities ratio of the textile industry has ranged between 2.2 and 2.4, somewhat higher than that of all manufacturing. Although this is favorable to the textile industry from the point of view of liquidity, it actually is brought about by the requirement for the textile mills to finance a greater portion of their investments from internally generated funds than from external investors.

Current Ratio - Liquidity
(ratios of current assets to current liabilities)

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
	(percent)											
All manufacturing	2.2	2.2	2.1	2.0	2.0	2.1	2.0	2.0	2.0	2.0	2.0	1.9
Textile industry	2.4	2.4	2.4	2.4	2.3	2.3	2.2	2.2	2.3	2.2	2.2	2.3

Source: FTC, Quarterly Financial Reports

Within the textile industry, liquidity has been slightly more favorable in the weaving mills and textile finishing than in the other segments, with ratios ranging from 2.0 to 2.1 between 1972 and 1974 according to Troy's Almanac. The knitting mills have shown somewhat less liquidity with ratios ranging between 1.7 to 1.8 during the same period.

b. Debt to equity

The financial structures of the firms in the manufacturing industries have shown significant changes over the past years with a trend towards a greater debt load. The debt to debt plus equity ratios of the textile industry have generally moved in consonance with the composite ratios of all manufacturing. In 1967, the ratio of all manufactures was slightly over 41 percent and increased to 48 percent in 1973. Since 1973, the ratios have decreased with the lack of availability of financing resulting from the recessionary period. The ratios within the textile industry have moved from 40.9 percent in 1967 to nearly 49 percent in 1973. The decline since 1973 has not been as abrupt for the textile industry as for all manufacturing which tends to illustrate the difficulty of firms in the industry to obtain equity funding as well as debt funding.

Debt to Debt Plus Equity

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
	(percent)											
All manufacturing	41.4	43.8	45.4	46.3	46.6	46.8	48.0	46.5	46.4	46.2	46.6	47.8
Textile industry	40.9	42.3	44.1	44.0	43.9	47.1	48.7	48.7	47.3	47.9	48.4	48.6

Source: FTC, Quarterly Financial Reports

Within the textile industry, the financial structure of the mills varies significantly between minor industries as shown below. The debt load in the knitting mills has been close to 60 percent. This indicates that the recent expansion in knitting equipment was facilitated by debt financing as opposed to equity financing. This again reflects the problems within the industry in obtaining support from the equity markets.

Debt to Debt Plus Equity

	1972	1973	1974	1975
	(percent)			
Weaving and finishing	41	41	41	44
Knitting	57	55	58	66
Others	47	55	50	54

Source: IRS, Source Book of Income Statistics

c. Debt structure

The current debt as a percentage of total liabilities within the textile industry has been slightly higher than for all manufacturing. As shown below, this percentage for the textile industry decreased from about 60 percent in 1967 to a low of almost 52 percent in 1971. Since 1971, it had increased to 57.4 percent by 1976. The increase indicated that current needs were being financed increasingly with short-term money during the period. This is contrary to what seems to be occurring in all manufacturing. The overall trend for most industries is typically toward increased financing through long-term debt.

Debt Structure
(Current debt to total debt)

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
	(percent)											
All manufacturing	55.6	54.7	55.0	53.3	52.1	52.6	55.1	53.8	50.4	50.8	51.0	52.3
Textile Industry	59.6	59.9	56.4	53.6	51.9	53.3	53.3	55.8	54.1	57.4	56.9	55.8

Source: FTC, Quarterly Financial Reports

d. Capital structure

During the period 1967-1978, the textile industry's long-term debt as a percent of long-term debt plus equity increased, from 22 percent to 29 percent as shown below. This again reflects the increasing difficulty of obtaining external financing through the equity markets within the industry.

Capital Structure
(Long-term debt to long-term debt plus equity)

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
	(percent)											
All manufacturing	24.1	26.1	27.2	28.7	29.5	29.4	29.3	29.5	29.2	28.1	28.8	31.3
Textile industry	21.8	22.7	25.6	27.0	27.4	29.3	30.8	28.7	30.0	29.7	28.8	29.5

Source: FTC, Quarterly Financial Reports

Among the minor industries, the capital structure varied significantly during the period. The weaving mills carried the lowest debt with a 21 percent load in 1969 and 21 percent in 1975. The knitting mills carried the highest load with its long-term debt increasing from 25 percent in 1969 to just under 40 percent in 1975. This reflects the volatility experienced within the knitting mills during the early 1970's associated with the rapid growth in the acquisition of new machines.

Capital Structure
(Long-term debt to long-term debt plus equity)

	1969	1970	1971	1972	1973	1974	1975
	(percent)						
Textile industry (composite)	22	24	24	25	28	28	26
Weaving and finishing	19	20	20	22	21	23	21
Knitting	25	27	34	34	34	41	38
Others	25	29	25	26	35	30	28

Source: IRS, Source Book of Income Statistics

7. Cost of Capital - After Tax

The current cost of capital was determined for purposes of this analysis by estimating various performance measures of the industry. The weights for the two respective types of capital for the textile industry were estimated utilizing the FTC data previously discussed, with the equity weight being 71 percent and the debt weight being 29 percent. The actual cost of debt was more difficult to estimate as the industry is comprised of a large number of diversified public firms and relatively specialized privately held firms. Accordingly, various equity cost-related measures were viewed including the averages of numerous published sources estimations of P/E and D/P ratios for the textile industry. From these sources, the cost of equity capital was determined to be approximately 9.5 percent.

To determine the weighted average current cost of capital, the before tax costs are adjusted to after-tax costs (debt capital only in this case). This is accomplished by multiplying the capital costs by one minus the tax rate (assumed to be 48 percent). These computations are shown below and result in the estimated current after-tax cost of capital being 8.3 percent.

Item	Weight	Before tax cost	Tax rate	After tax cost	Weighted cost
Debt	.29	10.0	0.48	5.2	1.5
Equity	.71	--	--	9.5	6.8
Cost of capital					8.3

It should be noted that this cost of capital estimate is not reflective of the industry's present capital costs but rather it is reflective of a long term capital cost including both highs and lows experienced by the industry.

8. Assessment of Ability to Finance New Investment

a. Financing new investment

The ability of a firm to finance new investment for pollution abatement is a function of several critical financial and economic factors. In general terms, new capital must come from one or more of the following sources:

(1) funds borrowed from outside sources; (2) equity capital through the sale of common or preferred stock; (3) internally generated funds--retained earnings and the stream of funds attributed to the depreciation of fixed assets.

For each of the three major sources of new investment, the most critical set of factors is the financial condition of the individual firm. For debt financing, the firm's credit rating, earnings record over a period of years, stability of earnings, existing debt-equity ratio, and the lenders' confidence in management will be major considerations. New equity funds through the sale of securities will depend upon the firm's future earnings as anticipated by investors, which in turn, will reflect past earnings records. The firm's record, compared to others in its own industry and to firms in other similar industries, will be a major determinant of the ease with which new equity capital can be acquired. In the comparisons, the investor will probably look at the trend of earnings for the past five or so years.

Internally generated funds depend upon the margin of profitability and the cash flow from operations. Also, in publicly-held corporations, stockholders must be willing to forego dividends in order to make earnings available for reinvestment.

The firm's industry and general economic conditions are also major considerations in attracting new capital. The industry will be compared to other similar industries in terms of net profits on sales and on net worth, supply-demand relationships, trends in production and consumption, the state of technology, impact of government regulations, foreign trade, and other significant variables. Declining or depressed industries are not good prospects for attracting new capital. At the same time, the overall condition of the domestic and international economy can influence capital markets. A firm is more likely to attract new capital during a boom period than during a recession. On the other hand, the cost of new capital will usually be higher during an expansionary period. Furthermore, the money markets play a determining role in new financing.

These general guidelines can be applied to the textile industry by looking at general economic data and industry performance over the recent past.

<u>b. General industry situation</u>

The textile industry experienced declining profitability during the 1973 to 1975 time period with profits as a percentage of sales declining from 2.9 percent in 1973 to 1.5 percent in 1976 (Table IV-21). However, in 1976, profits rose coinciding with general improvements in the overall domestic economy and in 1976 and 1977 the industry earned a 2.4 percent return on sales. This increased to 3.1 percent in 1978. As was shown in Table IV-16, the textile industry's profits have consistently been less than those experienced by the aggregated group of all industrial firms.

Table IV-21. The textile industry, general financial summary

	1972	1973	1974	1975	1976	1977	1978
Return on sales (%)	2.6	2.9	2.5	1.5	2.4	2.4	3.1
Return on assets (%)	4.0	4.7	3.8	2.2	4.2	4.5	5.9
Debt to equity ratio	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Current assets to current liabilities ratio	2.3	2.2	2.2	2.3	2.2	2.2	2.3

Source: Federal Trade Commission, Quarterly Financial Reports

Returns on assets for the textile industry are also shown on Table IV-21. The annual industry returns generally follow the same pattern as the industry's returns on sales. The industry's return on assets was 4.5 percent in 1977 and 5.9 percent in 1978.

Another factor relative to the industry's capability to finance new investments is the proportion of debt to equity the industry maintains. As shown in Table IV-21, the debt to equity ratio has remained constant since 1972 with debt representing 45 percent of the total of debt and equity.

Often, depending on the size of the investment, firms will choose short-term financing in lieu of long term debt financing. Relevant to such a situation is the industry's current ratio, that is, the ratio of the industry's current assets to its current liabilities. As depicted in Table IV-21, this ratio has been relatively constant since 1972 with current assets representing 2.2 to 2.3 times the current liabilities. The historical ratios indicate the industry has not experienced any industry-wide liquidity problems.

With regards to the future financial situation within the industry, Value Line projects gains in earnings for the next five years, particularly for the larger firms. With the exception of denim, most textile fabrics have strong future demand expectations, including polyester doubleknits. While knits have caused numerous problems in the recent past, the problems have been caused by overcapcity and not necessarily weak demand. During the past year or so, several large textile manufacturers have eliminated knit operations. Accordingly, with the supply/demand situation in better balance, the expectations for firms involved in knits are much brighter.

c. Expenditures for plants and equipment

Capital expenditures, as reported by the U.S. Department of Commerce, were relatively stable in the early 1960's, increasing slowly from approximately $326 million in 1960 to $382 million in 1963 (Table IV-22). Beginning in 1964 and continuing through 1966, capital expenditures increased, more than doubling in 1966 at $887 million. In 1967 and 1968, expenditures for capital improvements declined, and beginning in 1969, and continuing through 1974, capital expenditures increased every year over the previous years except in 1973. In 1974, the textile industry spent approximately $1.2 billion on capital improvements. In 1975, these expenditures declined to $997 million while in 1976 they increased to approximately $1.1 billion. In 1978, these expenditures amounted to about $1.4 billion.

Capital expenditures for the period 1970-1976 (expressed as a percent of sales) are compared below with depreciation. During the period, reinvestment has averaged about 92 percent of depreciation. This contrasts to the 1960's when reinvestment averaged about 120 percent of depreciation.

Table IV-22. The textile industry, total capital expenditures, 1960-76

Year	Capital Expenditures (Million $)
1960	326
1961	322
1962	376
1963	382
1964	504
1965	618
1966	887
1967	733
1968	691
1969	849
1970	811
1971	873
1972	1,127
1973	1,121
1974	1,169
1975	997
1976	1,087
1977	1,235
1978	1,371

Source: U.S. Department of Commerce

Comparison of Capital Expenditures
and Depreciation

	1970	1971	1972	1973	1974	1975	1976	1977	1978
Capital expenditures	2.6	2.7	3.0	2.7	2.7	2.3	2.4	3.2	3.4
Depreciation	2.9	2.9	2.8	2.9	2.8	2.9	2.5	2.5	2.5

Source: FTC Quarterly Financial Report and U.S. Department of Commerce.

As shown in Table IV-23, for 1975 and 1976, most of the industry's capital expenditures have been for new machinery and equipment. In 1976, for the total industry, new machinery and equipment expenditures represented 85 percent of the total industry expenditures with the remaining 15 percent representing expenditures predominantly for new structures and additions to existing facilities. The total capital expenditures and the various components for each of the major industry segments are also depicted in Table IV-23 for the years 1975 and 1976.

d. Capital availability

Recently, the textile industry has experienced a period of moderate growth coupled with relatively low profit levels. These factors have a considerable influence on the industry's ability to generate new capital for capital improvements and are expected to influence the industry's ability to finance investments for pollution controls as well as investments for other regulatory requirements.

The industry has a large number of family-owned (or controlled) facilities, especially in the small and medium size categories. Most of the larger mills are a part of larger multi-plant corporations. The family-owned mills are largely financed with internal capital and maintain relatively low levels of long-term debt. While new capital expenditures have increased during the past 15 years, expenditures during the past 5 years have somewhat stabilized.

The extent to which investment requirements will impose capital problems on the mills will depend on the individual mills' financial situations as well as the size of the investment requirements. Some problems are anticipated for some plants in the industry in their attempts to obtain capital. Others, particularly the more profitable and, perhaps, the larger mills, are not expected to encounter much difficulty. Potential sources of financing available to the industry include internal financing, banks and fiduciaries, stock or bond issues, or small business loans obtainable through the U.S. Environmental Protection Agency.

Table IV-23. The textile industry, expenditures for new plants and equipment, 1975-76

Segment	SIC	Total New Expenditures		New Structures and Additions to Plants		New Machinery and Equipment	
		1975	1976	1975	1976	1975	1976
		(Million Dollars)					
Textile Mills Products Industry	22	996.7	1,087.4	222.0	163.3	774.8	924.1
Weaving Mills, Cotton	221	133.4	124.3	24.0	15.4	109.4	108.9
Weaving Mills, Manmade Fiber & Silk	222	192.2	245.6	31.9	16.8	160.3	228.8
Weaving Mills, Wool	223	10.9	41.7	2.0	12.5	8.9	29.1
Narrow Fabric Mills	224	12.1	11.3	2.2	2.2	9.9	9.1
Knitting Mills	225	228.3	203.8	66.8	38.7	161.6	165.1
Dyeing & Finishing Mills	226	91.5	116.7	19.5	20.0	72.0	96.8
Floor Covering Mills	227	52.6	60.4	14.6	9.8	38.0	50.6
Yarn & Thread Mills	228	160.5	166.6	23.7	23.7	136.8	142.9
Miscellaneous Textile Goods	229	115.3	116.9	37.4	29.1	77.9	92.8

Source: U.S. Department of Commerce.

V. PRICES AND PRICE DETERMINATION

Textile product prices have increased during the past decade, however the rates of price increases have lagged behind those of most other manufactured products. The major reasons for the restraint in textile price increases are generally a result of stiff competition between fiber types and competition from less expensive textile imports. Improvements in the industry's production efficiency, especially in the man-made fiber mills, also has helped to minimize required price increases. Prices in the textile industry are determined through the interaction of numerous factors which effect both its supply and demand characteristics. Demand has been strong in recent years due to increases in the general population as well as increases in the per capita textile purchases, this has caused the industry to operate at its highest historical production level. Prices are also influenced by occurences such as strikes, oil shortages, and by government price supports and regulations.

In this chapter the major pricing processes are discussed including reviews of supply and demand relationships, the price determination processes, and trends in prices of raw materials and finished textile goods.

A. Supply and Demand Relationships

The supply and demand for textile fibers and goods are based on a number of price and non-price factors which have changed over time. For example, the uncertain supply and price fluctuations associated with cotton were withstood for many years until man-made fibers offered mills a relatively steady source of raw materials. As man-made fiber prices declined and their quality improved, their use was even more attractive and their demand by textile mills and consumers increased. Today, if cotton prices were to decline to levels below those of man-made fibers, textile mills would in all probability continue to predominately utilize man-made fibers because of their long run price and supply stability as well as consumer acceptance of man-made fibers.

While man-made fibers have moved rapidly into many major markets; most are utilized in the manufacture of apparel and home furnishings. Likewise, the major use of natural fibers such as cotton and wool is for the manufacture of apparel. Cotton was the major textile input in 1965, supplying 51 percent of the fiber used, but its use fell to 26 percent by 1977. In that same time period, the use of man-made fibers grew from 23 to 73 percent of all fibers used for textile goods.

1. Supply

The raw materials for textile fibers are predominately derived from four resources: animal hair, cotton, plant cellulose, and petroleum chemicals. Wool and cotton originate at farms and their production is dominated by natural factors. Man-made fibers are less vulnerable; the only major condition to production being the availability of plant cellulose and oil. The supply of finished goods depends upon the price and availability of fibers, the technology available, and the financial condition of the mills.

Imports of raw materials have little effect on domestic supplies with wool being the only fiber imported in significant quantities. However, imports of foreign semi-manufactured and manufactured products are commanding an increasing share of the U.S. market, which reduces the demand for U.S. fiber in turn.

a. Raw materials

Raw material supplies have changed in character over the past decade as the gap left by wool, cotton, and rayon and acetate has been filled by non-cellulosic fibers. Sheep raised and consequently, the wool supply has declined to about half its level from 1965. The amount of cotton planted, harvested, and produced has remained steady. Among the man-made materials, the rayon and acetate group has declined, while non-cellulosic fibers have increased dramatically.

Wool. The supply of wool has declined steadily since 1965 (Table V-1). Among the reasons for the drop are a decreasing demand for wool fabrics and the rising value of sheep meat. Some ranchers are raising sheep for meat rather than wool while others are completely switching from raising sheep to cattle. In 1965, ranchers raised 25,127,000 sheep and lambs and of these 23,756,000 were shorn. By 1977 this number had fallen to 12,766,000 sheep and lambs raised with 13,191,000 shorn. Reported wool produced dropped from 224,763,000 pounds to 108,627,000 pounds between 1965 and 1977.

Domestically raised sheep have a tendency to produce less wool than sheep in most other wool producing countries. This has been due, in part, to an increased emphasis on meat carcass quality at the expense of wool quality and yields.1/ To offset this, the U.S. government has encouraged increased wool production by enacting and updating its price support programs. The original goal of the first program, the National Wool Act of 1954, was to guarantee wool growers a minimum price at which their wool could be sold, which in turn, encourages an increase in annual production. This price support program has been extended several times with the most recent extension to continue thorugh 1981. In this program the difference between the actual average selling price and the guaranteed price level paid to the growers is derived from customs duties collected on imported wool and wool products.

1/ Ward, Lionel E., "Interfiber Competition With Emphasis on Cotton", Ann Arbor: University Microfilms International, 1969.

Table V-1. Number of sheep and lambs, sheep and lambs shorn, and production in the United States, 1965-1978

Year	All sheep and lambs	Sheep and lambs shorn 1/	Reported wool production
	(1,000 head)	(1,000 head)	(1,000 pounds)
1965	25,127	23,756	224,763
1966	24,734	22,923	219,153
1967	23,898	22,056	211,384
1968	22,140	20,759	197,896
1969	21,238	19,584	182,849
1970	20,423	19,163	176,787
1971	19,686	19,036	172,157
1972	18,710	18,816	168,618
1973	17,724	17,598	153,239
1974	16,394	16,142	138,663
1975	14,512	14,403	124,835
1976	13,311	13,669	114,817
1977	12,766	13,191	108,627
1978	12,348	12,452*	99,146

1/ Includes sheep shorn at commercial feed lots.
* Estimate
Source: U.S. Department of Agriculture, *Cotton and Wool Situation*, May 1978.

Wool produced in the U.S. is typically apparel quality wool, therefore, in order to protect domestic production, imported apparel wools are subject to a duty of 25.5 cents per pound. Carpet class wools are not produced in this country so fibers imported for carpet use are not dutiable In 1965, 33 percent of the total U.S. wool supply was imported for apparel (Table V-2). Imports declined annually until 1974, when a low of 11,800,000 pounds, or 7 percent of the total supply was reached. Since 1974, wool imports, which are mainly from Australia and New Zealand, rose and today imported wool for apparel represents over 21 percent of the total U.S. wool supply. This is due, as previously mentioned, to the curtailment of wool production by domestic producers. The quantity of carpet wool imported to the United States for rugs and carpeting however, has declined with the expansion of man-made fibers into these markets. Also shown in Table V-2, between 1965 and 1977, carpet wool supplies fell from 108,943,000 pounds to 18,780,000 pounds. The total U.S. wool supply has declined from 496,343,000 pounds in 1965 to 161,582,000 pounds in 1977, a reduction of 67 percent.

Cotton. As depicted in Table V-3, the supply of cotton has vacillated within the past decade. In 1965, 14,152,000 acres of cotton were planted, compared with 13,369,000 acres in 1978. During that time, plantings have fluctuated decreasing to about 9 million acres in 1967 and 1975 then increasing to around 14 million acres in 1972 and 1978. Until the late 1960's the market situation was usually one of oversupply with prices varying only a few cents from year to year. United States' price controls, supports, and subsidies, created in the 1930's, left the government with large surpluses of raw cotton which it would dispose of randomly, depressing the domestic and world cotton markets. In the late 1960's, the government altered its policy and held smaller surplus stocks, making cotton production and pricing more sensitive to real changes in supply and demand. Increased demand and higher prices encouraged oversupply, followed by declines in price, plantings, and supply shortages.

Acres of cotton planted is at the discrimination of the crop producers, with weather and insects affecting the level of production. Cotton production is also influenced by various government programs designed to control supply and support prices. Several control methods have been employed since government programs began in 1933. Among the programs initiated were acreage allotments, payments for acreage diversion or soil conservation, direct payments, and Commodity Credit Corporation non-recourse loans. One program in particular, the Food and Agriculture Act of 1977, has provisions covering cotton for the next four years. Average loan rates and a target price of 52 cents per pound for upland cotton have been established. Total deficiency payments to producers will be limited to $40,000 in 1978. All program benefits will be based on planted acres rather than an allotment system.

The total supply of cotton in the United States decreased by nearly one-third from 1965 to 1967. Since 1967, however, the supply has remained relatively stable, varying between 15 and 17 million bales available annually. Table V-4 depicts the annual supply of cotton in the United States as well as showing the relatively importance of beginning stocks

Table V-2. Sources of raw wool in the United States, 1965-1977

Year	Apparel Wool: Domestic supply (1,000 pounds)	Domestic supply Percent	Dutiable imports[1/] (1,000 pounds)	Dutiable imports Percent	Total apparel wool (1,000 pounds)	Total apparel wool Percent	Carpet wool[2/] (1,000 pounds)	Carpet wool Percent	Total supply (1,000 pounds)	Total supply Percent
1965	224,763	45.3	162,637	32.8	387,400	78.1	108,943	21.9	496,343	100.0
1966	219,153	44.2	162,537	32.7	381,690	76.9	114,625	23.1	496,315	100.0
1967	211,384	53.0	109,071	27.4	320,455	80.4	78,205	19.6	398,660	100.0
1968	197,896	44.3	129,717	29.0	327,613	73.3	119,599	26.7	447,212	100.0
1969	182,849	49.1	93,523	25.1	276,372	74.3	95,664	25.7	372,036	100.0
1970	176,787	53.6	79,810	24.2	256,597	77.8	73,325	22.2	329,922	100.0
1971	172,157	57.6	42,682	14.3	214,839	71.9	83,893	28.1	298,732	100.0
1972	168,618	63.6	24,790	9.3	193,408	72.9	71,849	27.1	265,257	100.0
1973	153,239	71.8	19,587	9.2	172,826	80.9	40,694	19.1	213,520	100.0
1974	138,663	83.7	11,800	7.1	150,463	90.9	15,147	9.1	165,610	100.0
1975	124,835	78.8	16,605	10.5	141,440	89.3	17,021	10.7	158,461	100.0
1976	114,817	66.6	38,387	22.3	153,204	88.9	19,076	11.1	172,280	100.0
1977	108,627	67.2	34,175	21.2	142,802	88.4	18,780	11.6	161,582	100.0
1978*	99,146	78.6	26,998	21.4	126,144	NA	NA	NA	NA	NA

1/ Apparel wool is dutiable, 25.5 cents per pound (clean basis)

2/ Carpet wool is duty-free since none is produced in the U.S.

* Estimate

Source: U.S. Department of Agriculture, *Cotton and Wool Situation*.

Table V-3. U.S. Cotton: acreage planted and harvested, yield per acre on harvested acreage and production

Year	Planted acreage	Harvested acreage	Yield per acre	Production
	1,000 acres	1,000 acres	pounds	1,000 bales
1965	14,152	13,615	498	14,973
1966	10,349	9,552	480	9,557
1967	9,448	7,997	447	7,443
1968	10,912	10,160	516	10,926
1969	11,882	11,055	434	9,990
1970	11,945	11,155	438	10,192
1971	12,355	11,471	438	10,477
1972	14,001	12,984	507	13,704
1973	12,480	11,970	520	12,974
1974	13,699	12,567	441	11,540
1975	9,493	8,796	453	8,302
1976	11,656	10,914	465	10,581
1977	13,372	12,814	520	13,202
1978	13,369	12,367	421	10,841

Source: U.S. Department of Agriculture, Cotton and Wool Situation, February, 1979.

Table V-4. Cotton fiber, total United States supply, 1965-1978

	Beginning stocks		Annual production		Imports		Total supply	
Year	1,000 Bales 1/	Percent	1,000 Bales 1/	Percent	1,000 Bales 1/	Percent	1,000 Bales 1/	Percent
1965/66	14,249	48.6	14,938	51.0	118	0.4	29,305	100.0
1966/67	17,078	63.9	9,557	35.7	105	0.4	26,740	100.0
1967/68	12,344	61.9	7,443	37.3	149	0.7	19,936	100.0
1968/69	6,584	37.5	10,926	62.2	68	0.4	17,578	100.0
1969/70	6,544	39.5	9,990	60.2	52	0.3	16,586	100.0
1970/71	5,843	36.4	10,192	63.4	37	0.2	16,072	100.0
1971/72	4,203	28.5	10,477	71.0	72	0.5	14,752	100.0
1972/73	3,258	19.2	13,704	80.6	34	0.2	16,996	100.0
1973/74	4,221	24.5	12,974	75.2	48	0.3	17,243	100.0
1974/75	3,808	24.8	11,540	75.0	34	0.2	15,382	100.0
1975/76	5,708	40.4	8,302	58.9	92	0.7	14,102	100.0
1976/77	3,681	25.7	10,581	74.0	38	0.3	14,300	100.0
1977/78	2,928	16.8	14,496	83.1	20	0.1	17,444	100.0

1/ One bale equals 480 pounds

Source: U.S. Department of Agriculture, *Cotton and Wool Situation* (predominately government-owned surplus cotton) and imports. As shown, in 1965, surplus cotton represented nearly 50 percent of the total cotton available that year. By 1977, surplus cotton represented only 16.8 percent of the total supply.

Imports of raw cotton to the United States have historically remained of relatively little significance, accounting for less than 1.0 percent of the total annual supply.

Man-made fibers. Unlike the natural fibers, the supply of man-made fibers has increased dramatically, from 2.4 million pounds in 1965 to 8,927 million pounds in 1978. These gains have not been shared by all types of man-made fibers, with the supply of textile glass and non-cellulosic fibers rising, while the supply of rayon and acetate has fallen (Table V-5). Production of man-made fibers is cheaper, less risky, and more adaptable to new technologies than the natural fibers. The quality of these fibers is constantly improving, often imitating or combining with natural fibers thereby discovering new uses and creating greater demand.

If companies over-anticipate projected demands in one period, future production must be reduced in the next period to prevent huge inventories and potential losses. In 1966, 332 million pounds of non-cellulosic fiber were produced while there was a capacity for 471 million pounds (Table V-5). In 1977, manufacturers had the capacity to produce 1,051 million pounds but actually only produced 787 million pounds of non-cellulosic fiber. Consequently these plants are capable of increasing the supply of fibers if the demand necessitates it. The major limiting factor in the supply of man-made raw fibers is the shortage or extreme price increase of petroleum chemicals.

Only a small portion of the U.S. man-made fiber supply is imported. In 1965, 160 million pounds of these fibers were imported, increasing to only 202 million pounds in 1978 (Table V-5). Before 1971, the amount of textile glass fiber imported was insignificant, but it is presently becoming increasingly more important. Rayon and acetate fiber quantities have wavered over the years while non-cellulosic fiber imports grew until 1972 and then began declining. In 1965, imports supplied 5.4 percent of the man-made fiber available in the U.S. In 1978, that amount dropped to 2.3 percent. From this data it can be seen the main import competition for man-made fibers has been in the form of finished apparel and goods, not as fibers.

b. Finished goods

The available supply of finished textile goods has increased from 9,050 million pounds of goods in 1965 to 13,516 million pounds in 1977. As shown in Table V-6, while the overall supply of textile goods has increased since 1965, the composition of the goods have changed significantly, including the increasing importance of imported textile goods. The following depicts the major fiber types of finished goods.

Table V-5. Man-made fibers: Total U.S. supply, 1965-1978.

Year	Textile glass: Domestic production	Textile glass: Imports	Textile glass: Total	Rayon and Acetate: Domestic production	Rayon and Acetate: Imports	Rayon and Acetate: Total	Non-cellulosics: Domestic production	Non-cellulosics: Imports	Non-cellulosics: Total	Total man-made fibers: Domestic production	Total man-made fibers: Imports	Imports as percent of total domestic production
	(million pounds)											(percent)
1965	282	*	282	927	85	1,012	1,777	75	1,852	2,986	160	5.4
1966	332	*	332	892	121	1,013	2,069	96	2,165	3,293	217	6.6
1967	308	*	308	822	95	917	2,191	110	2,301	3,321	205	6.2
1968	402	*	402	899	142	1,041	2,969	169	3,138	4,270	311	7.3
1969	501	*	501	774	97	871	3,262	134	3,396	4,537	231	5.1
1970	467	*	467	1,373	85	1,458	3,327	224	3,551	5,161	309	6.0
1971	468	2	470	1,392	88	1,480	3,975	386	4,361	5,835	476	8.2
1972	572	9	581	1,394	63	1,457	4,944	405	5,349	6,910	477	6.9
1973	688	13	701	1,357	66	1,423	5,822	333	6,155	7,867	412	5.2
1974	683	12	695	1,199	48	1,247	5,698	212	5,903	7,580	272	3.6
1975	547	9	556	749	47	796	5,391	134	5,525	6,687	190	2.8
1976	676	14	690	841	69	910	6,052	162	6,214	7,559	245	3.2
1977	787	23	810	888	82	970	6,691	169	6,860	8,366	274	3.3
1978	928	22	950	905	67	972	7,084	113	7,197	8,927	202	2.3

* denotes less than 0.5 million pounds

Source: Textile Economic Bureau, Inc., Textile Organon

Man-made fibers, capacity, production, and utilization, 1973-1977 and projections for 1978 and 1979.

Year	Textile glass: Capacity	Textile glass: Production	Textile glass: Utilization	Rayon and Acetate: Capacity	Rayon and Acetate: Production	Rayon and Acetate: Utilization	Non-cellulosic: Capacity	Non-cellulosic: Production	Non-cellulosic: Utilization	Total: Capacity	Total: Production	Total: Utilization
	million pounds	million pounds	percent	million pounds	million pounds	percent	million pounds	million pounds	percent	million pounds	million pounds	percent
1973	742	688	92.7	1,514	1,357	89.6	6,149	5,822	94.7	8,405	7,867	93.6
1974	780	683	87.6	1,503	1,199	79.8	6,898	5,698	82.6	9,181	7,580	82.6
1975	969	547	56.4	1,489	749	50.3	8,313	5,391	64.9	10,771	6,687	62.1
1976	932	676	72.5	1,243	841	67.7	7,770	6,052	77.9	9,945	7,569	76.1
1977	1,051	787	74.9	1,243	888	71.4	8,680	6,691	77.1	10,974	8,366	76.2
1978*	1,085	NA	NA	1,069	NA	NA	8,316	NA	NA	10,470	NA	NA
1979*	1,406	NA	NA	1,069	NA	NA	8,885	NA	NA	11,360	NA	NA

* Projected

NA denotes not available

Source: Textile Economic Bureau, Inc., Textile Organon.

Table V- 6. Total fiber equivalent of textile products available in the United States' markets, 1965-1977.

Year	Wool: U.S. mill consumption	Wool: % of total wool	Wool: Wool imports	Wool: % of total wool	Wool: Total wool available	Wool: Total wool as % of total supply	Cotton: U.S. mill consumption	Cotton: % of total cotton	Cotton: Cotton imports	Cotton: % of total cotton	Cotton: Total cotton available	Cotton: Total cotton as % of total supply
	(mil lbs)	(%)	(mil lbs)	(%)	(mil lbs)	(%)	(mil lbs)	(%)	(mil lbs)	(%)	(mil lbs)	(%)
1965	387	71.3	156	28.7	543	6.0	4,453	92.5	361	7.5	4,814	53.2
1966	370	72.1	143	27.9	513	5.3	4,621	90.1	510	9.9	5,131	52.6
1967	312	71.7	123	28.3	435	4.5	4,414	90.9	443	9.1	4,857	50.2
1968	230	61.2	146	38.8	376	3.6	4,104	89.6	474	10.4	4,578	43.8
1969	313	70.7	130	29.3	443	4.1	3,973	89.1	488	10.9	4,461	41.6
1970	240	67.4	116	32.6	356	3.4	3,774	89.1	463	10.9	4,237	40.7
1971	191	68.0	90	32.0	281	2.4	3,965	88.9	493	11.1	4,458	38.0
1972	219	69.7	95	30.3	314	2.4	3,850	86.3	611	13.7	4,461	34.8
1973	151	62.7	90	37.3	241	1.8	3,643	86.6	564	13.4	4,207	31.0
1974	93	55.7	74	44.3	167	1.4	3,306	86.8	503	13.2	3,809	31.6
1975	110	61.8	68	38.2	178	1.5	3,069	86.0	501	14.0	3,570	30.9
1976	122	55.5	98	44.5	220	1.7	3,389	82.7	709	17.3	4,098	31.9
1977	108	48.0	117	52.0	225	1.7	3,170	82.6	669	17.4	3,839	28.4

Year	Man-made: Rayon and acetate mill consumption	Man-made: % of total man-made	Man-made: Non-cellulosic mill consumption	Man-made: % of total man-made	Man-made: Man-made imports	Man-made: % of total man-made	Man-made: Total man-made available	Man-made: Total man-made as % of total supply	Total available: Total mill consumption	Total available: % of total supply	Total available: Total imports	Total available: % of total supply	Total available: Total available supply
	(mil lbs)	(%)	(mil lbs)	(%)	(mil lbs)	(%)	(mil lbs)	(%)	(mil lbs)	(%)	(mil lbs)	(%)	(mil lbs)
1965	1,593	43.1	2,021	54.7	79	2.2	3,693	40.8	8,454	93.4	596	6.6	9,050
1966	1,623	39.5	2,367	57.5	123	3.0	4,113	42.2	8,981	92.0	776	8.0	9,757
1967	1,520	34.7	2,725	62.2	139	3.1	4,384	45.3	8,971	92.7	705	7.3	9,676
1968	1,711	31.1	3,595	65.4	193	3.5	5,499	52.6	9,640	92.2	813	7.8	10,453
1969	1,624	28.0	3,928	67.6	258	4.4	5,810	54.2	9,838	91.8	876	8.2	10,714
1970	1,426	24.5	4,075	69.9	329	5.6	5,830	55.9	9,515	91.3	908	8.7	10,423
1971	1,506	21.6	5,024	72.0	451	6.5	6,981	59.6	10,686	91.2	1,034	8.8	11,720
1972	1,428	17.7	6,138	76.3	480	6.0	8,046	62.8	11,635	90.7	1,186	9.3	12,821
1973	1,389	15.2	7,275	79.7	465	5.1	9,129	67.2	12,458	91.8	1,119	8.2	13,577
1974	1,107	13.7	6,591	81.7	371	4.6	8,069	67.0	11,097	92.1	948	7.9	12,045
1975	802	10.3	6,614	84.6	400	5.1	7,816	67.6	10,595	91.6	969	8.4	11,564
1976	855	10.0	7,198	84.4	480	5.6	8,533	66.4	11,564	90.0	1,287	10.0	12,851
1977	869	9.2	8,032	85.2	531	5.6	9,432	69.9	12,179	90.2	1,317	9.8	13,496

Source: U.S. Department of Agriculture, Cotton and Wool Situations, and Textile Economic Bureau, Inc., Textile Organon.

Wool goods. The current supply of wool goods has decreased to about one-half the amount available in 1965. The decline in availability of wool has occurred both for wool imported into the United States and domestically produced wool products. Also the proportion of the total available textile goods supply represented by wool has declined; from 6.0 percent in 1965 to 1.8 percent in 1977. In 1965, the total domestic supply consisted of 543 million pounds of wool (Table V-6). Of this 1965 supply, 387 million pounds or 71 percent of the total, were provided by domestic mills with the remainder being accounted for by imported woolen products. In 1977, the total wool supply available declined to 245 million pounds with domestic mills accounting for 44 percent of the total and imports accounting for 56 percent.

Table V-7 indicates that of the total 129.4 million pounds of raw wool equivalent imported into the United States in 1978, nearly 75 percent (96.9 million pounds) was in the form of manufactured woolen products with the remainder being in raw wool or semi-manufactured form. As illustrated in the table, the percentage of manufactured wool imports has increased, from 65 to 70 percent in the late 1960's to around 80 percent in 1975-1978.

Table V-8 depicts U.S. mill consumption of raw wool on a scoured basis from 1965 to 1978. As shown, in 1978, 89 percent of all wool consumed was for apparel fabrics with the remainder being consumed by wool carpet mills. Historically, carpet mills utilized considerably more wool; now, however, their consumption of wool has declined from 112 million pounds in 1965 to approximately 13 million pounds in 1978.

Wool is predominately manufactured into broad woven fabrics and carpets and rugs. The majority of woolen and worsted fabrics are used in the manufacture of women's and children's apparel, followed by apparel for men and boys. As shown in Table V-9, production of woolen and worsted fabrics have declined from 267.3 million linear yards in 1965 to a low of 78.9 million yards in 1975. Since 1975 the production of these woolen fabrics has increased such that in 1978, 116.6 million linear yards were produced. This recent increase has been attributed to the economic recovery of the nation's general economic state coupled with the increased consumer demand for natural fibers.

Cotton goods. The total supply of cotton available in the U.S. has declined in recent years from 4,814 million pounds in 1965 to 3,839 million pounds in 1977 (Table V-6). While most cotton goods are domestically manufactured, the proportion of the U.S. total cotton products' supply accounted for by imported cotton goods has increased, rising from 7.5 percent of the total cotton goods supply available in 1965 to 17.4 percent in 1977. This rise in the proportion of cotton imports represents the near doubling of the quantity of cotton imported between 1965 and 1977, and the decline of domestic cotton supplied by over 25 percent. In 1965, domestic cotton accounted for 4,453 million pounds and imports, 361 million pounds. By 1977, domestic cotton had declined to 3,170 million pounds while cotton imports increased to 669 million pounds.

Table V-7. Raw wool equivalent of wool imports, 1965-1978.

Year	Semi-manufactured 1,000 pounds	Semi-manufactured Percent	Manufactured 1,000 pounds	Manufactured Percent	Total wool imports 1,000 pounds	Total wool imports Percent
1965	45,047	28.9	111,069	71.7	156,116	100.0
1966	48,167	33.7	94,691	66.3	142,858	100.0
1967	39,798	32.2	83,636	67.8	123,434	100.0
1968	50,168	34.4	95,799	65.6	145,967	100.0
1969	42,295	32.6	87,375	67.4	129,670	100.0
1970	36,441	31.3	80,119	68.7	116,560	100.0
1971	22,137	24.7	67,568	75.3	89,705	100.0
1972	15,502	16.3	79,875	83.7	95,377	100.0
1973	17,729	19.7	72,233	80.3	89,962	100.0
1974	15,166	20.4	59,059	79.6	74,225	100.0
1975	12,819	18.7	55,603	81.3	68,422	100.0
1976	17,988	18.2	80,591	81.8	98,579	100.0
1977	25,295	21.7	91,311	78.3	116,606	100.0
1978	32,465	25.1	96,904	74.9	129,369	100.0

Source: U.S. Department of Agriculture, Cotton and Wool Situation

Table V-8. United States' mill consumption of raw wool, scoured basis, 1965-1978.

Year	Apparel wool Million pounds	Apparel wool Percent	Carpet wool Million pounds	Carpet wool Percent	Total consumption Million pounds	Total consumption Percent
1965	275	71.1	112	28.9	387	100.0
1966	266	71.9	104	28.1	370	100.0
1967	229	73.2	84	26.8	313	100.0
1968	238	72.1	92	27.9	330	100.0
1969	219	70.0	94	30.0	313	100.0
1970	164	68.0	77	32.0	241	100.0
1971	116	60.7	75	39.3	191	100.0
1972	142	65.1	76	34.9	218	100.0
1973	110	72.8	41	27.2	151	100.0
1974	75	80.6	18	19.4	93	100.0
1975	94	85.5	16	14.5	110	100.0
1976	107	87.7	15	12.3	122	100.0
1977	95	88.0	13	12.0	108	100.0
1978	102	88.7	13	12.3	115	100.0

Source: U.S. Department of Agriculture, Cotton and Wool Situation

Table V-9. U.S. broad woven goods and tire cord production, 1965-1978

Year	Broad woven goods				
	Woolen and worsted fabrics	Cotton fabrics	Man-made fiber fabrics	Total	Total tire cord and tire fabrics
	(million linear yards)				(million pounds)
1965	267.3	9,237.8	3,899.2	13,404.3	495.8
1966	264.9	8,839.8	4,208.5	13,313.2	526.2
1967	238.6	8,278.1	4,216.5	12,733.2	471.9
1968	245.1	7,465.7	5,243.0	12,953.8	573.8
1969	222.5	6,968.0	5,378.5	12,569.0	641.0
1970	178.6	6,245.9	5,017.3	11,441.8	582.2
1971	112.6	6,147.5	4,870.5	11,130.6	622.9
1972	102.5	5,614.3	5,552.9	11,269.7	674.6
1973	106.0	5,085.7	6,088.4	11,280.1	685.6
1974	81.0	4,713.6	5,860.1	10,654.7	650.1
1975	78.9	4,094.7	5,278.3	9,451.9	523.0
1976	97.3	4,546.3	6,113.5	10,757.0	538.2
1977	101.7	4,371.9	6,220.4	10,694.0	605.4
1978	116.6	3,988.6	6,622.5	10,727.7	627.0

Source: U.S. Department of Agriculture, Cotton and Wool Situation

Of the 799 million pounds of cotton goods imported into the United States in 1978, Table V-10 depicts that 520.8 million pounds (65.2 percent) were in the form of manufactured cotton products (primarily apparel) with the remainder being predominately woven cotton cloth (30.9 percent). Since 1965, the proportion of imported cotton in manufactured form has increased (from about 40 percent in 1965); the proportion represented by woven cotton cloth has decreased (from about 50 percent in 1965); and the proportion of cotton yarn has decreased (from about 6.8 percent in 1965 and 20.0 percent in 1966). Imported cotton thread, which has consistently represented approximately 0.1 percent of the total cotton imported, has varied, in quantity, from year to year but usually ranged between 300,000 and 450,000 pounds annually.

As shown in Table V-11, the majority of domestically fabricated cotton is manufactured into cotton broad woven fabrics. In 1978, domestic mills consumed an estimated 6.3 million bales of cotton. Of this amount, almost 4.0 million bales (58.0 percent) were for cotton broad woven fabrics with 1.2 million bales (19.7 percent) being utilized for polyester/cotton blended fabrics while 1.4 million bales (22.3 percent) were utilized for other cotton textile products. When compared to data for 1978, the total estimated mill consumption was 32 percent higher in 1967 at 8.9 million bales with over 82 percent (7.3 million bales) of that amount being utilized in cotton broad woven fabrics, 4.8 percent (0.4 million bales) in blends, and 13.1 percent (1.2 million bales) being utilized in other cotton textile products. These changes in respective proportions reflect the decline in the number of bales of cotton utilized for broad woven fabrics since 1967 and the increase in the use of cotton in polyester/cotton blended fabrics.

The decline in the quantities of cotton broad woven fabrics was also illustrated in Table V-9. As shown in the table, in 1965, cotton fabrics accounted for 9.2 billion linear yards or 69 percent of the total 13.4 billion yards of broad woven fabrics produced. However, by 1978, cotton fabrics accounted for only 4.0 billion yards or 37 percent of the total 10.7 billion yards of broad woven fabrics produced. This decline in the use of cotton was fairly steady from 1965 to 1975 when cotton broad woven fabrics reached its all time production low since 1965. Since 1975 however, the quantity of cotton used increased slightly and appears to have somewhat leveled off in 1978.

Man-made goods. The total supply of man-made fiber goods has experienced tremendous growth in recent years with the quantity of man-made goods available increasing by nearly three times, from 3.7 billion pounds in 1965 to 9.4 billion pounds of goods in 1977 (Table V-6). In terms of the market share, man-made goods represented 40.8 percent of the total textile goods supply in 1965 which increased 69.8 percent by 1977.

As also shown in Table V-6, of the total man-made goods available in 1965, rayon and acetate goods represented 43.1 percent, non-cellulosic goods represented 54.7 percent, and imports represented 2.2 percent. By 1977, the proportion of rayon and acetate goods had declined to only 9.2 percent and non-cellulosic goods increased their share to 85.2 percent. During the same period imports also increased their respective share, from 2.2 percent in 1965 to 5.6 percent in 1977.

Table V-10. Raw cotton equivalent of U.S. cotton imports for consumption by cotton manufacturers, 1965-1978.

Year	Yarn		Thread		Woven cloth		Primary manufactured products		Total	
	1,000 pounds	Percent	1,000 pounds	Percent	1,000 pounds	Percent	1,000 pounds	Percent	1,000 pounds	Percent
1965	24,414	6.8	324	0.1	178,397	49.4	157,575	43.7	360,710	100.0
1966	101,919	20.0	345	0.1	228,222	44.7	179,811	35.2	510,297	100.0
1967	43,620	9.8	277	0.1	213,916	48.2	185,572	41.9	443,385	100.0
1968	57,217	12.1	456	0.1	210,918	44.5	205,255	43.3	473,846	100.0
1969	31,049	6.4	337	0.1	243,776	50.0	212,735	43.6	487,897	100.0
1970	24,338	5.3	377	0.1	236,052	51.0	202,410	43.7	463,177	100.0
1971	31,734	6.4	296	0.1	241,338	49.0	219,208	44.5	492,576	100.0
1972	39,421	6.5	334	0.1	313,277	51.3	257,671	42.2	610,703	100.0
1973	25,563	4.5	373	0.1	303,502	53.9	234,063	41.5	563,501	100.0
1974	13,025	2.6	336	0.1	259,480	51.6	229,838	45.7	502,679	100.0
1975	11,334	2.3	341	0.1	222,122	44.3	267,455	53.4	501,252	100.0
1976	25,688	3.6	474	0.1	318,634	45.0	363,805	51.3	708,601	100.0
1977	13,126	2.0	330	---	238,648	35.7	417,303	62.3	669,407	100.0
1978	30,334	3.8	427	0.1	247,051	30.9	520,835	65.2	798,647	100.0

Source: U.S. Department of Agriculture, Cotton and Wool Situation

Table V-11. Estimated U.S. mill consumption of raw cotton, by major textile product type, 1967-1978.

Year	Cotton broadcloth fabrics		Polyester/cotton blended fabrics		Other textile products		Total estimated consumption	
	1,000 bales 1/	Percent	1,000 bales 1/	Percent	1,000 bales	Percent	1,000 bales	Percent
1967	7,319	82.1	428	4.8	1,173	13.1	8,920	100.0
1968	6,614	77.5	699	8.2	1,225	14.3	8,538	100.0
1969	6,240	75.6	795	9.6	1,218	14.8	8,253	100.0
1970	5,845	74.7	837	10.7	1,143	14.6	7,825	100.0
1971	5,392	64.4	835	10.0	2,149	25.6	8,376	100.0
1972	5,055	62.8	941	11.7	2,053	25.5	8,049	100.0
1973	4,534	59.7	1,114	14.7	1,949	25.6	7,597	100.0
1974	4,181	60.0	1,072	15.4	1,718	24.6	6,971	100.0
1975	3,803	59.8	1,040	16.4	1,517	23.8	6,360	100.0
1976	4,247	58.8	1,317	18.2	1,661	23.0	7,225	100.0
1977	3,955	58.4	1,320	19.5	1,497	22.1	6,773	100.0
1978	3,670	38.0	1,243	79.7	1,411	22.3	6,324	100.0

Source: U.S. Department of Agriculture, Cotton and Wool Situation

As stated previously, in 1978 imported man-made yarn goods represented 7.8 percent of the total man-made goods available which represent total man-made imports of 640.0 million pounds. Of these imports, 77.4 percent were in the form of primary manufactured products (predominately apparel), 13.7 percent were woven cloth and fabric, 7.8 percent were man-made fiber yarns, and 1.2 percent were sliver, tops, and rovings (Table V-12). Since 1965, the annual quantities of man-made imports have increased significantly, from 79 million pounds in 1965 to 640 million pounds imported in 1978. In 1965, primary manufactured products were still the main imported form accounting for 64.7 percent of all man-made imports in that year. Imports of woven cloth and fabric accounted for 33.7 percent of all man-made imports in 1965, and man-made yarns accounted for 1.5 percent. Viewing the respective quantities of man-made imports over time, all have increased significantly. However, man-made goods in manufactured form have experienced the greatest growth, increasing by nearly 750 percent from 51 million pounds in 1965 to 421 million pounds in 1977.

Man-made fibers are predominately manufactured into broad woven fabrics. However, tire cords and fabrics, carpets, and hosiery are also predominately manufactured from man-made fibers. Broad woven fabrics manufactured from man-made fibers have increased in recent years from 3.9 billion linear yards in 1965 to over 6.6 billion yards in 1977 (Table V-9). Compared to other broad woven fabrics, man-made fabrics represented 29 percent of the total broad woven fabric production in 1965 and increased their share to 62 percent in 1978. Within man-made broad woven fabrics the trend has been toward less rayon and acetate fibers and more non-cellulosic fibers. According to information available in Textile Organon[1/] during the past seven years, the supply of broad woven rayon and acetate, 100% filament, fibers decreased by about 100 million linear yards as did 100% spun rayon and acetate with blends of other fibers. Non-cellulosic broad woven goods production increased between 1971 and 1977. Of the 100% filament non-cellulosic fibers, the polyester supply increased the most, from 233 to 521 million linear yards. Polyester and cotton blends also increased during the seven year period, from 1,998.6 to 2,663.9 million linear yards.

Another major use of man-made fibers is for the manufacture of tire cords and fabrics. As was also shown in Table V-9, production of these items has varied from year to year with an overall increasing trend over time. In 1965, 495.8 million pounds of tire cords and fabrics were produced. By 1978, production of such items amounted to 627.0 million pounds.

The production of carpet experienced a period of growth from 1965 to 1973; however since 1973 production has somewhat stabilized. In 1965, total shipments of broadloom carpets amounted to 301.9 million square yards and by 1973, shipments reached 842.2 million square yards (Table V-13). Since 1973, the annual shipments have stabilized varying between 700 and 800 million square yards annually.

1/ Textile Economic Bureau, Inc., Textile Organon, various issues.

Table V-12. Man-made fiber equivalent of U.S. man-made imports for consumption by manufacturers.

Year	Sliver, tops and rovings		Yarns		Woven cloth and fabric		Primary manufactured products		Total	
	1,000 pounds	Percent	1,000 pounds	Percent	1,000 pounds	Percent	1,000 pounds	Percent	1,000 pounds	Percent
1965	53	0.1	1,171	1.5	26,663	33.7	51,145	64.7	79,032	100.0
1966	759	0.6	3,856	3.1	45,937	37.3	72,513	58.9	123,065	100.0
1967	147	0.1	8,889	6.4	33,704	24.3	96,078	69.2	138,818	100.0
1968	70	---	18,267	9.4	43,384	22.4	131,604	68.1	193,325	100.0
1969	780	0.3	16,058	6.2	51,741	20.1	188,881	73.4	257,460	100.0
1970	1,790	0.5	24,125	7.3	57,089	17.3	246,254	74.8	329,258	100.0
1971	777	0.2	22,962	5.1	75,953	16.8	351,380	77.9	451,072	100.0
1972	2,894	0.6	27,293	5.7	83,504	17.4	366,762	76.3	480,453	100.0
1973	4,225	0.9	29,071	6.2	76,408	16.4	355,615	76.4	465,319	100.0
1974	2,392	0.6	11,541	3.1	62,287	16.8	295,032	79.5	371,252	100.0
1975	3,113	0.8	11,383	2.8	54,738	13.7	331,142	82.7	400,376	100.0
1976	2,844	0.6	16,339	3.4	64,478	13.4	395,826	82.6	479,487	100.0
1977	4,799	0.9	34,926	6.6	70,382	13.3	421,023	79.3	531,130	100.0
1978	7,556	1.2	49,620	7.8	87,760	13.7	495,035	77.4	639,971	100.0

Source: U.S. Department of Agriculture, Cotton and Wool Situation

Table V-13. Shipments of broadloom carpets, 1965-1977.

Year	Woven (million sq yds)	Woven (percent)	Tufted (million sq yds)	Tufted (percent)	Total (million sq yds)	Total (percent)
1965	41.3	13.7	260.6	86.3	301.9	100.0
1966	42.6	12.9	288.7	87.1	331.3	100.0
1967	40.0	10.9	328.6	89.1	368.6	100.0
1968	39.9	9.2	394.7	90.8	434.6	100.0
1969	39.3	7.9	455.3	92.1	494.6	100.0
1970	34.1	6.4	502.3	93.6	536.4	100.0
1971	31.3	5.3	558.5	94.7	589.8	100.0
1972	34.1	4.4	734.3	95.6	768.4	100.0
1973	32.8	3.9	809.4	96.1	842.2	100.0
1974	32.6	4.1	756.4	95.9	789.0	100.0
1975	26.7	3.8	676.7	96.2	703.4	100.0
1976	27.7	3.5	762.2	96.5	789.9	100.0
1977	25.0	2.9	834.8	97.7	859.8	100.0

Source: Carpet and Rug Institute, _Directory and Annual Report_, As shown in Table V-14, the majority of carpets manufactured in recent years have been composed of man-made fibers. The only natural fiber which has been significantly used in carpets in the past was wool; but recently its use has declined. In 1972, wool fibers represented approximately 5.0 percent of the fibers used in carpets. By 1977, this percentage had dropped to less than 1.0 percent.

The supply of hosiery has increased slightly between 1967 and 1978 with 230.3 million dozen pairs produced in 1967 and 263.8 million dozen pairs produced in 1978 (Table V-15). While the number of pairs of men's, children's, and infant's hosiery produced annually have increased since 1967, the number of women's pairs has decreased slightly.

There has also been a shift in women's hosiery away from stockings, toward pantyhose, sheer knee-hi's and anklets. The majority of hosiery is composed of man-made fibers. In a period covering January through April 1977, for example, 56 percent of total hosiery was nylon, 29 percent was acrylic, 12 percent was cotton, one percent was polyester, and two percent was other fibers.1/

2. Demand

Demand, for purposes of this analysis, reflects demand by the mills for raw materials as well as demand by consumers for finished textile products. Raw material demand is associated with the availability of fibers and the market forecasts for consumer desires. The major end-uses of textiles, which depict consumer demand, are apparel, home furnishings, and industrial uses. These are typically sold to households, businesses and industries, and the government. A small quantity of textile products are exported.

a. Raw Materials

In response to changing technologies and consumer demands, the types of fibers processed in textile mills have shifted away from wool, cotton, and silk to man-made. As shown in Table V-16, in 1965, 57.6 percent of the fibers consumed by U.S. mills was cotton, wool, or silk with the remaining 42.4 percent of the total fibers being man-made. By 1978, man-made fibers had increased their respective share of all fibers consumed to 74.9 percent with significant declines experienced for all the natural fibers. A discussion of the demand for each of the major fiber types is presented below.

Natural Fibers. The annual quantities of wool, cotton, and silk fibers consumed by U.S. mills are depicted in Table V-16. As shown, the quantity of wool consumed has declined from 457 million pounds in 1965 to 142 million pounds in 1978. As was shown in Tables V-1 and 2, this decrease in mill demand for wool fiber has closely corresponded to declines in reported raw wool production and the associated total supply of wool fibers.

1/ Textile Organon. Textile Economics Bureau, Inc., July 1977, 117.

Table V-14. Carpet composition - face yarns consumed, 1972-1977.

	1972		1973		1974		1975		1976		1977	
	1,000 pounds	Percent	1,000 pounds	Percent	1,000 pounds	Percent	1,000 pounds	Percent	1,000 pounds	Percent	1,000 pounds	Percent
Cotton	12,018	0.9	10,944	0.7	3,619	0.3	2,997	0.2	2,971	0.2	1,704	0.1
Rayon/acetate	75,374	5.5	54,154	3.6	23,273	1.7	19,104	1.6	12,109	0.9	7,525	0.5
Wool	68,861	5.0	40,012	2.6	10,138	0.8	15,027	1.2	13,152	1.0	13,459	0.9
Nylon filament	480,946	34.9	579,114	38.2	567,527	42.6	495,464	40.8	519,822	38.0	624,190	39.5
Nylon spun	337,550	24.5	417,188	27.5	370,436	27.8	371,777	30.6	495,525	36.2	589,991	37.4
Acrylic/modacrylic	147,066	10.6	140,100	9.2	127,309	9.5	93,553	7.7	83,977	6.1	77,245	4.9
Polyester	185,335	13.4	186,937	12.3	158,223	11.9	150,199	12.3	180,413	13.2	184,306	11.7
Polypropylene	66,856	4.8	83,707	5.5	69,772	5.2	65,968	5.4	57,660	4.2	73,013	4.6
All others	5,022	0.4	3,777	0.3	3,141	0.2	2,598	0.2	2,743	0.2	7,353	0.5
Total	1,379,028	100.0	1,515,933	100.0	1,333,438	100.0	1,216,687	100.0	1,368,372	100.0	1,578,786	100.0

Source: The Carpet and Rug Institute, Directory and Annual Report, 1977, 1978.

Table V-15. United States production of hosiery, 1967-1978.

Year	Womens		Mens		Childrens		Infants		Total	
	Mil doz pairs	Percent	Mil doz pairs	Percent	Mil doz pairs	Percent	Mil doz pairs	Percent	Mil doz pairs	Percent
1967	119.6	51.9	54.4	23.6	35.6	15.5	20.7	9.0	230.3	100.0
1968	121.9	55.3	50.1	22.7	30.2	13.7	18.1	8.2	220.3	100.0
1969	128.1	53.1	57.2	23.7	35.5	14.7	20.6	8.5	241.4	100.0
1970	125.7	51.5	64.2	26.3	33.6	13.8	20.6	8.4	244.1	100.0
1971	95.1	45.1	59.7	28.3	36.0	17.1	20.1	9.5	210.9	100.0
1972	102.7	45.1	63.5	27.9	40.0	17.6	21.7	9.5	227.9	100.0
1973	99.9	43.9	63.7	28.0	41.2	18.2	22.6	9.9	227.4	100.0
1974	88.7	41.0	64.2	29.7	41.4	19.1	22.1	10.2	216.4	100.0
1975	97.7	43.5	63.2	28.1	41.9	18.6	22.0	9.8	224.8	100.0
1976	113.8	44.8	66.0	26.0	46.4	18.3	27.7	10.9	253.9	100.0
1977	110.6	43.0	69.3	26.9	49.0	19.0	28.4	11.0	257.3	100.0
1978	110.9	42.0	76.4	29.0	46.7	17.7	29.8	11.3	263.8	100.0

Source: Textile Economics Bureau, Inc., Textile Organon, July 1978, August 1979.

Table V-16. U.S. mill consumption of man-made, cotton, wool and silk fibers.

	Rayon and acetate		Non-cellulosic & textile goods		Total man-made fiber		Wool		Cotton		Silk		Total	
	million pounds	percent	million pounds	percent	million pounds	percent	million pounds	percent	million pounds	percent	million pounds	percent	million pounds	percent
1965	1,593.3	44.0	2,027.3	56.0	3,620.6	42.4	457.0	5.4	4,452.6	52.2	6.3	.1	8,536.5	100.0
1966	1,623.3	40.7	2,368.8	59.3	3,992.0	44.1	427.9	4.7	4,621.0	51.1	4.6	.1	9,045.5	100.0
1967	1,520.4	35.9	2,716.2	64.1	4,236.6	47.0	366.6	4.1	4,414.2	48.9	2.8	*	9,020.2	100.0
1968	1,712.9	32.3	3,582.9	67.7	5,295.8	54.1	378.4	3.9	4,104.1	42.0	4.0	*	9,782.3	100.0
1969	1,623.8	29.2	3,928.3	70.8	5,552.1	56.2	354.9	3.6	3,972.6	40.2	3.3	*	9,882.9	100.0
1970	1,425.3	25.9	4,075.3	74.1	5,500.6	57.6	273.3	2.9	3,733.6	39.5	1.8	*	9,549.6	100.0
1971	1,506.0	23.1	5,024.1	76.9	6,530.1	60.9	219.3	2.1	3,965.1	37.0	1.7	*	10,715.3	100.0
1972	1,428.2	18.9	6,138.4	81.1	7,566.6	64.9	246.9	2.1	3,849.8	33.0	2.1	*	11,664.5	100.0
1973	1,389.2	16.0	7,276.7	84.0	8,665.9	69.3	182.1	1.5	3,643.3	29.2	2.8	*	12,492.4	100.0
1974	1,107.6	14.4	6,590.7	85.6	7,698.3	69.2	116.5	1.1	3,306.1	29.7	2.6	*	11,123.2	100.0
1975	802.0	10.8	6,618.0	89.2	7,420.0	69.9	132.0	1.2	3,068.7	28.9	1.0	*	10,621.7	100.0
1976	855.3	10.6	7,220.1	89.4	8,075.4	69.5	145.9	1.3	3,389.0	29.2	2.8	*	11,613.1	100.0
1977	868.7	9.8	8,020.2	90.2	8,888.9	72.9	133.9	1.1	3,169.8	26.0	1.6	*	12,194.2	100.0
1978	879.7	9.5	8,355.5	90.5	9,235.2	74.9	141.6	1.1	3,040.4	24.5	2.0	*	12,419.2	100.0

* less than 0.05 percent

Source: Textile Economics Bureau, Inc., Textile Organon

The demand by textile mills for cotton fiber has also declined. As shown in Table V-16, in 1965 mills consumed 4.5 billion pounds of cotton while in 1978, only 3.0 billion pounds were consumed; a reduction of 33 percent. However, it should be noted the decline in cotton consumption by the mills actually tended to level-off in 1974 and has remained consistently between 3.0 and 3.4 billion pounds since. Some manufacturers are now indicating a belief the worst of the cotton decline is over and that cotton consumption may start moderately increasing. This belief may be, in part, due to the fact that consumers are returning to "natural goods" and that cotton and man-made fibers are becoming more competitively priced.

Silk, a predominately imported fiber, also has declined in use by U.S. textile mills. In 1965, mills consumed 6.3 million pounds of silk. By 1978 this quantity had declined to 2.0 million pounds (Table V-16). The reasons for these declines in the use of silk include the increasing costs associated with its production and the ability of man-made fibers to imitate qualities associated with silk.

In addition to demand for natural fibers by U.S. mills, natural U.S. fibers are also consumed by textile producers in other countries. Table V-17 depicts the exports of U.S. raw fibers from 1965 to 1977. As shown, exports of wool have fluctuated from year to year with quantities ranging from lows of about 7.8 million pounds in 1969 and 1977 to a high of 55.3 million pounds in 1972. The main importers of U.S. wool fibers have been the United Kingdom and Japan. Total U.S. wool exports typically represent one percent or less of the total U.S. raw fiber exports.

With respect to exports of cotton fibers the U.S. has usually held the position of the world's largest exporter. In 1965, 3,035,000 bales (1,456 million pounds) were exported with 5,517,000 bales (2,648 million pounds) exported in 1977 (Table V-17). The USDA is predicting a good year for cotton exports in 1978. A combination of a large supply of cotton and competitive prices caused by the dollar's decline in the world markets has benefited the export market. Also, the major competitor in cotton exports, the USSR, has held off from offering quantities of cotton at the prevailing market price. The major recipients of U.S. cotton are Korea, Japan and the People's Republic of China. Much of this fiber returns to the U.S. in the form of imported goods.

Man-made fibers. The consumption of man-made fibers has increased with the production of textile glass and non-cellulosic fibers out-weighing the decline in use of rayon and acetate fibers. While the consumption of rayon and acetate declined by 45 percent between 1965 and 1978, the demand for textile glass and non-cellulosic fibers increased from 2,027 million pounds to 8,356 million pounds (Table V-16). These man-made fibers have adapted to a variety of end uses and have gradually developed into different markets.

Table V-17. U.S. raw fiber exports to the world, 1965-1977.

Year	Wool 1,000 pounds	Wool Percent	Cotton 1,000 pounds	Cotton Percent	Man-made fibers: Rayon & acetate 1,000 pounds	Rayon & acetate Percent	Man-made fibers: Non-cellulosic 1,000 pounds	Non-cellulosic Percent	Total 1,000 pounds	Total Percent
1965	8,633	0.5	1,456,800	88.9	50,883	3.1	122,680	7.5	1,638,996	100.0
1966	10,383	0.4	2,320,800	91.9	53,053	2.1	141,647	5.6	2,525,883	100.0
1967	10,560	0.5	2,093,280	90.9	56,314	2.4	142,397	6.2	2,302,551	100.0
1968	15,913	1.0	1,356,000	83.6	75,391	4.6	174,549	10.8	1,621,853	100.0
1969	7,803	0.5	1,381,440	82.0	80,535	4.8	214,146	12.7	1,683,924	100.0
1970	11,213	0.5	1,870,560	83.4	97,434	4.3	264,476	11.8	2,243,683	100.0
1971	23,364	1.2	1,624,800	80.8	87,625	4.4	275,444	13.7	2,011,233	100.0
1972	55,341	1.8	2,549,280	84.4	85,572	2.8	331,182	11.0	3,021,375	100.0
1973	36,522	1.0	2,939,040	81.8	24,150	0.7	594,244	16.5	3,593,956	100.0
1974	25,181	1.0	1,884,480	73.4	40,891	1.6	617,699	24.1	2,568,251	100.0
1975	27,266	1.3	1,589,280	76.1	26,791	1.3	446,114	21.4	2,089,451	100.0
1976	13,078	0.5	2,296,320	79.7	28,987	1.0	541,056	18.8	2,879,441	100.0
1977	7,875	0.2	2,648,160	81.5	57,667	1.8	533,689	16.4	3,247,391	100.0

Source: U.S. Department of Agriculture, Cotton and Wool Situation, and Textiles Economic Bureau, Inc. Textile Organon.

An increasing quantity of man-made fibers is exported each year. In 1965, a total of 173.6 million pounds of fibers was exported. By 1977, the total had grown to 591.4 million pounds (Table V-17). Rayon and acetate fiber exports rose steadily from 1965 to 1972 and then declined to below 1965 levels. In 1977, exports of rayon and acetate fibers climbed again to above 1965 levels. Non-cellulosic fiber exports have risen between 1965 and 1977, from 122.7 million pounds to 533.7 million pounds, respectively. Foreign countries typically are not as dependent on U.S. man-made fiber as they are for cotton fiber. Farm-produced cotton demands the often unavailable conditions of land and proper climate; conditions which are often lacking in foreign countries. However, factory produced synthetic fibers can be manufactured almost anywhere.

b. Finished Goods - By Fibers

Demand for finished textile goods can be approached from two perspectives. First, textile goods' demand can be viewed from the trends in the consumers' buying habits with respect to the finished goods fiber contents and second, the demand can be viewed from the consumers' buying habits with respect to product categories. In this section the demand for finished goods with emphasis on fiber content is discussed. In the subsequent section finished good demand trends with emphasis on end-use markets are discussed.

The competitive position of fibers is determined predominately by price, consumer demands and fabric characteristics. Prices are determined by raw material production costs and by the additional costs required to process the product. Availability of raw materials and supplies also influence cost. Technological advances have reduced production costs, although these price decreases may be outweighed by other cost increases. Fabric characteristics also give fibers advantages. Wool has heat retaining qualities which make it more popular in the north than in the south. Cotton was once considered the ideal material to be used in linens, however, cotton and man-made fiber blending has developed to the point where the advantages of cotton are retained while the favorable characteristics of man-made fibers are added.

Table V-18 depicts the quantities and respective proportions of the major fibers utilized in textile goods from 1965 to 1976. As shown, and as discussed in previous sections, the use of wool, cotton, and rayon and acetate in textile goods has declined in recent years with their combined proportion of all textile goods declining from 76.4 percent in 1965 to 38.7 percent in 1976. The fiber replacing these "traditional fibers" has been non-cellulosic man-made fiber which has increased its position from 23.6 percent of all textile goods in 1965 to 61.3 percent in 1976.

Demand trends and characteristics of each major fiber type are discussed below.

Wool fibers. Wool has assumed little of the textile market since 1965, when it retained six percent of the total textiles consumed. This fiber now represents 1.4 percent of the fabric used (Table V-18). Apparel dominates

Table V-18. All textiles goods, utilization in textile goods by fiber type, 1965-1976.

Year	Wool		Cotton		Man - Made: Rayon and Acetate		Man - Made: Non cellulosics		Total Fabric For All Textiles	
	million pounds	percent	million pounds	percent	million pounds	percent	million pounds	percent	million pounds	percent
1965	547	6.4	4,410	51.4	1,594	18.6	2,029	23.6	8,580	100.0
1966	526	5.9	4,456	49.7	1,613	18.0	2,372	26.5	8,967	100.0
1967	471	5.2	4,263	47.3	1,560	17.3	2,725	30.2	9,019	100.0
1968	483	4.9	4,112	41.6	1,729	17.6	3,552	36.0	9,876	100.0
1969	435	4.4	4,022	40.4	1,620	16.3	3,885	39.0	9,962	100.0
1970	350	3.6	3,851	39.7	1,419	14.6	4,074	42.0	9,694	100.0
1971	261	2.5	3,933	37.0	1,488	14.0	4,937	46.5	10,619	100.0
1972	283	2.4	4,035	34.0	1,410	11.9	6,136	51.7	11,864	100.0
1973	221	1.8	3,743	30.0	1,381	11.1	7,146	57.2	12,491	100.0
1974	153	1.3	3,501	30.2	1,130	9.7	6,810	58.7	11,594	100.0
1975	147	1.4	3,246	29.9	825	7.6	6,654	61.2	10,872	100.0
1976	163	1.4	3,516	29.9	863	7.3	7,202	61.3	11,744	100.0

Source: Textile Economic Bureau, Inc., Textile Organon the end product usage of wool, averaging about 65 percent of the wool used annually. Home furnishings are second in wool consumption (about 20 to 25 percent), and industrial and other consumer goods and exports share the remaining end-use markets (Table V-19).

Cotton Fibers. Cotton dominated the textile market in 1965, supplying 51 percent of the textile fibers consumed. By 1976, however, cotton consumption declined to 30 percent (Table V-18). Apparel has always demanded the largest share of cotton usage, averaging about 51 percent of all cotton consumed (Table V-20). Home furnishings utilized the second largest amount of cotton (25 to 30 percent), while industrial and other consumer goods were third in demand (15 to 20 percent). Although cotton exports have risen in their market share over the last few years from three percent in 1965 to 6.5 percent in 1977, exportation demands the smallest quantities of cotton.

Man-made Fibers. Utilization of all man-made fibers has increased since 1965 with the increase attributable to non-cellulosic fibers, since utilization of rayon and acetate fibers decreased. As was shown in Table V-18, consumption of non-cellulosic fibers increased from 23.6 percent of total textile goods in 1965 to 61.3 percent in 1976. During the same time period utilization of rayon and acetate fibers decreased from 18.6 to 7.3 percent. The end-use of rayon and acetate fibers has remained fairly consistent since 1965 with a slight increase in the proportion being utilized by apparel and slight decreases in the proportions being utilized by home furnishings and industrial and other textile goods manufacturers. As shown in Table V-21, in 1977 apparel accounted for 34.2 percent of all rayon and acetate utilized; home furnishings, 24.5 percent; industrial and other goods; 33.8 percent; and exports 7.5 percent.

End-use utilization of non-cellulosic fibers also has remained relatively consistent since 1965. As shown in Table V-22, apparel, home furnishings, and exports have increased slightly their proportions of textile goods utilizing non-cellulosic fibers, with the industrial and other goods share decreasing. In 1977, apparel accounted for 38.0 percent of the end-use of non-cellulosic fibers; home furnishings, 34.8 percent; industrial and other goods, 25.1; and exports, 2.1 percent.

c. Finished Goods - by end-use markets

The textile fibers discussed in the preceeding section are distributed into four major end-use markets: apparel, home furnishings, industrial and other consumer products, and exports. As shown in Table V-23, in 1977, 41.7 percent of all textiles were shipped as apparel; 31.8 percent were shipped as home furnishings; 22.8 percent were shipped as industrial and other consumer goods; and 3.7 percent were shipped as exports. In an effort to determine the major factors affecting consumption, DPRA has generated four functions relating income, age, employment, and housing starts to the final demand for textile end-use products. Equations 1 and 4 as shown in Table V-24, relate 1965-1977 per capita personal consumption expenditures for clothing and shoes to, first, disposal per capita income, and second, the proportion of 18-44 year-olds in the U.S. population. Each equation accounts for about 99 percent of the variation in clothing and shoe expenditures over this

Table V-19. End-use consumption summary for wool, 1965-1977

Year	Apparel million pounds	Apparel percent	Home Furnishings million pounds	Home Furnishings percent	Industry & Other million pounds	Industry & Other percent	Exports million pounds	Exports percent	Total million pounds	Wool percent
1965	373	68.2	124	22.7	42	7.7	8	1.5	547	100.0
1966	358	68.1	122	23.2	40	7.6	6	1.1	526	100.0
1967	331	70.3	99	21.0	36	7.6	5	1.1	471	100.0
1968	345	71.4	98	20.3	35	7.2	5	1.0	483	100.0
1969	282	64.8	108	24.8	44	10.1	1	0.2	435	100.0
1970	218	62.3	89	25.4	42	12.0	1	0.3	350	100.0
1971	162	62.1	85	32.6	8	3.1	6	2.3	261	100.0
1972	159	56.2	89	31.4	8	2.8	27	9.5	283	100.0
1973	134	60.6	53	24.0	9	4.1	25	11.3	221	100.0
1974	95	62.1	33	21.6	10	6.5	15	9.8	153	100.0
1975	95	64.6	32	21.8	7	4.8	13	8.8	147	100.0
1976	116	71.2	33	20.2	7	4.3	7	4.3	163	100.0
1977	115	72.3	32	20.1	8	5.0	4	2.5	159	100.0

Source: Textile Economics Bureau, Inc., Textile Organon, November, 1978.

Table V-20. End-use consumption summary for cotton, 1965-1977.

Year	Apparel million pounds	Apparel percent	Home Furnishings million pounds	Home Furnishings percent	Industry & Other million pounds	Industry & Other percent	Exports million pounds	Exports percent	Total million pounds	Cotton percent
1965	1,891	42.9	1,289	29.2	1,109	25.1	121	2.8	4,410	100.0
1966	1,866	41.9	1,282	28.8	1,175	26.4	133	3.0	4,456	100.0
1967	1,691	39.7	1,294	30.4	1,150	27.0	128	3.0	4,263	100.0
1968	1,630	39.6	1,260	30.6	1,099	26.7	123	3.0	4,112	100.0
1969	1,573	39.1	1,242	30.9	1,048	26.1	159	4.0	4,022	100.0
1970	1,525	39.6	1,199	31.1	995	25.8	132	3.4	3,851	100.0
1971	1,857	47.2	1,230	31.3	696	17.7	150	3.8	3,933	100.0
1972	1,903	47.2	1,246	30.9	690	17.1	196	4.9	4,035	100.0
1973	1,762	47.1	1,092	29.2	669	17.9	220	5.9	3,743	100.0
1974	1,692	48.3	962	27.5	592	16.9	255	7.3	3,501	100.0
1975	1,572	48.4	903	27.8	537	16.5	234	7.2	3,246	100.0
1976	1,737	49.4	941	26.8	571	16.2	267	7.6	3,516	100.0
1977	1,706	50.5	922	27.3	530	15.7	221	6.5	3,379	100.0

Source: Textile Economics Bureau, Inc., Textile Organon, November, 1978.

Table V-21. End-use consumption summary for rayon and acetate man-made fibers, 1965-1977

Year	Apparel million pounds	Apparel percent	Home Furnishings million pounds	Home Furnishings percent	Industry & Other million pounds	Industry & Other percent	Exports million pounds	Exports percent	Total million pounds	Rayon & Acetate percent
1965	452	28.4	506	31.7	593	37.2	43	2.7	1,594	100.0
1966	455	28.2	509	31.6	604	37.4	45	2.8	1,613	100.0
1967	523	33.5	447	28.7	546	35.0	44	2.8	1,560	100.0
1968	572	33.1	499	28.9	621	35.9	37	2.1	1,729	100.0
1969	530	32.7	433	26.7	616	38.0	41	2.5	1,620	100.0
1970	473	33.3	349	24.6	556	39.2	41	2.9	1,419	100.0
1971	670	45.0	383	25.7	400	26.9	35	2.4	1,488	100.0
1972	608	43.1	332	23.5	433	30.7	37	2.6	1,410	100.0
1973	600	43.4	336	24.3	400	29.0	45	3.3	1,381	100.0
1974	430	38.1	270	23.9	370	32.7	60	5.3	1,130	100.0
1975	349	42.3	188	22.8	243	29.5	45	5.5	825	100.0
1976	305	35.3	218	25.3	286	33.1	54	6.3	863	100.0
1977	292	34.2	209	24.5	288	33.8	64	7.5	853	100.0

Source: Textile Economics Bureau, Inc., Textile Organon, November, 1978.

Table V-22. End-use consumption summary for non-cellulosic man-made fibers, 1965-1977

Year	Apparel		Home Furnishings		Industry & Other		Exports		Total	Non Cellulosic
	million pounds	percent	million pounds	percent	million pounds	percent	million pounds	percent	million pounds	percent
1965	692	34.1	582	28.7	720	35.5	35	1.7	2,029	100.0
1966	787	33.2	675	28.5	871	36.7	39	1.6	2,372	100.0
1967	989	36.3	792	29.1	902	33.1	42	1.5	2,725	100.0
1968	1,270	35.8	1,071	30.2	1,163	32.7	48	1.4	3,552	100.0
1969	1,200	30.9	1,259	32.4	1,362	35.1	64	1.6	3,885	100.0
1970	1,368	33.6	1,314	32.3	1,328	32.6	64	1.6	4,074	100.0
1971	1,998	40.5	1,642	33.3	1,237	25.1	60	1.2	4,937	100.0
1972	2,503	40.8	2,052	33.4	1,510	24.6	71	1.2	6,136	100.0
1973	2,830	39.6	2,419	33.9	1,761	24.6	136	1.9	7,146	100.0
1974	2,722	40.0	2,160	31.7	1,739	25.5	189	2.8	6,810	100.0
1975	2,766	41.6	2,146	32.3	1,575	23.7	167	2.5	6,654	100.0
1976	2,782	38.6	2,353	32.7	1,893	26.3	174	2.4	7,202	100.0
1977	2,952	38.0	2,705	34.8	1,951	25.1	164	2.1	7,772	100.0

Source: Textile Economics Bureau, Inc., Textile Organon, November, 1978.

Table V-23. End-use consumption summary for all textile fibers, 1965-1977

Year	Apparel million pounds	Apparel percent	Home Furnishings million pounds	Home Furnishings percent	Industry & Other million pounds	Industry & Other percent	Exports million pounds	Exports percent	Total million pounds	All Fibers percent
1965	3,408	39.7	2,501	29.2	2,464	28.7	207	2.4	8,580	100.0
1966	3,466	38.7	2,588	28.9	2,690	30.0	223	2.5	8,967	100.0
1967	3,534	39.2	2,632	29.2	2,634	29.2	219	2.4	9,019	100.0
1968	3,817	38.6	2,928	29.6	2,918	29.5	213	2.2	9,876	100.0
1969	3,585	36.0	3,042	30.5	3,070	30.8	265	2.7	9,962	100.0
1970	3,584	37.0	2,951	30.4	2,921	30.1	238	2.5	9,694	100.0
1971	4,657	44.0	3,340	31.5	2,341	22.1	251	2.4	10,589	100.0
1972	5,173	43.6	3,719	31.3	2,641	22.3	331	2.8	11,864	100.0
1973	5,326	42.6	3,900	31.2	2,839	22.7	426	3.4	12,491	100.0
1974	4,939	42.6	3,425	29.5	2,711	23.4	519	4.5	11,594	100.0
1975	4,782	44.0	3,269	30.1	2,362	21.7	459	4.2	10,872	100.0
1976	4,940	42.1	3,545	30.2	2,757	23.5	502	4.3	11,744	100.0
1977	5,064	41.7	3,868	31.8	2,777	22.8	453	3.7	12,162	100.0

Source: Textile Economics Bureau, Inc., Textile Organon, November, 1978.

Table V-24. *Functional relationships in the end-use demand for textile goods*

Equation 1. Per capita expenditures for clothing and shoes (in current dollars) as a function of disposable income per capita (in current dollars)

dependent variable	: clothing/shoes. Observed mean: 259.92307		
independent variable	: income. Observed mean: 3,361.00000		
Equation 1. R^2=.996	clothing/shoes 259.92307 = 36.09652 + .05797 (3,361.00000)	income	
t for Ho: parameter = 0	:	57.11	
probability of a greater t by chance	:	.0001	
F for ind. var. SS	:	3,261.21	
probability of a greater F by chance	:	.0001	

Equation 2. Title: Per capita consumption of carpets (in pounds) as a function of total employment (in 1,000 persons) and of private housing starts (in 1,000 units)

dependent variable	: carpets. Observed mean: 6.84615		
independent variable	: employment. Observed mean: 80,511.92307		
independent variable	: housing. Observed mean: 1,601.00000		
Equation 2. R^2=.957	carpets 6.84615 = -16.13253 + .00025 (80,511.92307) + .00166 (1,601.00000)	employment	housing
t for Ho: parameter = 0	:	11.61	5.01
probability of a greater t by chance	:	.0001	.0005
F for ind. var. SS	:	197.61	25.10
probability of a greater F by chance	:	.0001	.0005

Equation 3. Title: Per capita consumption of home furnishings (in pounds) as a function of total employment (in 1,000 persons) and of private housing starts (in 1,000 units)

dependent variable	: furnishings. Observed mean: 15.51538		
independent variable	: employment. Observed mean: 80,511.92307		
independent variable	: housing. Observed mean: 1,601.00000		
Equation 3. R^2=.947	furnishings 15.51538 = -5.24387 + .00020 (80,511.92307) + .00267 (1,601.00000)	employment	housing
t for Ho: parameter = 0	:	8.34	7.12
probability of a greater t by chance	:	.0001	.0001
F for ind. var. SS	:	127.86	50.65
probability of a greater F by chance	:	.0001	.0001

Equation 4. Title: Per capita expenditures for clothing and shoes (in current dollars) as a function of the proportion of 18-44 year-old persons in the U.S. population

dependent variable	: clothing/shoes. Observed mean: 259.92307		
independent variable	: age structure. Observed mean: .36392		
Equation 4. R^2=.989	clothing/shoes 259.92307 = -1,316.64939 + 4,332.15856 (.36392)	age structure	
t for Ho: parameter = 0	:	32.60	
probability of a greater t by chance	:	.0001	
F for ind. var. SS	:	1,062.51	
probability of a greater F by chance	:	.0001	

Source: Development Planning and Research Associates, Inc.

period. Expenditure elasticities 1/ associated with these independent variables are 0.86 for income and 6.07 for age structure. Equation 2 relates the per capita consumption of carpets to total employment and to private housing starts. The two independent variables, acting jointly, account for about 96 percent of the annual variation in carpet consumption over the 1965-1977 period. Consumption elasticities are approximately 2.94 for total employment and 0.39 for private housing starts. Equation 3 relates the per capita consumption of all home furnishings to employment and housing starts. The two independent variables, acting jointly, account for about 95 percent of the annual variation in the consumption of home furnishings over the 1965-1977 period. Consumption elasticities are approximately 1.04 for total employment and 0.28 for private housing starts. Standard errors associated with regression parameters ranged between 2 and 20 percent of these parameters where only one standard error was greater than 14 percent of its parameter. The statistical results require interpretative care, but they support the findings of earlier researchers.

In addition to a quantitative analysis relating consumption to specific consumer characteristics, trends within end-use markets also depict demand for individual textile subsegments. These trends are discussed below.

Apparel. The quantity of textile fabric utilized for apparel increased from 3,408 million pounds in 1965 to 5,064 million pounds in 1977. The composition of apparel fabric has changed considerably since 1965, when cotton accounted for 55.5 percent of all apparel fabrics; wool, 10.9 percent; and man-made fabrics, 33.6 percent (Table V-25). The trend has been away from wool, cotton, and rayon and acetate use to non-cellulosic fabrics. In 1977, non-cellulosic fabrics represented 58.3 percent of total apparel fabrics compared to 20.3 percent in 1965. Other fibers' proportions in 1977 included cotton with 33.7 percent, wool with 2.3 percent, and rayon and acetate with 5.8 percent.

Home furnishings. As was shown in Table V-23, the home furnishing market for textiles has grown from 2.5 billion pounds of textile fibers in 1965 to over 3.8 billion pounds in 1977. With regards to the composition of the textile fabrics in this end-use market, the home furnishings market has experienced trends very similar to those of apparel fabrics. As shown in Table V-26, in 1965 over 51 percent of all home furnishings fabrics were

1/ These and subsequent elasticities have been estimated using a procedure suggested by Pindyck and Rubinfeld (p. 72). The results must be interpreted with some care. First, the elasticities as derived are point elasticities, valid at the mean points of the independent variables. For linear regression equations of the type derived, mean point elasticities do not accurately depict the situation away from the means and toward the extremities of the observed data. Second, where numerous independent variables are acting jointly and interdependently on the dependent variable, as is the case in textile goods, the effect of one variable should not be considered without also considering the jointly-acting effects of other variables.

Table V-25. Apparel fabric consumption by fiber type, 1965-1977.

	Cotton		Wool		Man - Made: Rayon and Acetate		Man - Made: Non Cellulosics		Total Fabric for Apparel	
Year	million pounds	percent	million pounds	percent	million pounds	percent	million pounds	percent	million pounds	percent
1965	1,891	55.5	373	10.9	452	13.3	692	20.3	3,408	100.0
1966	1,866	53.8	358	10.3	455	13.1	787	22.8	3,466	100.0
1967	1,691	47.8	331	9.4	523	14.8	989	28.0	3,534	100.0
1968	1,630	42.7	345	9.0	572	15.0	1,270	33.3	3,817	100.0
1969	1,573	43.9	282	7.9	530	14.8	1,200	33.5	3,585	100.0
1970	1,525	42.6	218	6.0	473	13.2	1,368	38.2	3,584	100.0
1971	1,827	39.2	162	3.5	670	14.4	1,998	42.9	4,657	100.0
1972	1,903	36.8	159	3.1	608	11.8	2,503	48.4	5,173	100.0
1973	1,762	33.1	134	2.5	600	11.3	2,830	53.1	5,326	100.0
1974	1,692	34.3	95	1.9	430	8.7	2,722	55.1	4,939	100.0
1975	1,572	32.9	95	2.0	349	7.3	2,766	57.8	4,782	100.0
1976	1,737	35.2	116	2.3	305	6.2	2,782	56.3	4,940	100.0
1977	1,706	33.7	115	2.3	292	5.8	2,952	58.3	5,064	100.0

Source: Textile Economic Bureau, Inc., Textile Organon, November, 1978

Table V-26. Home furnishing fabric consumption by fiber type, 1965-1977.

Year	Cotton		Wool		Man - Made: Rayon and Acetate		Man - Made: Non Cellulosics		Total Fabric for Home Furnishing	
	million pounds	percent	million pounds	percent	million pounds	percent	million pounds	percent	million pounds	percent
1965	1,289	51.5	124	5.0	506	20.2	582	23.3	2,501	100.0
1966	1,282	49.5	122	4.7	509	19.7	675	26.1	2,588	100.0
1967	1,294	49.2	99	3.8	447	17.0	792	30.0	2,632	100.0
1968	1,260	43.0	98	3.3	499	17.0	1,071	36.6	2,928	100.0
1969	1,242	40.8	108	3.6	433	14.2	1,259	41.4	3,042	100.0
1970	1,199	40.6	89	3.0	349	11.8	1,314	44.5	2,951	100.0
1971	1,230	36.8	85	2.5	383	11.5	1,642	49.2	3,340	100.0
1972	1,246	33.5	89	2.4	332	8.9	2,052	55.2	3,719	100.0
1973	1,092	28.0	53	1.4	336	8.6	2,419	62.0	3,900	100.0
1974	962	28.1	33	1.0	270	7.9	2,160	63.1	3,425	100.0
1975	903	27.6	32	1.0	188	5.8	2,146	65.6	3,269	100.0
1976	941	26.5	33	0.9	218	6.1	2,353	66.4	3,545	100.0
1977	922	25.1	32	0.9	209	5.7	2,705	73.7	3,868	100.0

Source: Textile Economic Bureau, Inc., _Textile Organon_, November, 1978.

cotton; however, by 1977, cotton's share had declined to less than 26 percent. Usage of wool and rayon and acetate also declined in the home furnishings market as was also the case for the apparel market. In 1965, wool fabrics represented 5.0 percent of all fabrics used in home furnishings; by 1977 this percentage had declined to 0.9 percent. Usage of rayon and acetate declined from 20.2 percent of all home furnishings fabrics in 1965 to 5.7 percent in 1977. Similar to the trends in apparel fabric composition, man-made non-cellulosic fabrics have become the major fabric utilized in the home furnishings market, accounting for 73.7 percent of all home furnishings fabrics in 1977, up from 23.3 percent in 1965.

Industrial and other consumer goods. The quantity of demand for industrial and other consumer textile products, such as linings, shoes and slippers, luggage and handbags, toys, and medical surgical and sanitary supplies, has changed very little between 1965 and 1976, with total fabric utilized varying between 2.5 and 3.0 billion pounds annually (Table V-23). As in the case of both the apparel market and the home furnishings market, the composition of fabrics utilized in the industrial and other consumer goods markets has shifted from a heavy use of cotton (45.0 percent in 1965) to a high proportion of non-cellulosic fabric (70.3 percent in 1977). The historical data for cotton, wool and man-made fabrics utilized in industrial and other consumer textile goods are presented in Table V-27.

Exports. Exports of textiles have increased steadily since 1965, with total textile exports increasing from 207 million pounds in 1965 to 453 million pounds in 1977. As shown in Table V-28, the majority of the 1977 textile exports were cotton (48.8 percent of total textile exports), followed by non-cellulosic material (36.2 percent), rayon and acetate materials (14.1 percent), and wool (0.9 percent). Since 1965, cotton has consistently accounted for 50 percent or more of the total textile exports (except in 1974 when cotton goods accounted for 49.1 percent of the total). Wool exports have fluctuated from year to year but usually have represented 2 to 3 percent of the total annual textile exports. Past exports of man-made materials have varied over time depending on the fiber type. Basically, exports of rayon and acetate decreased while exports of non-cellulosic materials increased.

The raw fiber equivalents of exports of wool, cotton, and man-made textile materials are depicted in Table V-29, illustrating the major form of each respective fibers' exports. As shown in the table, for wool, most wool exported in recent years has been in the form of tops and yarns and manufactured products. Combined, these forms of wool exports accounted for almost 80 percent of all wool exports in 1978.

For exports of cotton, most are either in the form of cotton cloth (61.8 percent of 1978 exports) or manufactured cotton products (38.2 percent).

Table V-27. Industrial and other fabric consumptions by fiber type, 1965-1977

	Cotton		Wool		Man - Made: Rayon and Acetate		Man - Made: Non Cellulosics		Total Fabric for Industry and Other	
Year	million pounds	percent	million pounds	percent	million pounds	percent	million pounds	percent	million pounds	percent
1965	1,109	45.0	42	1.7	593	24.1	720	29.2	2,464	100.0
1966	1,175	43.7	40	1.5	604	22.5	871	32.4	2,690	100.0
1967	1,150	43.7	36	1.4	546	20.7	902	34.2	2,634	100.0
1968	1,099	37.7	35	1.2	621	21.3	1,163	39.9	2,918	100.0
1969	1,048	34.1	44	1.4	616	20.1	1,362	44.4	3,070	100.0
1970	995	34.1	42	1.4	556	19.0	1,328	45.5	2,921	100.0
1971	696	29.7	8	0.3	400	17.1	1,237	52.8	2,341	100.0
1972	690	26.1	8	0.3	433	16.4	1,510	57.2	2,641	100.0
1973	669	23.6	9	0.3	400	14.1	1,761	62.0	2,839	100.0
1974	592	21.8	10	0.4	370	13.6	1,739	64.1	2,711	100.0
1975	537	22.7	7	0.3	243	10.3	1,575	66.7	2,362	100.0
1976	571	20.7	7	0.3	286	10.4	1,893	68.7	2,757	100.0
1977	530	19.1	8	0.3	288	10.4	1,951	70.3	2,777	100.0

Source: Textile Economic Bureau, Inc., Textile Organon, November, 1978.

Table V-28. Export fabric consumption by fiber type, 1965-1977

	Cotton		Wool		Man - Made				Total Fabric for Exports	
					Rayon and Acetate		Non Cellulosics			
Year	million pounds	percent	million pounds	percent	million pounds	percent	million pounds	percent	million pounds	percent
1965	121	58.5	8	3.9	43	20.8	35	16.9	207	100.0
1966	133	59.6	6	2.7	45	20.2	39	17.5	223	100.0
1967	128	58.4	5	2.3	44	20.1	42	19.2	219	100.0
1968	123	57.7	5	2.3	37	17.4	48	22.5	213	100.0
1969	159	60.0	1	0.4	41	15.5	64	24.2	265	100.0
1970	132	55.5	1	0.4	41	17.2	64	26.9	238	100.0
1971	150	59.8	6	2.4	35	13.9	60	23.9	251	100.0
1972	196	59.2	27	8.2	37	11.2	71	21.5	331	100.0
1973	220	51.6	25	5.9	45	10.6	136	31.9	426	100.0
1974	225	49.1	15	2.9	60	11.6	189	36.4	519	100.0
1975	234	51.0	13	2.8	45	9.8	167	36.4	459	100.0
1976	267	53.2	7	1.4	54	10.8	174	34.7	502	100.0
1977	221	48.8	4	0.9	64	14.1	164	36.2	453	100.0

Source: Textile Economic Bureau, Inc., Textile Organon, November, 1978.

The various forms of man-made fiber textile materials' exports are also shown in Table V-29. As shown, most man-made textile exports are either cloth and fabric or man-made fiber manufactured products. In 1978, these two forms represented 52.0 and 39.5 percent, respectively, of all man-made textile material exports.

B. Price Determination

Segments within the textile industry are highly competitive with prices of its output determined through the direct and indirect interaction of many variables. Although textile demand has been strong during recent years, certain segments have operated with excess supply capacity resulting in lower capacity utilization rates generally ranging from 60 to 80 percent. Furthermore, increasing levels of imports have added to the available supplies of certain textile goods. These factors plus consumer attitudes and spending habits influence prices received for textile goods.

In this section, the textile price determination process is described. Included in the discussion are descriptions of the major price influencing factors and historical trends in textile prices.

1. The Price Determination Process and Influencing Factors

The textile industry's pricing process, at one time, could be depicted as the closest model of pure competition existing in the major manufacturing industries in the U.S. However, during the past two to three decades, the competitive environment has changed and accordingly the applicability of pure competitive situations have been reduced 1/.

While the available supply and market demand for specific textile goods are major determinants of the price of the goods, numerous other factors have considerable influence in the actual price received by the textile manufacturers. These are described below.

(1) Characteristics of the product: its seasonal, cyclical, and secular demand; breadth of market, i.e., degree to which it is multipurpose; nature of styling and operation where styled.
(2) Elasticity of supply: extent to which machinery can be transferred into and out of the market; policy of shift operation; industry practice concerning goods in process and finished inventories: are goods made to stock, on order only, or are goods made and sold at the market almost regardless of price?
(3) Extent of producer specialization by produce and by market level. Degree of inertia among producers and respect to changes in product construction.

1/ Georgia Institute of Technology, Economic Analysis of Pretreatment Standards for the Textile Industry, for the U.S. Environmental Protection Agency, July, 1977.

Table V-29

Raw wool equivalent of U.S. exports of wool products, 1965-1978

Year	Tops and Yarns 1,000 pounds	Tops and Yarns percent	Fabrics 1,000 pounds	Fabrics percent	Manufactured Products 1,000 pounds	Manufactured Products percent	& Wastes 1,000 pounds	& Wastes percent	Carpets & Rugs 1,000 pounds	Carpets & Rugs percent	Total 1,000 pounds	Total percent
1965	618	4.0	804	5.1	4,740	30.3	8,876	56.7	614	3.9	15,652	100.0
1966	730	5.8	586	4.6	4,388	34.6	6,399	50.4	588	4.6	12,691	100.0
1967	858	9.9	550	6.4	3,431	39.7	3,293	38.1	509	5.9	8,541	100.0
1968	828	8.9	496	5.3	3,562	38.1	3,635	38.9	818	8.8	9,339	100.0
1969	1,132	12.7	395	4.4	2,676	30.1	3,686	41.4	1,004	11.3	8,393	100.0
1970	1,101	16.1	403	5.9	1,982	28.9	2,484	36.3	881	12.9	6,851	100.0
1971	5,414	44.9	469	3.9	2,342	19.4	2,616	21.7	1,205	10.0	12,046	100.0
1972	26,111	78.3	599	1.8	2,804	8.4	2,753	8.3	1,065	3.2	33,332	100.0
1973	23,468	70.3	1,069	3.2	4,241	12.7	2,601	7.8	1,984	5.9	33,363	100.0
1974	14,226	54.0	922	3.5	5,702	21.7	2,978	11.3	2,504	9.5	26,332	100.0
1975	11,823	55.3	1,293	6.0	4,203	19.7	2,186	10.2	1,880	8.8	21,385	100.0
1976	5,728	37.8	955	6.3	4,929	32.6	1,277	8.4	2,261	14.9	15,150	100.0
1977	3,176	24.4	878	6.7	5,407	41.5	1,591	12.2	1,986	15.2	13,038	100.0
1978	2,565	20.4	1,094	8.7	7,246	57.7	929	7.4	733	5.8	12,567	100.0

Raw cotton equivalent of U.S. cotton exports, 1965-1978

Year	Yarn 1,000 pounds	Yarn percent	Thread and Twine 1,000 pounds	Thread and Twine percent	Cloth 1,000 pounds	Cloth percent	Manufactured Cotton Products 1,000 pounds	Manufactured Cotton Products percent	Total 1,000 pounds	Total percent
1965	7,104	4.1	3,069	1.8	110,301	63.5	53,258	30.6	173,732	100.0
1966	6,518	3.4	3,352	1.8	122,843	64.8	56,813	30.0	189,526	100.0
1967	5,737	3.0	3,148	1.7	119,797	63.6	59,717	31.7	188,399	100.0
1968	4,442	2.4	3,218	1.7	115,202	61.2	65,338	34.7	188,200	100.0
1969	37,432	16.1	3,014	1.3	118,171	50.9	73,446	31.6	232,063	100.0
1970	15,180	7.6	2,562	1.3	113,932	57.2	67,512	33.9	199,186	100.0
1971	16,245	7.2	2,964	1.3	130,841	57.8	76,261	33.7	226,311	100.0
1972	17,375	6.2	4,043	1.4	174,482	60.0	94,044	32.4	290,444	100.0
1973	15,372	4.8	5,293	1.6	199,825	61.4	104,707	32.2	325,197	100.0
1974	17,926	4.6	6,087	1.6	228,024	58.5	137,381	35.3	389,418	100.0
1975	11,958	3.4	5,038	1.4	217,388	61.5	119,270	33.7	353,654	100.0
1976	12,160	2.9	6,318	1.5	248,391	60.2	146,285	35.4	413,154	100.0
1977	10,150	2.8	6,733	1.8	203,981	55.2	148,598	40.2	369,462	100.0
1978	20,340	5.7	11,627	3.3	219,767	61.8	135,980	38.2	355,745	100.0

Man-made fiber equivalent of U.S. exports of man-made textile products, 1965-1978

Year	Sliver, tops, and roving 1,000 pounds	Sliver, tops, and roving percent	Yarn 1,000 pounds	Yarn percent	Cloth & Fabric 1,000 pounds	Cloth & Fabric percent	Man-Made Fiber Manufactured Products 1,000 pounds	Man-Made Fiber Manufactured Products percent	Total 1,000 pounds	Total percent
1965	4,809	3.7	2,815	2.2	87,721	68.0	33,711	26.1	129,056	100.0
1966	6,384	4.6	2.009	1.4	93,121	66.5	38,462	27.5	139,976	100.0
1967	4,500	3.4	2,606	2.0	84,218	63.3	41,654	31.3	132,978	100.0
1968	5,042	3.9	3,412	2.6	75,166	58.3	45,374	35.2	128,994	100.0
1969	6,002	4.1	5,969	4.0	79,345	54.3	54,914	37.6	146,230	100.0
1970	5,644	3.8	6,171	4.2	76,404	52.0	58,833	40.0	147,052	100.0
1971	4,541	3.1	5,849	4.0	70,186	47.9	66,101	45.0	146,677	100.0
1972	5,142	2.9	7,479	4.2	83,681	47.1	81,282	45.8	177,584	100.0
1973	10,653	3.7	23,459	8.2	128,628	44.6	125,587	43.5	288,227	100.0
1974	13,381	3.4	34,222	8.8	176,505	45.2	166,626	42.6	390,734	100.0
1975	6,777	2.1	20,934	6.5	160,627	49.8	134,050	41.6	322,388	100.0
1976	12,254	3.5	24,666	7.0	164,007	46.8	150,249	42.7	352,176	100.0
1977	12,124	3.3	27,396	7.5	166,819	45.4	160,737	43.8	367,076	100.0
1978	10,147	2.3	27,559	6.2	229,569	52.0	174,423	39.5	441,700	100.0

Source: U.S. Department of Agriculture, Cotton and Wool Situation, February, 1979.

(4) Degree of uniformity in the offerings of different producers. (This is not so much a question of knowing what mills produce the best or poorest qualities as the extent of variation vs. homogeneity of products).
(5) Number and relative size of sellers in the market; extent and character of price leadership.
(6) Procedures by which sellers claim to arrive at selling prices; attention given to market information, probable action of competitors, statistical appraisal of market prospects, own costs, etc.
(7) Number and relative size of buyers in the market; extent and character of their domination of the market; procedures by which they claim to arrive at prices they will pay.

For most textile facilities, the initial basis for determining prices of their products is the same as for most products; the manufacturer attempts to recover his raw material and production costs plus a margin of profit. With this information plus consideration of the market environment and other influencing factors, the manufacturers usually either chooses a simple formula in setting prices such as costs + overhead + fair profit = price, or charges what the market will bear. In setting prices, manufacturers sometimes attempt to penetrate a market through low prices, possibly sacrificing profits and selling at or below costs to attract a following, or they may want to set prices extremely high in order to establish it as a high quality, expensive item. For example, DuPont charged the maximum amount possible for Qiana, a silk-like fabric, when the product was initially introduced, in the hope that consumers would associate the fabric with high fashion. To accomplish this, DuPont charged high prices--$5.95 to $8.95 per pound compared with a market price of $8 to $10 per pound for silk. The appetite of lower-priced fashion markets has now been whetted and the company plans to broaden its coverage by dropping to the next lowest price category as promotion and production costs continue to drop 1/. When analyzing the consumer, manufacturers must determine whether the customer is willing to pay more to maintain or increase quality or if he will sacrifice quality for quantity.

As will be presented in the next section, prices of textile goods have varied during recent years with most, if not all, increasing when expressed in current dollars (not adjusted for inflation). These price changes are a result of various factors, the most common being changes in the prices or costs of the various components comprising the finished product. As was shown in Exhibit IV-1 (page IV-19), textile manufacturing represents just one of many manufacturing steps involved in converting chemical or agricultural

---

1/ "Pricing Strategy in an Inflation Economy", Business Week. Reprinted by Vernon, Ivan R. and Charles W. Lamb, Jr., ed. The Pricing Function, Lexington, Mass.: Lexington Books, 1976, 43.

products (fibers) into consumer textile goods available at retail stores. To gain a perspective of the respective shares of the retail dollar of textile goods, Edward H. Glade, Jr., estimated the distribution of the consumers' retail dollar spent for cotton denim dungarees. In this estimate, the costs of producing, ginning, marketing and processing raw cotton and manufacturing and distributing cotton products were included in the dollar spent, as were retail displaying and merchandising. This distribution is presented in Table V-30. As shown, of the $8 retail value of a pair of cotton denim dungarees in 1974, 6.4 percent of this price was associated with the farm production of cotton, 2.0 percent was associated with ginning and marketing to the textile mills, 19.6 percent was associated with the textile mill processing and finishing, 30.0 percent was associated with apparel manufacturing, and 42.0 percent was associated with wholesaling and retailing.

2. Prices and Marketing Patterns

As a means of illustrating price trends and relationships, textile products were grouped according to marketing patterns, as listed below. Fibers are comprised of both plant fiber and animal hair produced on the farm, and synthetic fibers produced primarily in the chemical industry.

(a) Fibers
(b) Yarn
(c) Fabrics
(d) Carpets
(e) Apparel
(f) Home furnishings

Yarn, fabrics and carpets are manufactured almost entirely within the textile industry. Yarn is produced exclusively in the industry and constitutes an intermediate product, while fabrics and carpets may be either intermediate or final products. Apparel and home furnishings are final products which may be produced within the industry or within other industries. In Table V-31, additional groupings are shown for each of the major classifications. These major groupings include specific products to be discussed below for which commodity prices can be identified.

In Chapter IV, the broad relationships between the major markets involved were illustrated in Exhibit IV-1. More specific relationships are shown in Exhibit V-1 in this chapter in order to indicate at what point in the production flow products may appear in each of the markets. These markets show the relationships between mills falling within the classification system of the industry as covered subsequently in the study.

As pointed out above, the fiber markets provide the raw material input to the textile industry. This input includes not only cotton, wool and synthetic staple and tow but also unprocessed filament yarns. In the production flow, fiber may appear as processed yarn produced in the yarn mills

Table V-30. Cotton denim dungarees: estimated distribution of the retail dollar by operation or service, 1974 1/

Operation or Service	Cost per pound of cotton[2]		Cost per pair produced[3]		Proportion of retail dollar	
		Dollars		*Dollars*		*Dollars*
Farm production		.366		.516		6.4
Ginning		.061		.086		1.1
Marketing to textile mills		.052		.073		0.9
Warehousing services	(.010)		(0.14)		(0.2)	
Compression	(.008)		(.011)		(0.1)	
Transportation	(.014)		(.020)		(0.3)	
All other[4]	(.020)		(.028)		(0.3)	
(Accumulated value at mill door)		(.479)		(.675)		(8.4)
Textile mill processing and finishing		1.115		1.572		19.6
(Accumulated value after textile mill)		(1.594)		(2.247)		(28.0)
Apparel manufacturing		1.715		2.418		30.0
(Accumulated value after manufacturing		(3.309)		(4.665)		(58.0)
Wholesaling-retailing		2.390		3.370		42.0
Total value at retail		5.699		8.035		100.0

[1]Estimates were developed from both published and unpublished sources. Farm production, ginning, and marketing costs are U.S. Department of Agriculture data; textile mill processing and apparel manufacturing estimates were adapted from data from the Bureau of Labor Statistics; and Wholesaling-retailing margins estimated from private trade sources. Complete methodology and data sources are available on request. [2]These data represent the estimated cost or value added to 1-pound of cotton at each stage from production through retailing for cotton used in the manufacture of men's cotton denim dungarees. [3]Costs per pair produced reflects the estimated cost or value added to a typical pair of denim dungarees containing 1.41 pounds of cotton (2.256 sq. yds. x .625 pounds per sq. yd.) at each stage from production through retailing. [4]Includes buying and selling expenses, cotton insurance, financing, and overhead expenses of marketing firms.

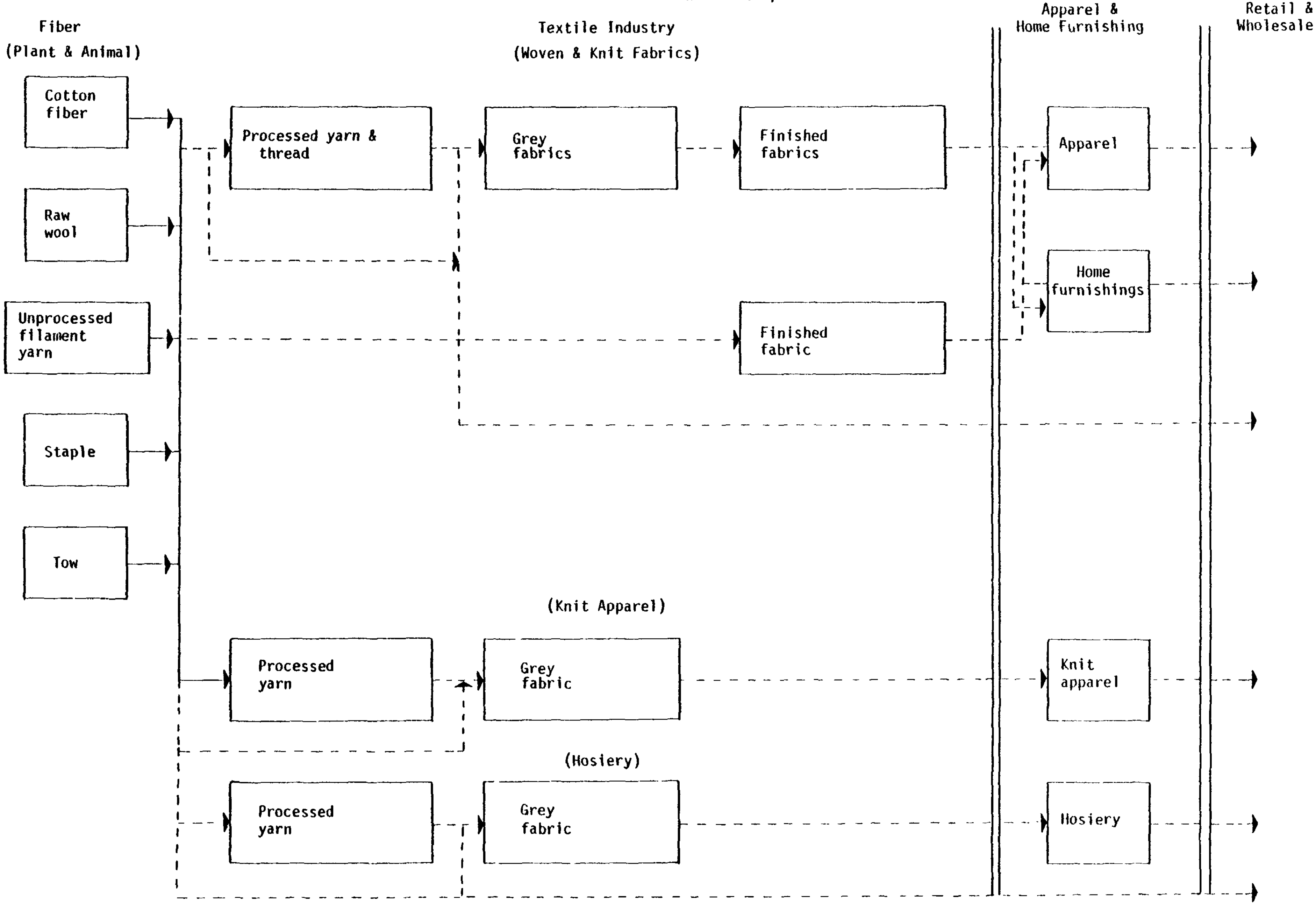
Source: Glade, Edward H., Jr. "Who Gets the Cotton Denim Dollar?" Cotton and Wool Situation, USDA, March 1976, 30-32.

Table V-31. The textile industry - major product groupings

Fibers	Processed Yarn	Fabric	Apparel	Textile Homefurnishings	Floor Covering
Plant fiber and Animal hair	Processed yarn	Gray fabric	Womens	Sheets	Carpets
Cotton	Cotton	Broad woven	Coats and suits	Cotton	Tufted
Wool	Wool	Cotton	Dresses		Woven
	Synthetic	Synthetic	Knit	Towels	Wool
Synthetic	Blends	Blends	Woven	Cotton	Synthetic
Fiber			Underwear		
Unprocessed filament yarn	Thread	Knit	Hosiery	Blankets	
		Synthetic blends		Wool	
Staple	Cotton		Mens	Synthetic	
Tow	Synthetic		Suits and coats		
		Finished fabric	Woven		
		Broad woven	Knit		
		Cotton	Trousers		
		Wool	Knit		
		Synthetic	Woven		
		Blends	Shirts		
			Woven		
		Knit	Knit		
		Synthetic	Underwear		
		Blends	Hosiery		
		Wool			

Source: Development Planning and Research Associates, Inc.

Exhibit V-1. Production flows and market patterns.



Source: Development Planning and Research Associates, Inc.

or it may be consumed in weaving, knitting or carpet mills and appear as an intermediate or final product at any stage along the product flow. For example, fiber is consumed in some cases by large integrated carpet mills, however, carpets produced from the fiber will not appear in any market prior to the floor covering market.

Within the fabric system, yarn from the processed yarn markets may be consumed either by greige mills or integrated mills. If consumed by greige mills, it may appear along the product flow in the greige fabric markets where it will be an intermediate product to be consumed by the finishing mills. However, it may also next appear on the finished fabric markets if the fabric is processed through a commission mill. Another flow for the yarn is through integrated mills in which it is milled into greige fabric and then finished prior to entering the finished fabric market. A third flow for the yarn is through a full integrated mill which not only mills and finishes fabric but also fabricates final products, e.g. mills which produce sheets. In this case, products from the yarn would not enter a market prior to the textile home furnishing market. Fabric appearing on the finished fabric market is a final product to the textile industry exiting to the apparel or home furnishing industry.

The flow of yarn through the knit apparel and hosiery mills can be as diverse as the flow involving woven fabric. The significant difference is that the finished product appears as a final product on the apparel market.

3. Raw Material Prices

Sources for price information vary considerably by type of product produced. USDA publishes detailed data on fiber prices including cotton, wool, and man-made. BLS publishes monthly spot prices on textile mill products, apparel, home furnishings and carpets in its Producer Price and Price Indexes. However, these prices are obtained as a means of developing the price indexes and are not intended to be used in developing specific price series. Hence, from this data, only a few significant price series can be developed. The Daily News Records reports spot prices on yarn, cotton, cotton group goods, and man-made group goods. A discussion of the prices provided from these sources is contained below.

Wool (from USDA source). Prices for fine U.S. graded wool paralleled Australian wool closely through 1972 with 3/8 blood fleece wool at a slight quality differential. A 50 cent price gap opened between U.S. and Australian fine wools in 1973 and has been maintained since that time. Wool prices hit a low in 1971 resulting from heavy supplies but then cycled to all time highs in 1973 resulting from shortages induced in 1971. Since that erratic swing in the 1972-1973 cycle, however, prices have tended to be more stable over the past few years, as shown in Table V-32.

Table V-32. Wool and cotton prices: current dollars

Year	Raw wool, clean basis, Boston: Good French Combing & Staple: Graded territory fine	Raw wool, clean basis, Boston: Good French Combing & Staple: Graded fleece 3/8 blood	Raw wool, clean basis, Boston: Australian 64's, warp and half warp	Cotton prices: Received by farmers (Am. upland)	Cotton prices: SLM grade 41, staple 34, ID market
	--dollars per pound--			--cents per pound--	
1965	1.2	1.2	1.2	28.0	29.5
1966	1.3	1.2	1.2	20.6	22.8
1967	1.2	.9	1.1	25.4	28.8
1968	1.2	.8	1.2	22.0	24.5
1969	1.2	.9	1.2	20.9	23.1
1970	1.0	.9	.9	21.9	24.3
1971	.7	.6	.8	28.1	33.0
1972	1.2	.9	1.3	27.2	35.6
1973	2.5	1.6	3.0	44.4	67.1
1974	1.8	1.5	2.2	42.8	41.2
1975	1.5	1.2	2.1	51.1	58.0
1976	1.8	1.7	2.2	64.7	73.4
1977	1.8	1.8	2.3	51.8	50.8
1978	1.9	1.8	2.3	58.5	52.7

Source: U.S. Department of Commerce, Bureau of Economic Analysis, Business Statistics, 1975, 1977, 1979.

Cotton (from USDA sources). Cotton prices paid to farmers and cotton prices on the market have fluctuated dramatically over the past decade. Cotton suffered its greatest loss in its share of the market in 1968 when a short supply in 1967 caused high prices, spurring many mills to shift over to man-made fibers. This fluctuation was minor, though, when compared to the period between 1972 and 1978 (Table V-32 and Exhibit V-2). Market prices jumped from 35.6 cents in 1972 to 67.1 cents per pound in 1973 and then fell to 41.2 cents in 1974. Prices began climbing again and reached 73.4 cents in 1976 and then fell to 50.8 cents in 1977, rising slightly to 52.7 percent in 1978. The differences in market prices and prices paid to farmers were also erratic during the 1972 to 1978 period. Prior to 1970, the difference between the two prices varied by only a couple of cents; in 1972 they widened to almost 5 cents. The gap continued widening until 1973, when the market price was almost 23 cents higher per pound than farmers received. The market price fell in 1974, however, declining below the price received by farmers. The market price fell below that received by farmers, again, in 1978.

Man-made fibers (from USDA sources). Consumption of man-made fibers has risen dramatically over the past decade. This growth corresponds with the long-run trend of downward prices of man-made fibers. The man-made fiber prices have fallen primarily due to greater efficiency within the industry. Although prices for all synthetic fibers have declined since the Korean War, the non-cellulosic fibers have fallen the most and cellulosic fibers the least. Another characteristic of man-made fibers is the consistency of prices throughout time and among producing companies, for all types of material. The price is typically steady for long periods of time, usually, when one company raises or lowers a price, the others follow. A third characteristic of man-made fiber pricing is discounting. Although list prices are known, market sales are often contracted at lower levels and man-made fiber buyers receive trade discounts of five to 15 percent 1/. The main types of discounts offered include offering a percentage off for volume purchases and arranging promotion sharing and other inducements.

Polyester fibers have declined dramatically in price, dropping from 86 cents per pound in 1965 to 35 cents in 1972. Since that time, prices have increased to 54 cents per pound in 1978 (Table V-33).

Rayon staple, which was priced lower than polyester in 1965, maintained a constant price through 1971 while polyester declined dramatically. Since 1971, rayon has increased in price to slightly over that of polyester.

1/ Ward, Lionel E. Interfiber Competition with Emphasis on Cotton, unpublished Ph.D. dissertation, University of California, Davis. Available through University Microfilm International 1962, p. 37 and Economic Research Service, U.S. Textile Fiber Demand, USDA Bulletin No. 1500, Washington D.C., September 1974, p. 22.

Exhibit V-2. Selected Market Prices, January 23, 1978

COTTON GRAY GOODS

	Construction		Spot 1st. Qtr	2nd Qtr	3rd Qtr
	WIDE PRINT CLOTHS				
48	78x76	3.50	53½	53½	53½
48	68x68	3.96	48½	48½	—
48	64x56	4.45	41½	41	41
48	60x48	5.00	36½	38½	38½
45	64x60	4.65	—	40	—
45	64x56	4.75	39	38½	38½
45	60x48	5.35	33½	33½	33½
	BLENDED PRINT CLOTHS				
	Polyester-Cotton				
48	78x54	3.90	x50	—	43
48	96x56	3.50	47½	—	47
	Polyester-Rayons				
48	78x56	3.90	47½	—	47-47½
	65-35 Blends				
	Voile				
47	60x56		—	42	—
	Batiste				
47	96x72		x51	51	—
	Broadcloth				
47	128x72		61	61	—
	SHEETINGS				
50	44x40	4.40	37½	37½	
58	48x44	1.40	97	97	—
	OSNABURGS				
57	32x26	3.10	49	49	—
40	40x26	2.11	65	65	—
	Broken Twills				
58	72x56	1.06	$1.30-$1.32	$1.30-$1.32	
	S.F. APPAREL DUCK				
47	100x36	1.80	70	70	—
47	84x28	1.87	—	—	—
	DRAPERY SAILCLOTH				
52	96x36	1.58	—	84	—
	DRILLS				
59	68x40	1.85	78	78	—
59	68x40	2.25	67	67	—
45	72x48	1.95	71	71	—
48	72x60	1.64	84	84	—

INDUSTRIAL DUCK

Army $1.40 on 37 in., 13-oz.; Chafers, single 11.65 ounce $1.34.

First column represents the width of cloth, second column the count per square inch, third column is the weight in yards per pound. The fourth column is the spot price (immediate delivery) fifth column and sixth columns usually give the succeeding quarters for which delivery is quoted.

COTTON YARNS

NEW YORK PRICES

COMBED YARNS

Counts	Single Knits	Warp Plies
10s	1.41-1.43	1.51-1.53
18s	1.44-1.46	1.54-1.56
20s	1.46-1.48	1.56-1.58
24s	1.50-1.52	1.60-1.62
30s	1.56-1.58	1.71-1.74
36s	1.78-1.80	1.92-1.95
40s	1.87-1.90	2.02-2.05

CARDED YARNS

Counts	Single Knits	Warp Plies
10s	1.16-1.18	1.26-1.28
14s	1.18-1.20	1.28-1.30
18s	1.20-1.22	1.30-1.32
20s	1.23-1.25	1.33-1.35
24s	1.30-1.32	1.40-1.42
30s	1.39-1.42	1.48-1.50

POLYESTER/COMBED COTTON 50/50s

18 singles	1.40-1.42
30 singles	1.52-1.54
38 singles	1.76-1.79

OPEN-END YARNS

All-cotton 10s	1.08-1.10
All-cotton 18s	1.20-1.22
Poly-cotton 18s	1.18-1.20

MAN MADE GRAY GOODS

January 23, 1978

	FILAMENT FABRICS	
	(Acetate Taffeta)	
45½	180x54	32
45½	92x56	30-31
45½	92x62	32½-33
	Acetate Lining	
45½	120x68	44½
	Acetate-Rayon Lining	
45½	120x68	58
	Rayon Lining	
45½	136x80	68
	SPUN YARNS GOODS	
	Rayon Challis	
48	3.20yd	51
	Mohair-Effects	
	Acetate-Rayon	
45½	104x40	47½

NYLON GRAY GOODS

49½	96x86 taffeta	41-42
49½	96x68 taffeta	34

FINISHED TRICOT

Nylon

108" 40 den. 6.00 sq. yd. dull	39-40
108" 40-den. 6.00 sq. yd. semi-dull	41-42
108" 40 den. 6.00 sq. yd. multilobal	49-50
54" 40 den. 6.00 lin. yd. dull PFP	59-60
54" 40 den. 6.00 lin. yd. branded multilobal PFP	64-66

Acetate

108" 40-den., 6.00-sq. yd	25-26
108" brushed 80/20 acetate/nylon	.90-92½
54" brushed triacetate/nylon 80/20	1.65
60" acetate/nylon 65/35, 32-guage unsueded, bright, for printing	47½

Triacetate

54" 60-den 3.00 yd. lin., for printing	.60

The above price tables are based on mill sales of average quality fabrics or yarns. In the event of inactive numbers, prices are for the last reported sales. The symbol "X" before a price indicates second-hand sales.

Source: Fairchild Publications, Daily News Record, January 23, 1978.

Table V-33. Landed group B mill points: man-made staple fiber prices at f.o.b. producing plants current dollars.

Year	Rayon 1/	Polyester 2/
1965	27	85
1966	26	80
1967	24	62
1968	25	56
1969	26	45
1970	25	41
1971	27	37
1972	31	35
1973	33	37
1974	51	46
1975	51	48
1976	54	53
1977	58	56
1978	58	54

1/ 1.5 and 3.0 denier, regular rayon staple.

2/ Reported average market price for 1.5 denier polyester staple for cotton blending.

Source: Cotton Situation, November 1974 and Cotton and Wool Situation, May 1978 and September 1974.

Fiber price comparison. While individual fiber price movements are important, these price changes become even more significant when one fiber is compared with a substitute fiber. These price relationships are a key factor in determining the type of fiber and type of blends that will be used in the manufacturing process. Two basic price ratios are shown in Table V-34: wool/polyester and cotton/polyester.

The wool/polyester price ratio has changed dramatically over the past with wool becoming increasingly disadvantageous with respect to polyester. In 1965 the ratio was 1.4 to 1 but it increased steadily to 1971 with sharp increases in 1972 to 3.4 to 1 and reached a peak of 6.8 to 1 in 1973. Since that time the ratio has become somewhat more favorable to wool with a ratio of 3.2 to 1 in 1972.

The cotton to polyester price ratio followed a similar pattern but not as dramatic. Cotton had a distinct advantage in 1965 with a price ratio of 0.4 to 1. By 1971 the ratio changed to a 0.9 to 1 relationship as cotton prices increased. In 1973, the rate hit a peak of 1.8 to 1 and has declined to 0.9 to 1 since that time.

The determinants of the demand for fibers, factors affecting fiber substitution, and interfiber competition have been studied by a variety of authors (Blakeley, 1962; Ward, 1969; Barlowe and Donald, 1971; Evans, April and September, 1977). In general, fiber demand is determined by price effects, trend effects, and the relative stability of fiber supply. Both own-price and cross-price 1/ effects are important. Most writers have found significantly larger cross-price effects than own-price effects, especially for cotton (Evans, September, 1977; Ward, 1969). Long term trends in relative prices have been very significant, but fiber markets have not quickly responded to short term changes in relative prices (Ward, 1969). While quantitative analysis has usually demonstrated these price effects, virtually all writers have maintained that trend variables are at least as important as prices in the determination of fiber market shares (Ward, 1979; Barlowe and Donald, 1971; Evans, April 1977; Ga. Tech, 1977). The term "trend" groups effects from technological change, market inerta, tastes and preferences, market promotion, and research. Technological developments, most of which have favored non-cellulosic synthetics, include the discovery of new uses, new products, and new materials; developments in blending, weaving, and dyeing; technical and quality fabric characteristics; and machinery capacities and speeds. Market inerta includes factors related to the momentum of buying habits, the level of fiber consumption in previous periods, types and capacities of installed machinery, the reluctance to change fibers in current use, and the finality of a change in fiber mix once that change is effected. Fashion, style, comfort, fabric performance characteristics, advertising and market promotion, and research on new materials and uses are also important. Finally, supply stability is a positive factor

---

1/ Cross-price effects refer to the effects on a product induced by changes in the prices of that product's substitutes (competitors).

Table V-34. Price ratios of wool to polyester and cotton to polyester, 1965-1977

Year	Wool	Polyester	Ratio	Cotton	Polyester	Ratio
1965	1.20	.85	1.4:1	.30	.85	.4:1
1966	1.30	.80	1.6:1	.23	.80	.3:1
1967	1.20	.62	1.9:1	.29	.62	.5:1
1968	1.20	.56	2.1:1	.24	.56	.4:1
1969	1.20	.45	2.7:1	.23	.45	.5:1
1970	1.10	.41	2.7:1	.24	.41	.6:1
1971	.70	.37	1.9:1	.33	.37	.9:1
1972	1.20	.35	3.4:1	.36	.35	.1:1
1973	2.50	.37	6.8:1	.67	.37	1.8:1
1974	1.80	.46	4.0:1	.41	.46	.9:1
1975	1.50	.48	3.1:1	.58	.48	1.2:1
1976	1.80	.53	3.4:1	.73	.53	1.4:1
1977	1.80	.56	3.2:1	.51	.56	.9:1

Source: U.S. Department of Agriculture, Cotton and Wool Situation.

for synthetics and against cotton (Ward, 1969; Ga. Tech, 1977). On several occasions in recent years, the quantity of available cotton has fluctuated sharply (for example, during 1966-67 and 1973-74), while man-made fibers have remained available. This has produced price instability in cotton, thereby curtailing some cotton fiber shipments. The instability of cotton supplies has added impetus to the switch to man-made fibers 1/.

In support of these contentions, Blakeley (1962) was able to show significant effects on the domestic consumption of cotton from both the domestic production of man-made fibers and the lagged domestic mill consumption of cotton 2/. These variables outweighed cotton fiber price in their respective effects on mill cotton consumption. Blakley estimated the own-price elasticity of cotton fiber demand at -0.86, an estimate which he notes as higher than that obtained by other researchers. Evans (September 1977) found that the domestic mill consumption of cotton was significantly associated with total domestic fiber consumption, cotton fiber prices, and polyester staple fiber prices. The prices' terms carried the heaviest weights in Evans' equations, and polyester fiber prices had slightly greater explanatory power than cotton fiber prices. Own (cotton fiber) price elasticity was estimated at -0.25 to -0.35, and cross (cotton-polyester fiber) price elasticity was estimated at 0.35 to 0.40. Using price ratios, Evans was also able to show that a change in relative prices favorable to polyester had a highly significant impact on the domestic mill consumption of cotton fiber.

Ward (1969) generated numerous equations relating the consumption of individual fibers to own and competing fiber prices, and to total domestic fiber consumption. In general, Ward found that own and cross price effects were highly significant in fiber market share determination through time. In cotton, own-price was of less importance than competing man-made fiber prices, especially non-cellulosics. In non-cellulosics, own-price effects were relatively more important than cross price effects.

Ward generated numerous estimates of own and cross price elasticities of fiber consumption. These were summarized in the table below (Ward, 1969, p. 142).

1/ For a discussion of these considerations, see Barlowe and Donald (1971); and Barlowe, Russell G., Analysis of Cotton and Man-made Fiber Substitution in End-use Item Consumption in the United States, Unpublished Masters Thesis, 1967, University of Maryland.

2/ The influence of previous period consumption on present period consumption is actually a measure of the structural momentum in the system.

Approximate Direct and Cross-Elasticities Between
Raw Fiber Consumption and Fiber Prices

Fiber Consumption	Raw Riber Prices			
	Cotton	Wool	Cellulosic	Non-cellulosic
Cotton	0 to -0.1	0	0.4 to 0.6	0.2 to 0.4
Wool	0 to 0.2	-0.3 to -0.5	0.4 to 0.7	0.6 to 1.0
Cellulosic	0.2 to 0.4	0	-0.1 to -0.3	0.3 to 0.6
Non-cellulosic	0	0	0	-1.0 to -1.5

For cotton, all elasticities were relatively low, but cross-price effects were more important than own-price effects 1/. For man-made non-cellulosics, elasticities were moderate to greater-than-unity, with own-price effects more important than cross-price effects.

Ward notes the great influence of the supply reliability, technology, and inerta factors in the determination of fiber market shares, and partially attributes the explanatory power of his total fiber consumption variables to such considerations. Ward and the other authors also note that short term responses to changes in relative prices are apparently small, but that such changes have major significance in the longer term.

This analysis generated four functions relating to the competition for market share between cotton and non-cellulosic fibers. Findings, shown on Table V-35, generally support the discussion of findings by earlier writers. Equations 5 and 6 relate the 1965-1977 total textile market shares of cotton fiber and non-cellulosic fibers to the prices of the two fibers during those years. The two equations account for 94 to 96 percent of the variation in market shares during the years observed. Fiber share elasticities 2/ for cotton (Equation 5) are estimated as follows: own-price, -0.29 and cross-price (cotton share non-cellulosic price) 0.37. For non-cellulosics (Equation 6) the elasticities are estimated as: own-price, -0.46 and cross-price (non-cellulosic share-cotton price) 0.46.

Equations 7 and 8 relate the 1965-1977 market shares of cotton and non-cellulosic fibers in home furnishing end-uses to the prices of the two fibers during those years. The two equations account for about 94 percent of the variation in home furnishing end-use fiber market shares during the years observed. Market share elasticities for the two fibers in their home

1/ Many post-war researchers have estimated the own-price elasticity of cotton fiber in a range between -0.1 and -0.4.

2/ See footnote, p. V-35.

Table V-35. Functional relationships in interfiber competition

---

Equation 5. Title: Cotton fiber snare of U.S. textile products as a function of cotton fiber price and lagged non-cellulosic fiber price

dependent variable	: cotton fiber share. Observed mean: 376.53846
independent variable	: cotton price. Observed mean: 47.15384
independent variable	: lagged non cellulosic price. Observed mean: 57.92307

Equation 5.
R^2=.959

cotton fiber share = ... cotton price ... lagged non-cellulosic price

376.53846 = 347.33157 - 2.30466 (47.15384) + 2.38041 (57.92307)

		cotton price	lagged non-cellulosic price
t for Ho: parameter = 0	:	6.55	-6.41
probability of a greater t by chance	:	.0001	.0001
F for ind. var. SS	:	118.73	41.08
probability of a greater F by chance	:	.0001	.0001

Equation 6. Title: Non-cellulosic fiber share of U.S. textile products as a function of cotton fiber price and lagged non-cellulosic fiber price

dependent variable	: non-cellulosic share. Observed mean: 458.84615
independent variable	: cotton price. Observed mean: 47.15384
independent variable	: lagged non-cellulosic price. Observed mean: 57.92307

Equation 6.
R^2=.941

non-cellulosic share = ... cotton price ... lagged non-cellulosic price

458.84615 = 462.27596 + 4.43801 (47.15384) -3.67209 (57.92307)

		cotton price	lagged non-cellulosic price
t for Ho: parameter = 0	:	6.55	-6.41
probability of a greater t by chance	:	.0001	.0001
F for ind. var. SS	:	118.73	41.08
probability of a greater F by chance	:	.0001	.0001

Equation 7. Title: Cotton fiber share of total fiber use in home furnishings as a function of cotton fiber price and lagged non-cellulosic fiber price

dependent variable	: cotton fiber/home furnishings. Observed mean: 36.83846
independent variable	: cotton price. Observed mean: 47.15384
independent variable	: lagged non-cellulosic price. Observed mean: 57.92307

Equation 7.
R^2=.946

cotton fiber/home furnishings = ... cotton price ... lagged non-cellulosic price

36.83846 = 38.47239 -.32647 (47.15384) + .23757 (57.92307)

		cotton price	lagged non-cellulosic price
t for Ho: parameter = 0	:	-7.32	6.29
probability of a greater t by chance	:	.0001	.0001
F for ind. var. SS	:	136.92	39.60
probability of a greater F by chance	:	.0001	.0001

Equation 8. Title: Non-cellulosic fiber share of total fiber use in home furnishings as a function of cotton fiber price and lagged non-cellulosic fiber price

dependent variable	: non-cellulosic/home furnishing. Observed mean: 48.71538
independent variable	: cotton price. Observed mean: 47.15384
independent variable	: lagged non-cellulosic price. Observed mean: 57.92307

Equation 8.
R^2=.937

non-cellulosic/home furnishings = ... cotton price ... lagged non-cellulosic price

48.71538 = 48.26342 + .52468 (47.15384) -.41933 (57.92307)

		cotton price	lagged non-cellulosic price
t for Ho: parameter = 0	:	6.44	-6.08
probability of a greater t by chance	:	.0001	.0001
F for ind. var. SS	:	112.12	36.98
probability of a greater F by chance	:	.0001	.0001

Source: Development Planning and Research Associates, Inc.

furnishing end-uses are estimated as follows: for cotton (Equation 7), own-price, -0.42 and cross-price (cotton share non-cellulosic price), 0.37. For non-cellulosics, the elasticity estimates are: own-price, -0.50 and cross-price (non-cellulosic share-cotton price) 0.51. Standard errors associated with the regression parameter in all four equations ranged between 12 and 16 percent of those parameters. Again, the statistical results require interpretative care and comparison with the results of other researchers. The results generally support those of the other works cited.

4. Price Indexes

BLS publishes two types of indexes, industry and producer price (formerly wholesale price index), which are applicable to a study of prices within the textile industry. The industry indexes provide indexes on the output of SIC industries at the 4 digit level and product classes at the 5 digit level. While these indexes cover information which could be very valuable in an analysis of the industry, the series are relatively new and provide very little data prior to 1975. Consequently, these indexes are excluded from further consideration in this study.

The Producer Price Indexes (PPI) provide a measure of price movements at several levels. First it provides an index of prices at the aggregate industry level - Textile Products and Apparel, then it provides indexes of the major classifications and groupings discussed previously. Finally, it gives price indexes for a number of specific commodities.

Textile products underwent a significant reclassification in 1976 in order to reflect the decline in importance of wool products to the textile industry and the increase in importance of synthetic and knit products. Prior to the reclassification, textile products had been grouped according to type of fiber. For example, the synthetic wholesale price index components included unprocessed and processed yarn, fibers, and fabrics. With the reclassification, textile products are now grouped largely according to current marketing patterns. This reclassification should facilitate analysis of prices in terms of production flows. A comparison of the groupings under the two systems is shown below.

WPI, Textile Products and Apparel

Prior to 1976	1976
Cotton products	Synthetic fibers
Wool products	Processed yarns and thread
Synthetic	Grey fabrics
Apparel	Finished fabrics
	Apparel

The Textile Products and Apparel PPI reflect changes in both textile products and apparel. Changes in the index are weighted such that about 46 percent of the change is attributable to changes in textile products while 54 percent is attributable to apparel. Within textile products weight of each component are listed below:

Synthetic fiber	14%
Processed yarn and thread	21
Grey fabric	23
Finished fabric	44
	100%

The price movements between all commodities, and textile products and apparel are compared in Table V-36. During the past 10 years (except for 1975), textiles have lagged behind all commodities. Prior to 1972, the lag was minor with textiles increasing at an average rate of 2.6 percent per year while all commodities increased 3.6 percent. Since 1972, textiles have increased appreciably less with annual increases averaging 6.4 percent against 10.4 percent for all commodities. Partial explanation of this difference lies in the changes in the weighting system applied to textiles. Prior to 1975, a large part of the increase in the producer's index was due to acceleration of prices in cotton textiles. However, with the reclassification in 1976, a greater weight to movements in prices of synthetics and knit fabric tended to depress the overall index.

Price indexes of the products of the major textile markets are also shown in Table V-36. Apparel products, which includes clothing and hosiery, increased at a rate slightly higher than the composite textile and apparel index through 1972. Since then it has lagged, in 1976 it was about 10 points less. This difference points out that the prices of fabrics have actually increased faster than apparel.

Textile home furnishing prices have increased significantly higher than both the composite index and the apparel index over the past few years. This is due primarily to a large increase in 1974 when prices in home furnishings increased over 25 percent contrasted to an increase of less than 10 percent in the apparel prices. The price indexes of carpets has substantially lagged the other products over the past 10 years. Except for 1973, price increases for carpet have been considerably less than 10 percent. Hosiery, which is a component of the apparel index, has actually decreased over the past ten years. Hosiery is shown separately here because it is delineated from the other fabrics in a subsequent part of this study.

Inputs to the textile market system include wool, cotton, and synthetic fibers. Synthetic fibers consist of unprocessed filament yarn as well as staple and tow. A comparison of the fiber indexes is also shown in Table V-36. The index for natural fibers climbed to over 200 (twice that of 1967) in 1976. Among cotton and wool, the indexes have fluctuated considerably throughout the period. All of the fibers reach indexes of about 200 in 1973 and dropped off drastically in 1975 rising in 1976. Domestic wool

Table V-36. Producer price indexes - fabrics
(cotton, wool, synthetics)

	Code	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
<u>Grey Woven Fabrics</u>												
Broad woven	0337								*	100.0	106.2	104.6
Cotton (Old)	031202	100.0	102.3	103.7	104.4	110.5	124.1	145.7	178.5	177.9	NA	NA
(New)	033701								*	100.0	108.8	112.6
Synthetic	033703								*	100.0	106.0	101.1
Jute & burlap	033704	100.0	97.3	106.5	107.6	124.8	142.0	133.0	181.8	137.7	110.1	112.6
<u>Grey Knits</u>												
Knits	0338								*	100.0	104.1	107.4
Synthetics	033802								*	100.0	76.0	79.7
<u>Finished Fabrics</u>												
Broad woven	0342								*	100.0	105.4	110.3
Cotton (Old)	034201	100.0	104.0	104.0	107.6	110.6	120.5	143.5	178.1	173.2	NA	NA
(New)									*	100.0	109.0	120.3
Synthetic (Old)	034203	100.0	111.1	115.1	104.3	101.5	116.9	1,145.5	161.7	140.6	NA	NA
(New)									*	100.0	101.8	99.7
Knits	0343								*	100.0	96.2	95.5
Cotton	034301								*	100.0	110.7	118.4
Synthetics	034503								*	100.0	95.1	93.8
Nylon tricot	03430341	100.0	92.1	89.3	81.2	88.0	90.7	94.2	128.3	112.3	110.0	119.4
Acetate tricot	03430351	100.0	107.2	102.9	96.4	100.6	87.7	90.9	126.7	131.7	127.3	130.8
<u>Plant and Animal Fiber</u>												
<u>Fiber</u>	015	100.0	104.6	93.1	90.2	92.8	117.5	197.8	193.9	153.1	223.9	
Raw Cotton	0151	100.0	107.2			97.6		193.1	199.3	155.2	234.1	
Domestic apparel wool	0152	100.0	102.9			59.2		194.9	139.3	109.4	139.9	
Foreign wool	0153	100.0	105.5			84.8		237.0	191.8	165.1	202.6	
<u>Synthetic Fibers</u>	031								*	100.0	102.4	107.3
Unprocessed filament yarn	0315								*	100.0	103.1	108.9
Cellulosic	031501	100.0	101.3	102.3	102.5	105.2	107.7	109.9	119.4	130.6	139.7	139.6
Non-cellulosic	031502	100.0	100.0	100.0	100.0	100.0	100.0	99.9	102.3	103.2	105.9	113.5
Staple	0316								*	100.0	101.5	104.5
Tow	0317								*	100.0	98.8	106.2
<u>Textile Markets</u>												
Textile product and apparel		100.0	103.7	106.0	107.1	109.0	113.6	123.8	139.1	137.9	148.2	154.0
Apparel		100.0	103.6	107.4	110.8	113.6	114.8	119.0	129.5	133.4	139.9	147.3
Home furnishings (sheets and pillows)		100.0	104.2	100.8	103.5	104.9	109.2	113.3	143.3	151.9	159.3	171.3
Carpets		100.0	100.7	99.0	96.5	96.1	101.0	110.9	114.6	117.9	NA	NA
Hosiery	100.0	100.0	98.7	NA	NA	97.7	97.7	98.0	100.0	91.2	107.6	NA

* Astericks indicate those series begun in 1976.

Source: Bureau of Labor Statistics, <u>Wholesale Price Indexes</u>.

reflects the lowest index at less than 140 in 1976. While the natural fibers nearly doubled since 1967, the synthetic fibers have remained relatively stable. A composite index of synthetics was not developed until the 1976 reclassification; consequently synthetic price movements cannot be compared directly with the natural fibers. However, the two unprocessed filament yarn indexes (cellulosic and non-cellulosic) reveal the relative stability of the synthetic prices. The cellulosic yarn rose to about 140 by 1976 while the non-cellulosic has remained stable, rising to less than 120.

The indexes of fabric prices are shown in Table 36. Again, the indexes for the major groupings were not developed until the reclassification in 1976. Consequently movement of prices for gray and finished fabrics cannot be effectively analyzed.

Indexes are available for grey and finished cotton broad woven fabrics and finished wool. The grey cotton broad woven fabric index increased to about 180 by 1975 and leveled off for the next 2 years (actually decreasing slightly in 1977). Finished cotton fabric moved with the grey fabrics until 1976. In 1976, the index increased to 120.3 (1975 base) contrasted to an index of 105.6 for grey cotton fabrics. Wool finished fabrics is the only fabric with a complete series (other than burlap and jute). Its index had advanced to 140.7 by 1977, dropping slightly during the 1975 recession.

Exhibit V-2. Selected Market Prices, October 18, 1979

COTTON GRAY GOODS

	Construction		Spot 4th. Qtr.	1st. Qtr.	2nd Qtr.
WIDE PRINT CLOTHS					
60	60x48	3.93	—	56¼	—
51	64x56	4.20	53	53¼-53	—
48	78x76	3.50	x66	67	—
48	78x54	3.95	x52½	—	52
48	64x56	4.45	50	50	—
48	60x48	5.35	43¼	43	—
45	60x48	5.35	41	41	41
BLENDED PRINT CLOTHS					
Polyester-Cotton					
64	78x54	2.99	70	70	—
48	78x54	4.00	x46	46	—
48	96x56	3.50	54	54	—
Polyester-Rayons					
48	78x56	3.90	x45½	46	—
65-35 Blends					
Voile					
47	60x56		42	42	—
Batiste					
47	96x72		57	57	—
Broadcloth					
47	128x72		82	80	80
SHEETINGS					
50	44x40	4.40	42	42	—
58	48x44	1.40	—	$1.12	$1.12

OSNABURGS					
57	32x26	3.10	—	—	—
40	40x26	2.11	70	70	—
Broken Twills					
58	72x56	1.06	—	—	—
S.F. APPAREL DUCK					
47	84x28	1.87	—	—	
DRAPERY SAILCLOTH					
52	96x36	1.58	$1.05	$1.05	$1.05
48	100x36	1.88	93	86	86
DRILLS					
59	68x40	1.85	—	88	—
59	68x40	2.25	—	80	—
45	72x48	1.95	—	—	—
48	72x60	1.64	—	—	—

Industrial Duck

Army $1.38 on 37 in., 13 oz.

First column represents the width of cloth, second column the count per square inch, third column is the weight in yards per pound. The fourth column is the spot price (immediate delivery) fifth column and sixth columns usually give the succeeding quarters for which delivery is quoted.

COTTON

COTTON N.Y. FUTURES MARKET OCTOBER 18 1979

	Open	Close	Prev.
December	65.80t	65.10t	65.70t
March	66.20t	65.70t	66.15t
May	67.20t	66.85t	67.10t
July	68.30b	67.80t	68.25t
October	68.75b	68.75b	69.00b
December	69.60t	69.50b	69.50b
March	70.50b	70.65b	70.50b

t-traded b-bid o-offered

MAN-MADE FIBERS

Cellulosic Fibers

Rayon Staple 70
High modulus staple 75
150-den. acetate 1.01
55 den. acetate 1.15-1.20

Non-Cellulosic Fibers

Poly blend staple 64-66
150-den. polyester feeder 72-75
40-den. nylon, dull/beams 1.85-1.90
3 den. acrylic staple 62-64

COTTON YARNS

NEW YORK PRICES

COMBED YARNS

Count	Singles	Plied
16s	1.56-1.58	1.66-1.68
18s	1.58-1.60	1.68-1.70
20s	1.60-1.62	1.70-1.72
24s	1.65-1.68	1.77-1.80
30s	1.70-1.73	1.85-1.88
36s	1.94-1.96	2.09-2.12

CARDED YARNS

Count	Singles	Plied
10s	1.24-1.26	1.36-1.38
14s	1.26-1.28	1.38-1.40
18s	1.32-1.34	1.44-1.46
20s	1.37-1.39	1.50-1.52
24s	1.43-1.45	1.56-1.58
30s	1.53-1.55	1.66-1.68
30s poly-blend	1.47-1.50	

POLYESTER/COMBED COTTON 50/50s

18 singles 1.42-1.45
30 singles 1.58-1.60
36 singles 1.80-1.82

OPEN-END YARNS

All-cotton 10s 1.10-1.12
All-cotton 18s 1.20-1.24
Poly-cotton 18s 1.22-1.24

MAN MADE GRAY GOODS

October 18, 1979

FILAMENT FABRICS
(Acetate Taffeta)

45½	92x56	54
45½	92x62	57½
Acetate Lining		
45½	120x68	x70 - 66½
Rayon Lining		
45½	136x80	83-84

SPUN YARN GOODS

Rayon Challis

48 68x56 3.20 yd. 58½-60
48 68x56 3.20 yd. HWM 62-64

Mohair-Effects
Acetate-Rayon

45½ — 104x40 56-57

Polyester-rayon

46 84x34 53-54

NYLON GRAY GOODS

49½ 96x86taffeta x70-72 60
49½ 96x68taffeta x62 56

FINISHED TRICOT

Nylon

108" 40 den. 6.00 sq. yd. full 51-54
108" 40 den. 6.00 sq. yd. semi-dull 52-55
108" 40 den. 6.00 sq. yd. bright, unbranded 54-57
108", 40-den., 6.00 sq. yd. bright, branded 56-60
108" 40/28 lin. yd. brushed 1.55-1.65

Acetates & Blends

108" 55-den. 6.00 sq. yd. 31-32
54" brushed 80/20 acetate/nylon gauge, white 1.20-1.25
54" triacetate/nylon 80/20 velour, gauge, white 1.75-1.80
54" acetate/nylon 80/20 velour ... 1.25-1.30
60" triacetate/nylon 65/35 boucle 1.85-1.95
60" acetate/nylon 65/35 terry 1.65-1.70
60" acetate/nylon 65/35, 32 gauge unsueded, bright, for printing 64

The above price tables are based on mill sales of average quality fabrics of yarns. In the event of inactive numbers, prices are for the last reported sales. The symbol "X" before a price indicates second-hand sales.

Source: Fairchild Publications, Daily News Record, October 18, 1979.

VI. REPRESENTATIVE MODEL PLANTS

Over 1,100 individual textile mills are engaged in manufacturing processes which, in one form or another, generate wastewaters and thus fall within the scope of this analysis and would be subject to effluent control guidelines. Approximately 80 percent of these existing mills are discharging wastewater into publicly owned treatment works (POTW's) and are classified as indirect dischargers; the remaining 20 percent are discharging directly into receiving waters (rivers and lakes) and are classified as direct dischargers. Model plants representing both type dischargers were developed from a synthesis of data obtained from surveys of the industry as well as published sources. The model plants were based on the economic conditions in the industry during 1977 which were considered "baseline" in the analysis. The treatment systems in-place in the industry during 1977 varied considerably.

In the model plant development, it was assumed that the direct dischargers (except as noted below) have met BPT requirements while the indirect dischargers have not had any treatment systems installed. In addition to model plants representing existing mills or sources, models were developed to represent new sources (mills to be constructed in the future). As in the case of the existing mills, new source models were developed both for direct and indirect dischargers. In order to facilitate the analysis in this chapter, model plant data are organized under four classifications.

(1) existing direct dischargers,
(2) existing indirect dischargers,
(3) new source direct dischargers,
(4) new source indirect dischargers.

A. Model Plant Development

Model plants were developed primarily from data accumulated from two surveys of the industry. The initial survey was technical in nature and was conducted during preparation of the Development Document. The survey was designed to develop a descriptive and representative data base covering:

(1) number and location of facilities,
(2) production levels,
(3) wastewater discharge quantities,
(4) methods of discharge,
(5) general treatment status.

From this data base, the industry was divided into subcategories (and subdivisions) discussed in Chapter III. A range of mill sizes both in terms of production levels and flow rates was identified. Eight flow rates were selected as a means of establishing production levels for representative model plants. These flow rates varied from a low of 0.05 mgd to a high of 5.0 mgd as shown in Table VI-1 and were established as the capacity levels.

These levels were then converted to specific production rates (kkg per day) for each of the models within the subcategories. These rates provided the basis for preparing the required control costs and for constructing the model plants.

As a part of this study, a second survey was conducted involving a random sample of about a quarter of the wet processors in the industry and covered questions on production, finance and wastewater discharge. The survey responses revealed that additional segmentation within the industry was required in order to reflect the economic characteristics of different type mills in terms of product ownership and degree of integration. Consequently, in addition to categorization by type processing, mills were further categorized by type of mills to include (1) integrated, (2) commission, and (3) own fabric finishers.

Responses to the survey provided the data base from which the financial profiles of the individual model plants were constructed. Model plants were developed for the capacities shown in Table VI-1. One or more models were developed for most of the size categories (i.e., commission, integrated) in order to represent the various type mills. Some of the capacity levels established in the Development Document were not utilized as indicated by "X" in the table since it was found that the subcategories could be adequately covered with a fewer number. For example, the survey indicated that the number of simple processors in woven fabric finishing (4A) was not significant in the larger categories. Consequently, model plants were developed for the smallest capacities, only. Similarly, no mills were identified in the larger sizes in knit fabric (5); model plants were not developed for these capacities.

As indicated above, each subcategory was represented by one or more type mills. This representation became a problem in the woven and knit fabric subcategories (5) in which mills were categorized by both type processing and type mills as well as by sizes. Over 50 combinations were possible in the woven fabric subcategory (4). Consequently, to reduce the number of model plants to a manageable level, the structure shown in Table VI-2 was selected for these two subcategories. This structure is believed to be descriptive of the more common combinations in each subcategory. Simple processing was generally limited to the small size categories while desizing was restricted to the integrated mills (woven fabric (4)). With the establishment of the structures of each subcategory, model plants were then developed which consisted of pro forma income statements and investment characteristics. The models were developed to represent actual mills in the industry by estimating a number of key parameters to include annual production, sales, profit, capital investment (book value) and liquidation value (salvage value).

Table VI-1. The textile industry, selected model plant capacities 1/ (flow rate and production)

Subcategory	Type 2/ Discharger	0.05	0.11	0.25	0.6	1.0	1.5	3.0	5.0
		Flow Rate - mgd							
		production - kkg per day							
1. Wool scouring	D	16.2 3/	35.6	80.9					
	I	16.0		81.0					
2. Wool finishing	D				8.0		20.0	40.0	
	I			3.3			20.0	40.0	
4. Woven fabric finishing a. Simple processing	D		5.3		X		X		
	I	2.4		X		X			
b. Complex processing plus desizing	D				26.0			130.0	220.0
	I			X	26.0			130.0	
c. Complex processing plus desizing	D				20.0		50.0	X	
	I				20.0		50.0		170.0
5. Knit fabric finishing a. Simple processing	D			7.7		X		X	
	I			7.7	X	31.0			
b. Complex processing	D			7.7	18.6	X			
	I	1.5			18.6		X		
c. Hosiery products	D	2.7	6.0						
	I	2.7		13.6					
6. Carpet finishing	D			20.0	49.0		120.0		
	I		8.9		49.0		122.0		
7. Stock & yarn finishing	D			9.4	23.0	38.0	57.0		
	I		4.2	9.4	23.0				
8. Nonwoven manufacturing	D	X	10.4	X					
	I			24.0	57.0				
9. Felted fabric processing	D		?.0						
	I	0.9		4.4	10.7				

1/ "X" indicates capacities for which control costs were developed; however, these capacities were not used in the development of the economic model plants; subcategory three (low water use processing) was omitted.

2/ Type dischargers: D = direct and I = indirect.

3/ In most cases, the production capacities of direct and indirect mills with the same flow rates were the same. In a few cases they were different primarily because of varying efficiencies that can be expected in the two type mills.

Source: Development Document for Proposed Effluent Limitations Guidelines, New Source Performance Standards and Pretreatment Standards for the Textile Mills Point Source Category, U.S. Environmental Protection Agency, Effluent Guidelines Division, EPA 440/1-79-022b, October 1979.

Table VI-2. Textile industry, model plant capacities-woven and knit fabric finishing (flow rate and type processing)

	Subcategory	Type Mill	Type[1/] Discharger	Type Processing (subdivisions) (Size - flow rate - mgd) 0.05	0.11	0.25	0.6	1.0	1.5	3.0	5.0
4.	Woven fabric finishing	Commission	D		Simple		Complex			Complex	
			I	Simple			Complex			Complex	
		Own fabric	D		Simple		Complex			Complex	
			I	Simple			Complex			Complex	
		Integrated	D		Simple		Desizing		Desizing		Complex
			I	Simple			Desizing		Desizing		Desizing
5.	Knit fabric[3/] finishing	Commission	D			Simple, Complex[2/]	Complex				
			I	Complex		Simple	Complex	Simple			
		Integrated	D			Simple, Complex[2/]	Complex				
			I			Simple	Complex	Simple			

1/ D = direct, I = indirect.

2/ Two models were developed for this flow rate and size category, one for the simple processing and the other for the complex processing subdivision.

3/ Hosiery products subdivision is not shown for the knit fabric finishing subcategory.

Source: Development Document for Proposed Effluent Limitations Guidelines, New Source Performance Standards and Pretreatment Standards for the Textile Mills Point Source Category, U.S. Environmental Protection Agency, Effluent Guidelines Division, EPA 440/1-79-022b, October 1979.

The production level of each model was computed as the product of the annual capacity (in pounds of product) and the utilization rate. The utilization rates were based on the surveys and varied between subcategories and type mills.

After the production level was established, the sales volume was then determined by multiplying the dollars per pound of production by its annual production. The dollars per pound were estimated based on an average of the "typical" values of the surveys corresponding to the model category. Values which were extremely high or low relative to the majority of the values were generally excluded from the averaging. The values used represent a composite of a variety of product mixes and consequently can not be identified with any specific textile product. For example, the woven fabric subcategory (4) reflects mills of which 48 percent were producing woven fabric only, 13 percent producing narrow fabrics, and the remainder processing a variety of mixes such as fabric and yarn, and fabric and sheeting. In the knit fabric subcategory (5), 28 percent of the mills surveyed were producing circular fabric only, 17 percent were producing warp and the remainder were producing mixes of fabric and apparel (underwear).

Levels of profits were determined for each model plant by averaging the returns on sales from the survey data appropriate to its size and type category. As was discussed above, the "typical" value was sought by excluding exceptionally high or low values from the computation. These averages were then compared with data contained in other published sources in order to establish their reasonableness. If the project levels differed widely from the data reported in the published sources, an investigation was made to determine the reason for the difference. When it was considered appropriate, returns on sales were modified to fall within the framework of these sources. The most valuable published data source proved to be Robert Morris Associates, Annual Statement Studies which reports data for mills organized within a structure similar to the one utilized in this study. With sales level and profit level established for each model plant, an appropriate cost structure was developed including depreciation and interest. The sales level, cost structure and profits comprised the pro forma income statement.

The capital investment for each model plant was derived by calculating the difference between the total assets and current liabilities (this equals net working capital plus fixed assets) for each surveyed mill. These values, expressed as percentages of sales, were then analyzed to arrive at a typical value for the model plant as discussed above. The asset structures of the surveyed mills were analyzed and a breakout of net working capital and current and fixed assets was determined for each of the model plants.

The final parameter to be derived was the salvage or liquidation value of the model plant which is the sum of the net working capital (computed previously) and the salvage value of the fixed assets. The salvage value was established by an analysis of the estimates provided in the survey. This was a key parameter used in the model plant NPV analysis. An over estimation of the value would tend to overstate the impacts in the analysis while an underestimation of the salvage value would understate the magnitude of the impacts. A detailed discussion of the characteristics of the individual models is contained below.

B. Model Plant Characteristics

The textile mills vary by operational and financial characteristics; thus, the models will not accurately depict the characteristics of any existing mill. However, since the subcategories discussed above group the mills into segments having similar processes, discharge methods, and economic characteristics, it was possible to develop models which are descriptive of the common operational and financial characteristics.

The various models utilized in this report are shown in Table VI-3 for the existing direct dischargers, Table VI-4 for the existing indirect dischargers, and Table VI-5 for both direct and indirect discharge new source models. These models incorporate the capacities shown in Table VI-1 for the subcategories and subdivisions. As indicated above, model plants were developed for three types of mills to include commission, own fabric (yarn, hosiery), and integrated. These mill types represent mills within the industry with respect to product ownership and extent of integration of milling processes. The "commission" models represent those mills which are engaged in finishing only, but do the finishing on a commission basis; they do not own the products which they process. The "own fabric" models represent those mills which are also engaged in finishing only; however, these mills actually purchase the textile materials processed. The integrated models represent those mills engaged in both greige milling and finishing operations. Models were developed for each of the above type mills because of the significant differences in the financial profile of these mills in the industry.

Tables VI-3 to VI-5 show the types of models used in each of the subcategories. Although the economic characteristics of these type models differ significantly within subcategories, the waste characteristics and control technologies are assumed to be identical for those models having the same production capacities. Consequently, the <u>type</u> of model should be disregarded when relating the models in this report with those in the Development Document. Within a given subcategory and for a specific capacity level, the control technology and costs contained in the Development Document are applicable to each of the type models (commission,own fabric, and integrated). The subdivisions (simple processing, complex processing and complex processing plus desizing) are not identified in Tables VI-3 to VI-5. These are identified as appropriate in subsequent tables. The hosiery products subdivision of knit fabric finishing is shown separate from the simple and complex processing subdivisions since the hosiery mills constitute a distinct and separate industry from an economic perspective. To facilitate the correlation of model plants developed in this report with the subcategorization discussed in the Development Document (Table VI-1), the subcategory numbers and subdivision letters will be placed in parenthesis after each model plant discussed in the text.

Table VI-3. Textile industry, representative existing direct model plants' capacities

Subcategory	Type mill	Capacity Small	Medium	Large	X-Large
		-----------kkg per day			------------
1. Wool scouring	Commission	16.2	35.6	80.9	
2. Wool finishing	Commission	8.0	-	-	
	Integrated	8.0	20.0	40.0	
4. Woven fabric finishing	Commission	5.3	26.0	130.0	
	Own fabric	5.3	26.0	130.0	
	Integrated	5.3	20.0	50.0	220.0
5. Knit fabric finishing	Commission	-	7.7 1/	18.6	
	Integrated	-	7.7 1/	18.6	
5c. Hosiery products 2/	Own hosiery	2.7	6.0	-	
	Integrated	2.7	6.0	-	
6. Carpet finishing	Integrated	20.0	49.0	120.0	
7. Stock & yarn finishing	Commission	9.4	23.0	57.0	
	Own yarn	9.4	23.0	38.0	57.0
	Integrated	9.4	-	38.0	
8. Nonwoven manufacturing		-	10.4	-	
9. Felted fabric processing		-	2.0	-	

1/ Two model plants were developed in the medium category for both the commission and integrated mills to cover simple and complex processing.

2/ Subdivision of the knit fabric finishing subcategory.
Source: DPRA estimates based on survey and published data.

Table VI-4. Textile industry, representative existing indirect discharging model plants' capacities.

Subcategory	Type Mill	Capacity Small	Medium	Large	X-Large
		----------------kkg per day------------			
1. Wool scouring	Commission	16.0		81.0	
2. Wool finishing	Commission	3.3			
	Integrated	3.3	20.0	40.0	
4. Woven fabric finishing	Commission	2.4	26.0	130.0	
	Own fabric	2.4	26.0	130.0	
	Integrated	2.4	20.0	50.0	170.0
5. Knit fabric finishing	Commission	-	7.7	18.6	
	Integrated	1.5	7.7	18.6	31.0
5c. Hosiery products 1/	Own hosiery	2.7	-	13.6	
	Integrated	2.7	-	13.6	
6. Carpet finishing	Integrated	8.9	49.0	122.0	
7. Stock & yarn finishing	Commission	4.2	9.4	23.0	
	Own yarn	4.2	9.4	23.0	
	Integrated	-	9.4	23.0	
8. Nonwoven manufacturing		24.0	57.0	-	
9. Felted fabric processing		0.9	4.4	10.7	

1/ Subdivision in the knit fabric finishing subcategory.

Source: DPRA estimates based on survey and published data.

Table VI-5. Textile industry, new source model plants' capacities

Subcategory	Type mill	Size 1/	Direct Dischargers	Indirect Dischargers
			-----------kkg-----------	
2. Wool finishing	Integrated	Medium	20.0	20.0
4. Woven fabric finishing	Own fabric	Medium	NA	26.0
		Large	130.0	NA
	Integrated	Large	50.0	50.0
5. Knit fabric finishing	Integrated	Large	18.6	18.6
5c. Hosiery products 2/	Integrated	Medium	6.0	NA
		Large	NA	13.6
6. Carpet finishing	Integrated	Small	20.0	NA
		Medium	NA	49.0
7. Stock & yarn finishing	Own yarn	Medium	23.0	9.4
8. Nonwoven manufacturing		Medium	10.4	57.0
9. Felted fabric processing		Medium	2.0	4.4

1/ Size designations correspond with the designations for existing model plants.

2/ Subdivision in the knit fabric finishing subcategory.

Source: DPRA estimates based on survey and published data.

For the existing models, both direct and indirect dischargers, four size designations were used to reflect the size structure within the subcategories: small, medium, large, and x-large. Model plant capacities were expressed in kilograms of textile materials processed per day. The models with the largest capacities are the x-large integrated woven fabric models with capacities of 170,000 and 200,000 kg per day for indirect (4c) and direct dischargers (4b), respectively. The capacities of the medium and large models of both the direct and indirect dischargers are generally the same within each subcategory. However, the capacities of the small models are significantly different, with the small indirect dischargers about half the size of the small direct dischargers.

For the new source mills, only a limited number of models were developed to reflect the most likely sizes and types to be constructed. The size capacities of these models correspond with those of specific existing mills; consequently, the same size designations were used.

No new source wool scouring (1) models were developed since it was not considered likely that any of these mills would be constructed in the foreseeable future. In most cases, new source models were considered to be integrated since this type of mill was considered to be the most likely to be developed in the future. No new source commission models were developed for any of the subcategories.

C. Operational Characteristics

The operational characteristics for the existing direct and indirect dischargers are summarized in Tables VI-6 and VI-7. These characteristics were determined from the industry surveys as well as discussions with industry members and include data on daily capacity, utilization, annual production and number of employees. The production and utilization rates for the new source models were assumed to correspond to the same type and size models of the existing mills. The new source models' numbers of employees were assumed to be 15 percent fewer than the existing models. This slightly reduced employment requirement reflects the utilization of labor saving equipment and the requirement for a reduced maintenance force in the new source mills. The operational characteristics for the new source models are summarized in Table VI-8 for the direct dischargers and Table VI-9 for the indirect dischargers.

Utilization rates were based on a 250 to 300 day work year and varied considerably between type dischargers, subcategories, and size categories. Two models reflected utilization rates of 100 percent--the large integrated wool finishing (2) and felt (9) models; both direct dischargers. Among the direct discharger models, the lowest utilization rate occurred in the small wool scouring (1) mill (55 percent). Among the indirect dischargers, the model with the lowest utilization rate was the small woven fabric model (4a) with a rate of 57 percent. The rates of the remaining models in both categories (direct and indirect dischargers) varied generally between 70 and 85 percent.

Table VI-6. The textile industry, representative existing direct discharging model plants' operational characteristics

Subcategory	Type mill	Size	Type 1/ processing	Daily capacity	Utilization rate	Annual Production	Number of Employees Production	Non-production	Total
				(kkg)	(%)	(1,000 lbs)			
1. Wool scouring	Commission	Small		16.2	55	5,941.4	141	43	184
		Medium		35.6	88	20,758.5	254	31	285
		Large		80.9	90	48,214.6	752	105	657
2. Wool finishing	Commission	Small		8.0	85	4,497.4	129	13	142
	Integrated	Small		8.0	85	4,497.4	749	127	876
		Medium		20.0	75	9,920.7	818	107	925
		Large		40.0	100	26,455.2	2,411	482	2,893
4. Woven fabric finishing	Commission	Small	Simple	5.3	76	2,680.8	60	9	69
		Medium	Complex	26.0	80	13,933.1	238	54	292
		Large	Complex	130.0	73	62,765.0	1,082	227	1,309
	Own fabric	Small	Simple	5.3	76	2,680.8	135	26	161
		Medium	Complex	26.0	80	13,933.1	446	98	544
		Large	Complex	130.0	73	62,765.0	1,436	431	1,867
	Integrated	Small	Simple	5.3	76	2,680.8	235	42	277
		Medium	Desize	20.0	77	10,185.3	511	61	572
		Large	Desize	50.0	80	26,455.2	1,340	134	1,474
		X-Large	Complex	220.0	70	101,852.5	6,956	696	7,652
5. Knit fabric finishing	Commission	Medium	Simple	7.7	69	3,498.7	112	5	117
		Medium	Complex	7.7	72	3,650.8	106	26	132
		Large	Complex	18.6	77	9,506.2	241	77	318
	Integrated	Medium	Simple	7.7	69	3,498.7	279	72	351
		Medium	Complex	7.7	72	3,650.8	237	74	311
		Large	Complex	18.6	77	9,506.2	644	71	715
5c. Hosiery products 2/	Own hosiery	Small		2.7	76	1,373.5	194	36	230
		Medium		6.0	90	3,571.5	590	111	701
	Integrated	Small		2.7	76	1,373.5	412	45	457
		Medium		6.0	90	3,571.5	622	81	703
6. Carpet finishing	Integrated	Small		20.0	69	9,279.2	409	107	516
		Medium		49.0	64	21,164.2	567	159	726
		Large		120.0	79	62,698.8	1,507	468	1,975
7. Stock & yarn finishing	Commission	Small		9.4	77	4,753.1	57	12	69
		Medium		23.0	81	12,142.9	122	26	148
		Large		57.0	72	26,984.3	437	92	529
	Own yarn	Small		9.4	77	4,753.1	130	29	159
		Medium		23.0	81	12,142.9	247	79	326
		Large		38.0	88	21,340.5	454	100	544
		X-Large		57.0	72	26,984.3	611	141	752
	Integrated	Small		9.4	77	4,753.1	237	43	280
		Large		38.0	88	21,340.5	814	147	961
8. Nonwoven manufacturing		Medium		10.4	85	5,846.6	98	59	157
9. Felt fabric processor		Medium		2.0	100	1,289.7	121	42	163

1/ Type processing (or subdivision) applicable to woven and knit fabric finishing is shown for each model plant in these subcategories. These include simple, complex, and complex plus desizing (Desize).

2/ Hosiery products is a subdivision of the knit fabric finishing subcategory.

Source: DPRA estimates based on survey and published data.

Table VI-7. The textile industry, representative existing indirect discharging model plants' operational characteristics

Subcategory	Type mill	Size	Type 1/ processing	Daily capacity	Utilization rate	Annual production	Number of Employees: Production	Non-production	Total
				(kkg)	(%)	(1,000 lbs)			
1. Wool scouring	Commission	Small		16.0	65	6,950.0	165	48	213
		Large		81.0	95	50,264.9	784	109	893
2. Wool finishing	Commission	Small		3.3	80	1,763.7	51	5	56
	Integrated	Small		3.3	80	1,763.7	234	39	273
		Medium		20.0	85	11,243.5	927	121	1,048
		Large		40.0	95	25,132.4	2,290	458	2,748
4. Woven fabric finishing	Commission	Small	Simple	2.4	57	904.8	20	3	23
		Medium	Complex	26.0	70	12,191.4	208	47	255
		Large	Complex	130.0	84	72,222.7	1,245	262	1,507
	Own fabric	Small	Simple	2.4	57	904.8	46	9	55
		Medium	Complex	26.0	70	12,191.4	390	86	476
		Large	Complex	130.0	84	72,222.7	1,652	495	2,147
	Integrated	Small	Simple	2.4	57	904.8	79	14	93
		Medium	Desize	20.0	85	11,243.5	564	67	631
		Large	Desize	50.0	80	26,455.2	1,340	134	1,474
		X-large	Desize	170.0	85	93,695.5	6,399	640	7,039
5. Knit fabric finishing	Commission	Medium	Simple	7.7	62	3,143.8	148	34	182
		Large	Complex	18.6	79	9,753.2	308	77	385
	Integrated	Small	Complex	1.5	73	740.3	71	19	90
		Medium	Simple	7.7	62	3,143.8	251	66	317
		Large	Complex	18.6	79	9,753.2	633	197	830
		X-large	Simple	31.0	81	16,607.3	1,126	124	1,250
5c. Hosiery products 2/	Own hosiery	Small		2.7	76	1,373.9	194	35	229
		Large		13.6	65	5,875.3	970	183	1,153
	Integrated	Small		2.7	76	1,373.9	412	44	456
		Large		13.6	65	5,875.3	847	111	958
6. Carpet finishing	Integrated	Small		8.9	69	4,107.2	18	5	23
		Medium		49.0	74	23,818.5	638	178	816
		Large		122.0	75	59,524.2	1,430	443	1,873
7. Stock & yarn finishing	Commission	Small		4.2	71	1,956.6	23	4	27
		Medium		9.4	70	4,321.0	44	9	53
		Large		23.0	78	11,693.2	155	33	188
	Own yarn	Small		4.2	71	1,956.6	53	11	64
		Medium		9.4	70	4,321.0	88	28	116
		Large		23.0	78	11,693.2	249	54	303
	Integrated	Medium		9.4	70	4,321.0	216	39	255
		Large		23.0	78	11,693.2	446	81	527
8. Nonwoven manfacturing		Small		24.0	71	11,113.4	186	113	299
		Medium		57.0	76	28,483.4	430	206	636
9. Felted fabric processing		Small		0.9	85	506.0	168	80	248
		Medium		4.4	65	1,862.9	175	61	236
		Large		10.7	62	4,373.9	447	134	581

1/ Type processing (or subdivision) applicable to woven and knit fabric finishing is shown for each model plant in these two subcategories. These include simple, complex, and complex plus desizing (Desize).

2/ Hosiery product is a subdivision of the knit fabric finishing subcategory.

Source: DPRA estimates based on survey and published data.

Table VI-8. The textile industry, new source direct discharging model plants' operational characteristics

Subcategory	Type mill	Size	Type Processing 1/	Daily Capacity	Utilization rate	Annual production	Number of Employees		
							Production	Non-production	Total
				(kkg)	(%)	(1,000 lbs)			
2. Wool finishing	Integrated	Medium		20.0	75	9,920.7	695	91	786
4. Woven fabric finishing	Own fabric	Large	Complex	130.0	73	62,765.0	1,149	345	1,494
	Integrated	Large	Desize	50.0	80	26,455.2	1,139	114	1,253
5. Knit fabric finishing	Integrated	Large	Compley	18.6	77	9,506.2	547	60	607
5c. Hosiery product 2/	Integrated	Medium		6.0	90	3,571.5	529	69	598
6. Carpet finishing	Integrated	Small		20.0	69	9,279.2	368	96	464
7. Stock & yarn finishing	Own yarn	Medium		23.0	81	12,142.9	210	67	277
8. Nonwoven manufacturing		Medium		10.4	85	5,846.6	83	51	134
9. Felted fabric processing		Medium		2.0	100	1,289.7	103	36	139

1/ Type processing (or subdivision) is applicable to woven and knit fabric finishing only.
2/ Hosiery products is a subdivision of the knit fabric finishing subcategory.
Source: DPRA estimates based on survey and published data.

Table VI-9. The textile industry, new source indirect discharging model plants' operational characteristics

Subcategory	Type mill	Size	Type Processing[1/]	Daily Capacity	Utilization rate	Annual Production	Number of Employees: Production	Number of Employees: Non-production	Number of Employees: Total
				(kkg)	(%)	(1,000 lbs)			
2. Wool finishing	Integrated	Medium		20.0	85	11,243.5	788	103	891
4. Woven fabric finishing	Own fabric	Medium	Complex	26.0	70	12,191.4	312	69	381
	Integrated	Large	Desize	50.0	80	26,455.2	1,139	114	1,253
5. Knit fabric finishing	Integrated	Large	Complex	18.6	79	9,753.2	538	167	705
5c. Hosiery products[2/]	Integrated	Large		13.6	65	5,875.3	720	94	814
6. Carpet finishing	Integrated	Medium		49.0	74	23,818.5	574	160	734
7. Stock & yarn finishing	Own yard	Medium		9.4	70	4,321.0	75	24	99
8. Nonwoven manufacturing		Medium		57.0	7	24,483.4	366	175	605
9. Felted fabric processing		Medium		4.4	65	1,862.9	149	52	201

1/ Type processing (or subdivision) is applicable to woven and knit fabric only.

2/ Hosiery products is a subdivision of the knit fabric finishers category.

Source: DPRA estimates based on survey and published data.

Annual production quantities for the model plants were based on the daily capacities and utilization rates shown in the tables and are expressed in thousands of pounds of textile materials processed. The outputs of the wool scouring models (1) reflected the quantity of clean wool produced. The outputs of the remaining models represented a composite of the products produced within each of the subcategories and do not represent any specific sizes or weights of material. For example, the outputs of the woven fabric mills (4) represented a combination of manmade and cotton woven fabric piece goods, sheets, towels, blankets, and other broadwoven fabrics and the outputs of the knit fabric mills represented a combination of warp and circular knit fabric, and outerwear and underwear apparel.

The estimated number of production and nonproduction workers employed in each of the model plants is also shown in the tables. The numbers of employees varied significantly not only between models in the subcategories but also between the types of mills. The most labor intensive models fell in the hosiery products subdivision (5c) although the total number of employees in this subdivision is relatively small. For all models, the integrated models were more labor intensive than the finishers (both commission and own fabric) due to the added requirement for workers in the greige mill operations. The number of employees in the new source models was assumed to be 15 percent fewer than in the existing models as a result of increased efficiencies.

D. Investment Characteristics

The investment characteristics for the existing direct discharging, existing indirect, and new source direct, and new source indirect models are depicted in Tables VI-10, 11, 12 and 13, respectively. Included in these tables are estimates for the models' assets (both fixed and current), current liabilities, net working capital, total invested capital, and salvage values for nonconforming uses. These are discussed below.

1. Fixed Assets

The fixed assets depicted in the tables are considered reflective of net or book values of the buildings, equipment, and land. As would be expected in an industry with a substantial number of older plants and equipment, the book values of the models' assets reflect significant levels of depreciation. The models' fixed assets were estimated from information provided in the industry surveys.

2. Net Working Capital

The models' net working capital or operating capital is defined as that capital necessary to maintain the day to day operations of the mills. Included in the computation of this capital are a firm's current assets

Table VI-10. The textile industry, representative existing direct discharging model plants' investment characteristics[1/]

Subcategory	Type mill	Size	Type processing	Daily capacity	Total assets	Fixed assets	Current assets	Current liabilities	Net working capital	Total invested capital	Salvage value
				(kkg)	($000)						
1. Wool scouring	Commission	Small		16.2	2,145.6	796.5	1,349.1	917.9	431.2	1,227.7	998.1
		Medium		35.6	5,305.9	2,614.1	2,691.8	1,345.2	1,346.6	3,960.7	2,241.9
		Large		80.9	9,585.2	5,106.0	4,479.2	1,350.0	3,129.2	8,235.2	4,050.1
2. Wool finishing	Commission	Small		8.0	1,611.4	324.4	1,287.0	820.3	466.7	791.1	761.7
	Integrated	Small		8.0	9,470.5	2,437.9	7,032.6	3,495.8	3,536.8	5,974.7	5,763.2
		Medium		20.0	17,839.7	5,313.5	12,526.2	8,517.9	4,008.3	9,321.8	7,393.0
		Large		40.0	46,984.1	12,444.2	34,539.9	29,206.5	5,333.4	17,777.6	12,698.4
4. Woven fabric finishing	Commission	Small	Simple	5.3	768.4	389.3	379.2	42.2	337.0	726.3	675.5
		Medium	Complex	26.0	4,737.2	933.6	3,803.6	2,995.5	808.1	1,741.7	1,107.0
		Large	Complex	130.0	22,282.0	3,701.0	18,581.0	15,377.5	3,203.5	6,904.5	5,962.8
	Own fabric	Small	Simple	5.3	3,129.5	1,450.7	1,678.8	938.0	740.8	2,191.5	1,753.2
		Medium	Complex	26.0	20,096.8	7,166.7	12,930.1	8,159.8	4,770.3	11,937.0	7,234.8
		Large	Complex	130.0	63,165.6	22,631.3	40,534.3	25,447.6	15,086.7	37,718.0	23,096.2
	Integrated	Small	Simple	5.3	4,818.3	2,177.6	2,640.7	1,543.7	1,097.0	3,274.6	2,339.1
		Medium	Desize	20.0	13,469.0	5,541.2	7,927.8	5,198.6	2,729.2	8,270.4	5,907.3
		Large	Desize	50.0	31,861.6	13,347.4	18,514.2	14,639.2	3,875.0	17,222.4	11,481.6
		X-Large	Complex	220.0	111,292.2	51,594.7	59,697.5	21,410.2	38,287.3	89,882.0	87,057.3
5. Knit fabric finishing	Commission	Medium	Simple	7.7	1,275.3	328.6	946.7	708.6	238.1	566.7	425.1
		Medium	Complex	7.7	1,342.6	340.1	1,002.5	751.1	251.4	591.5	443.6
		Large	Complex	18.6	3,503.5	1,067.4	2,436.1	1,647.2	788.9	1,856.3	898.3
	Integrated	Medium	Simple	7.7	5,626.8	2,220.1	3,406.7	1,414.2	1,992.5	4,212.6	3,008.9
		Medium	Complex	7.7	8,019.4	3,671.0	4,348.4	1,464.3	2,884.1	6,555.1	5,820.8
		Large	Complex	18.6	15,579.6	8,095.4	7,484.2	1,717.6	5,766.6	13,862.0	13,259.3
5c. Hosiery products 2/	Own hosiery	Small		2.7	1,482.5	456.2	1,026.3	522.1	504.2	960.4	960.4
		Medium		6.0	9,125.2	1,387.0	7,738.2	6,205.2	1,533.0	2,920.0	2,920.1
	Integrated	Small		2.7	5,971.2	1,690.7	4,280.5	1,636.3	2,644.2	4,334.9	2,817.6
		Medium		6.0	6,752.7	1,992.9	4,759.8	1,642.6	3,117.2	5,110.1	4,562.5
6. Carpet finishing	Integrated	Small		20.0	10,045.1	3,987.4	6,057.7	2,070.1	3,987.6	7,975.0	4,492.5
		Medium		49.0	17,054.0	5,521.4	11,532.6	1,003.2	10,529.4	16,050.8	16,050.8
		Large		120.0	81,664.5	25,008.0	56,656.5	24,828.9	31,827.6	56,835.6	56,835.6
7. Stock & yarn finishing	Commission	Small		9.4	832.4	555.0	277.4	111.6	165.8	720.8	720.8
		Medium		23.0	1,235.8	906.3	329.5	58.5	271.0	1,177.3	1,033.5
		Large		57.0	3,353.0	3,141.0	212.0	36.6	175.4	3,316.4	2,926.2
	Own yarn	Small		9.4	3,613.5	1,280.6	2,332.9	799.0	1,533.9	2,814.5	2,814.4
		Medium		23.0	5,733.6	1,831.6	3,902.0	1,211.4	2,690.6	4,522.2	3,230.2
		Large		38.0	16,338.5	7,324.3	9,014.2	5,070.5	3,943.7	11,268.0	4,507.2
		X-large		57.0	18,904.9	8,231.0	10,673.9	5,186.4	5,487.5	13,718.5	6,022.8
	Integrated	Small		9.4	3,161.1	749.2	2,411.9	1,264.4	1,147.5	1,896.7	1,671.9
		Large		38.0	14,368.3	7,102.3	7,266.0	3,441.8	3,824.2	10,926.5	4,370.6
8. Nonwoven manufacturing		Medium		2.0	4,009.1	1,912.1	2,097.0	1,616.7	480.3	2,392.4	2,247.4
9. Felt Fabric processing		Medium		10.4	3,382.4	2,168.8	1,213.6	515.1	698.5	2,867.3	2,708.0

1/ Total Assets = Fixed Assets + Current Assets; Net Working Capital = Current Assets - Current Liabilities; Total Invested Capital = Fixed Assets + Net Working Capital; Salvage Value = Net Working Capital + Salvage Value of Fixed Assets.

2/ Hosiery products is a subdivision of the knit fabric finishing subcategory.

Source: DPRA estimates based on survey and published data.

Table VI-11. *The textile industry, representative existing indirect discharging model plants' investment characteristics.* 1/

Subcategory	Type mill	Size	Type processing	Daily capacity	Total assets	Fixed assets	Current assets	Current liabilities	Net working capital	Total invested capital	Salvage value
				(kkg)	($000)						
1. Wool scouring	Commission	Small		16.0	2,510.3	1,130.0	1,380.3	875.7	504.6	1,634.6	1,167.6
		Large		81.0	9,992.7	5,322.9	4,669.8	1,407.4	3,262.4	8,585.3	4,222.3
2. Wool finishing	Commission	Small		3.3	632.0	127.3	504.7	321.7	183.0	310.3	298.7
	Integrated	Small		3.3	2,959.1	761.7	2,197.4	1,092.4	1,105.0	1,866.7	1,797.5
		Medium		20.0	20,218.1	6,021.8	14,196.4	9,653.7	4,542.7	10,564.4	8,378.7
		Large		40.0	44,635.1	11,822.2	32,812.9	27,746.2	5,066.7	16,888.9	12,063.6
4. Woven fabric finishing	Commission	Small	Simple	2.4	259.1	131.3	127.8	14.1	113.7	245.0	227.8
		Medium	Complex	26.0	4,145.1	816.8	3,328.3	2,621.2	707.1	1,523.9	1,341.1
		Large	Complex	130.0	25,639.1	4,258.3	21,380.8	17,694.6	3,686.2	7,944.5	6,861.2
	Own fabric	Small	Simple	2.4	1,056.5	134.7	921.8	671.8	250.0	384.7	269.3
		Medium	Complex	26.0	17,584.3	5,593.0	11,991.3	7,149.6	4,841.7	10,434.7	6,338.1
		Large	Complex	130.0	72,682.0	23,262.4	49,419.6	29,282.0	20,137.6	43,400.0	26,536.9
	Integrated	Small	Simple	2.4	1,626.5	735.1	891.4	521.1	370.3	1,105.4	789.6
		Medium	Desize	20.0	14,868.4	3,588.0	11,280.4	5,738.7	5,541.7	9,129.7	6,521.2
		Large	Desize	50.0	31,861.6	13,347.5	18,514.1	14,639.1	3,875.0	17,222.5	11,481.7
		X-large	Desize	170.0	102,374.5	47,457.6	54,916.9	19,695.8	35,221.1	82,678.7	80,081.5
5. Knit fabric finishing	Commission	Medium	Simple	7.7	2,806.4	785.8	2,020.6	1,496.8	523.8	1,309.6	748.4
		Large	Complex	18.6	3,586.6	908.5	2,678.1	2,006.6	671.5	1,580.0	1,185.0
	Integrated	Small	Complex	1.5	1,337.0	652.5	684.5	278.9	405.6	1,058.1	1,058.1
		Medium	Simple	7.7	5,055.9	1,994.7	3,061.2	1,270.8	1,790.4	3,785.1	3,379.7
		Large	Complex	18.6	21,422.9	9,806.1	11,616.8	3,912.0	7,704.8	17,510.9	16,765.8
		X-large	Simple	31.0	27,217.6	14,142.6	13,075.0	3,000.8	10,074.2	24,216.8	25,269.7
5c. Hosiery products 2/	Own hosiery	Small		2.7	1,483.0	456.4	1,026.6	522.4	504.2	960.6	960.6
		Large		13.6	8,406.3	3,391.4	5,014.9	3,602.6	1,412.3	4,803.7	4,803.7
	Integrated	Small		2.7	5,972.9	1,691.0	4,281.9	1,636.9	2,645.0	433.6	2,818.4
		Large		13.6	9,195.8	2,713.8	6,482.0	2,237.2	4,244.8	6,958.6	6,213.4
6. Carpet finishing	Integrated	Small		8.9	4,446.3	1,765.2	2,681.1	916.0	1,765.1	3,530.3	1,988.5
		Medium		49.0	19,193.1	6,214.1	12,979.0	1,129.0	11,850.0	18,064.0	18,064.0
		Large		122.0	77,529.1	28,851.6	48,677.5	11,957.2	36,720.3	65,571.9	51,428.2
7. Stock and yarn finishing	Commission	Small		4.2	470.9	111.6	359.3	326.0	33.3	144.9	144.9
		Medium		9.4	799.5	322.6	476.9	380.6	96.3	418.9	367.8
		Large		23.0	1,947.0	899.6	1,047.4	778.7	268.7	1,168.3	1,038.4
	Own yarn	Small		4.2	1,487.2	527.1	960.1	328.7	631.4	1,158.5	1,158.4
		Medium		9.4	2,040.3	651.8	1,388.5	431.1	957.4	1,609.2	1,149.4
		Large		23.0	8,952.3	3,364.8	5,587.5	2,778.3	2,809.2	6,174.0	2,469.6
	Integrated	Medium		9.4	2,873.6	681.1	2,192.5	1,149.4	1,043.1	1.724.2	1,494.3
		Large		23.0	7,872.8	3,400.6	4,472.2	1,885.9	2,586.3	5,986.9	2,394.8
8. Nonwoven manufacturing		Small		24.0	8,957.4	3,474.4	5,483.0	4,409.8	1,073.2	4,547.6	2,756.1
		Medium		57.0	20,735.9	9,505.3	11,230.6	8,294.4	2,936.2	12,441.5	7,975.4
9. Felt fabric processing		Small		0.9	2,385.2	1,041.9	1,343.3	400.6	942.7	1,984.6	1,872.2
		Medium		4.4	3,560.0	1,835.5	1,724.5	989.3	735.2	2,570.7	1,956.0
		Large		10.7	8,358.6	3,222.7	5,135.9	3,109.9	2,026.0	5,248.7	3,936.5

1/ Total Assets = Fixed Assets + Current Assets; Net Working Capital = Current Assets - Current Liabilities; Total Invested Capital = Fixed Assets + Net Working Capital; Salvage Value = Net Working Capital + Salvage Value of Fixed Assets.
2/ Hosiery products is a subdivision of the knit fabric finishing subcategory.

Source: DPRA estimates based on survey and published data.

Table VI-12. The textile industry, representative new source model plants' investment characteristics - direct dischargers 1/

Subcategory	Type Mill	Size/ Type 2/	Capacity	Total Assets	Fixed Assets	Current Assets	Current Liabilities	Net Working Capital	Total Invested Capital	Salvage Value
				$1,000						
2. Wool finishing	Integrated	Medium	20.0	60,346.1	47,819.7	12,526.4	8,518.0	4,008.4	51,828.1	8,790.4
4. Woven fabric finishing	Own fabric	Large (C)	130.0	98,815.5	58,280.5	40,535.0	25,448.0	15,087.0	73,367.5	20,915.1
	Integrated	Large (D)	50.0	72,997.9	54,483.3	18,514.6	14,639.5	3,875.1	58,358.4	9,323.4
5. Knit fabric finishing	Integrated	Large (C)	18.6	19,168.9	13,972.1	5,196.8	1,717.6	3,479.2	17,451.3	6,935.1
5c. Hosiery product 3/	Integrated	Medium	6.0	16,717.2	11,957.4	4,759.8	1,642.6	3,117.2	15,074.6	4,312.9
6. Carpet finishing	Integrated	Small	20.0	19,615.1	13,557.5	6,057.6	2,070.1	3,987.5	17,545.0	5,343.3
7. Stock & yarn finishing	Own yarn	Medium	23.0	8,664.0	4,761.9	3,902.1	1,211.4	2,690.7	7,452.6	3,166.9
8. Nonwoven manufacturing		Medium	10.4	13,856.4	11.759.4	2,097.0	1,616.5	2,207.9	12,239.9	1,656.2
9. Felt fabric processing		Medium	2.0	7,249.8	5,604.1	1,645.7	975.9	669.8	6,273.9	1,256.1

1/ Total Assets = Fixed Assets + Current Assets; Net Working Capital = Current Assets - Current Liabilities; Total Invested Capital = Fixed Assets + Net Working Capital; Salvage Value = Net Working Capital + Salvage Value of Fixed Assets.
2/ Type processing applicable to woven and knit fabric finishing is shown for each model in these subcategories. These include "C" for complex and "D" for complex desizing.
3/ Hosiery products is a subdivision of the Knit Fabric Finishing Subcategory.
Source: DPRA estimates based on survey and published data.

Table VI-13. The textile industry, representative new source model plants' investment characteristics - indirect dischargers 1/

Subcategory	Type Mill	Size/ Type 2/	Capacity	Total Assets	Fixed Assets	Current Assets	Current Liabilities	Net Working Capital	Total Invested Capital	Salvage Value
				$1,000						
2. Wool finishing	Integrated	Medium	20.0	74,411.1	60,215.0	14,196.1	9,653.5	4,542.6	64,757.6	10,564.1
4. Woven fabric finishing	Own fabric	Large (C)	130.0	31,469.2	19,477.9	11,991.3	7,149.6	4,841.7	24,319.6	6,789.5
	Integrated	Large (D)	50.0	66,308.4	47,793.8	18,514.6	14,639.5	3,875.1	51,668.9	8,654.5
5. Knit fabric finishing	Integrated	Large (C)	18.6	29,558.5	17,941.7	11,616.8	3.912.0	7,704.8	25,646.5	9,499.0
5c. Hosiery product 3/	Integrated	Medium	6.0	22,764.8	16,282.8	6,482.0	2,237.2	4,244.8	20,527.6	5,873.1
6. Carpet finishing	Integrated	Small	20.0	34,105.9	21,127.3	12,978.6	1,129.0	11,849.6	32,976.9	13,962.3
7. Stock & yarn finishing	Own yarn	Medium	23.0	4,223.8	2,835.3	1,388.5	431.1	957.4	3,792.7	1,240.9
8. Nonwoven manufacturing		Medium	10.4	40,659.9	29,429.0	11,230.9	8.294.6	2,936.3	32,365.3	5,879.2
9. Felt fabric processing		Medium	2.0	7,592.7	5,868.1	1,724.6	989.3	735.3	6,603.4	1,322.1

1/ Total Assets = Fixed Assets + Current Assets; Net Working Capital = Current Assets - Current liabilities; Total Invested Capital = Fixed Assets + Net Working Capital; Salvage Value = Net Working Capital + Salvage Value of Fixed Assets.

2/ Type processing applicable to woven and knit fabric finishing is shown *for each model* in these subcategories. These include "C" for complex and "D" for complex desizing.

3/ Hosiery products is a subdivision of the Knit Fabric Finishing *Subcategory*.

Source: DPRA estimates based on survey and published data.

and current liabilities. Current assets represent those assets a firm maintains that could be converted to cash with relative ease. Current assets include such items as raw materials inventory, finished product inventory and accounts receivable.

Current liabilities represent those a firm maintains on short period demand. Current liabilities include short term notes and accounts and wages payable.

The difference between current assets and current liabilities represents the firm's operating capital or, as it is sometimes called, net working capital. Net working capital represents the quantity of capital that the firm is required to maintain for daily cash balances.

As illustrated in the tables, the net working capital varied both with the type of mill (finishing vs. integrated) and the nature of the textile material input. The integrated mills, which accomplish a full range of textile operations, have a very high requirement for working capital. On the other hand, the finishing plants have relatively low working capital requirements. Additionally, mills purchasing fabric for processing have a higher working capital requirement than those mills purchasing yarn for finishing.

3. Total Investment

Two measures of the models' total investments are provided. First, total assets--the total of both fixed and current assets is provided. Second, the total invested capital--the book value of debt and equity which was computed as the sum of net working capital and fixed assets is shown. While each represents a measure of the models' investment, total assets is used in the subsequent analysis to determine the returns on investment (or total assets).

4. Salvage Value

The salvage value for nonconforming uses represents the amount of money that could be recovered should a mill cease operation. This will vary from mill to mill, depending on the location and the age of the facility, its condition, and the usability of its equipment.

As described earlier in the report, only a limited market exists for certain types of used machinery and equipment; thus, most of a closing plant's equipment would be scrapped.

Salvage value is represented by the sum of the net working capital and the scrap or salvage value of the fixed assets. In developing model plants, the salvage values of fixed assets were determined from estimates obtained from industry surveys. The values varied widely between the model plants.

E. Sales and Cost Characteristics

Model plant sales and costs' characteristics were developed from the industry survey responses, conversations with industry personnel, and from information available in published sources. Financial profiles depicting sales and costs' characteristics were developed for each of the model plants. Due to the number of tables required to depict each model's profile, the tables are presented in Appendix B of this report. The profiles of the existing direct and indirect discharger models are very similar to each other with the principal differences due to differences in model size and utilization rates. As indicated previously, the profiles reflect economic conditions of 1977. Each major financial component is discussed below.

1. Annual Sales

Annual sales of the model plants were determined from the production characteristics described in Tables VI-6, 7, 8 and 9 as well as from estimates of final product prices. Prices were estimated primarily from the industry surveys and as discussed previously, were based on differences in product mixes as produced by the various types and sizes of models in each of the subcategories. Prices generally varied within subcategories between different size and type models. This variation reflects differences in products and markets that can be expected in the industry.

2. Textile and Fiber Materials Costs

The costs of textile and fiber materials used as inputs to the models' production varied widely between both subcategories and types of mills within subcategories. The commission models reflected no raw material input costs since they were assumed to be processing textile materials owned by other mills on a commission or fee basis. The integrated models reflected relatively low costs in all subcategories as their inputs were assumed to be yarn and, in some cases, fiber. The material costs for the finishing mills (own fabrics) were appreciably higher than the other models as they represented the purchase of semi-processed fabrics and apparel.

3. Labor Costs

Labor costs were developed from the industry surveys and reflect varying wages for different types and sizes of mills. The labor costs include costs for both direct and indirect labor.

In the existing mills categories, the highest labor costs occurred among the commission models, amounting to between 35 and 40 percent of sales. Since these mills incurred little material input costs, labor costs represented their major cost component. The labor costs of the finishing mills (own fabric) ranged between 10 to 20 percent of sales. Those of the integrated mills were generally higher, with most being about 20 to 30 percent of sales.

For the new source models, the labor costs were from 10 to 15 percent lower than those of the corresponding existing models. These lower costs reflect the increased operating efficiencies expected of these new mills.

4. Other Costs

These costs include expenditures for dyes and finishing materials and other miscellaneous costs, including administrative and selling expenses. They varied considerably for different models and were generally the highest (as a percent of sales) in the commission mills, ranging between 15 to 25 percent for those models.

5. Depreciation and Interest Costs

The model plants' depreciation and interest costs were developed from the industry surveys and published sources. Depreciation and interest both expressed as a percent of sales are shown in Tables VI-14 and VI-15 for existing direct and indirect discharging model plants, respectively. With a few exceptions, the costs were the same for both the direct and indirect discharging models. Depreciation as a percent of sales ranged from a low of 0.4 percent for the small commission wool finishing model (2) to a high of 7.4 for the large direct commission knit fabric model (5b). Depreciation for the remaining models generally fell in the range of 1 to 3 percent of the models' sales. Interest costs expressed as a percent of sales varied considerably less than depreciation. A number of model plants incurred no interest costs. The model plant with the highest interest cost was the large carpet model (6) with an interest cost of 2.3 percent of the model's sales. The rates of the remaining models varied generally between 0.5 and 1.5 percent.

In the case of the new source models, the depreciation as a percent of sales varied from 1.4 to 7.9 percent. As expected, interest costs as a percent of sales for the new source models were significantly greater than those of the existing source models because of the greater debt load associated with a new facility. The new source models' interest and depreciation expenditures are summarized in Table VI-16.

Table VI-14. The textile industry, representative existing direct discharger model plants' depreciation and interest.

Segment	Type mill	Size	Type processing	Daily capacity	Depreciation as a percent of sales	Interest as a percent of sales
				(kkg)	(%)	(%)
1. Wool scouring	Commission	Small		16.2	2.3	0.5
		Medium		35.6	5.0	0.1
		Large		80.9	3.2	0.0
2. Wool finishing	Commission	Small		8.0	0.4	0.0
	Integrated	Small		8.0	1.4	1.5
		Medium		20.0	1.1	1.3
		Large		40.0	2.2	1.4
4. Woven fabric finishing	Commission	Small	Simple	5.3	0.5	1.0
		Medium	Complex	26.0	5.0	0.2
		Large	Complex	130.0	4.0	2.3
	Own fabric	Small	Simple	5.3	1.6	0.6
		Medium	Complex	26.0	1.4	0.6
		Large	Complex	130.0	1.3	0.6
	Integrated	Small	Simple	5.3	2.5	1.6
		Medium	Desize	20.0	1.7	1.9
		Large	Desize	50.0	2.8	2.1
		X-large	Complex	220.0	1.7	0.6
5. Knit fabric finishing	Commission	Medium	Simple	7.7	3.0	0.5
		Medium	Complex	7.7	0.7	2.8
		Large	Complex	18.6	7.4	2.1
	Integrated	Medium	Simple	7.7	1.4	0.1
		Medium	Complex	7.7	1.4	1.1
		Large	Complex	18.6	4.2	0.7
5c. Hosiery products 1/	Own hosiery	Small		2.7	1.4	0.6
		Medium		6.0	1.4	0.6
	Integrated	Small		2.7	1.7	1.2
		Medium		6.0	1.5	0.9
6. Carpet finishing	Integrated	Small		20.0	1.6	1.0
		Medium		49.0	1.2	2.2
		Large		120.0	1.4	2.3
7. Stock & yarn finishing	Commission	Small		9.4	3.5	1.7
		Medium		23.0	3.5	1.7
		Large		57.0	3.5	1.7
	Own yarn	Small		9.4	0.8	1.0
		Medium		23.0	1.1	0.0
		Large		38.0	2.9	1.6
		X-large		57.0	1.5	0.4
	Integrated	Small		9.4	2.8	0.0
		Large		38.0	2.0	1.0
8. Nonwoven manufacturing		Medium		10.4	2.6	1.3
9. Felt fabric processing		Medium		2.0	3.0	1.2

1/ Hosiery products is a subdivision of the knit fabric finishing subcategory.

Source: OPRA estimates based on survey and published data.

Table VI-15. The textile industry, representative existing indirect discharger model plants' depreciation and interest

Segment	Type mill	Size	Type processing	Daily capacity	Depreciation as a percent of sales	Interest as a percent of sales
				(kkg)	(%)	(%)
1. Wool scouring	Commission	Small		16.0	2.3	0.5
		Large		81.0	3.2	0.0
2. Wool finishing	Commission	Small		3.3	0.4	0.0
	Integrated	Small		3.3	1.4	1.6
		Medium		20.0	1.1	1.3
		Large			2.2	1.4
4. Woven fabric finishing	Commission	Small	Simple	2.4	0.5	1.1
		Medium	Complex	26.0	5.0	0.2
		Large	Complex	130.0	4.0	2.3
	Own fabric	Small	Simple	2.4	1.6	0.6
		Medium	Complex	26.0	1.4	0.6
		Large	Complex	130.0	1.3	0.0
	Integrated	Small	Simple	2.4	2.5	1.6
		Medium	Desize	20.0	1.9	1.9
		Large	Desize	50.0	2.8	2.1
		X-large	Desize	170.0	1.7	0.6
5. Knit fabric finishing	Commission	Medium	Simple	7.7	3.0	0.5
		Large	Complex	18.6	0.7	0.8
	Integrated	Small	Complex	1.5	1.6	0.3
		Medium	Simple	7.7	1.4	0.1
		Large	Complex	18.6	1.4	1.1
		X-large	Simple	31.0	4.2	0.7
5c. Hosiery products1/	Own hosiery	Small		2.7	1.4	0.6
		Large		13.6	1.4	0.6
	Integrated	Small		2.7	1.7	1.2
		Large		13.6	1.5	0.9
6. Carpet finishing	Integrated	Small		8.9	1.6	1.0
		Medium		49.0	1.2	2.2
		Large		122.0	1.4	2.3
7. Stock & yarn finishing	Commission	Small		4.2	3.5	1.7
		Medium		9.4	3.5	1.7
		Large		23.0	3.5	1.7
	Own yarn	Small		4.2	0.8	1.0
		Medium		9.4	1.1	1.0
		Large		23.0	2.9	1.6
	Integrated	Medium		9.4	2.8	0.0
		Large		23.0	2.0	1.0
8. Nonwoven manufacturing		Small		24.0	3.5	2.1
		Medium		57.0	1.7	1.0
9. Felt fabric processing		Small		0.9	4.6	1.8
		Medium		4.4	2.4	0.7
		Large		10.7	1.2	0.0

1/ Hosiery products is a subdivision of the knit fabric finishing subcategory.

Source: DPRA estimates based on survey and published data.

Table VI-16. The textile industry, representative new source model plants' depreciation and interest

Subcategory	Type Mill	Size/ Type 1/	Daily Capacity	New Source - Direct Dischargers Depreciation % of Sales	New Source - Direct Dischargers Interest % of Sales	New Source - Indirect Dischargers Depreciation % of Sales	New Source - Indirect Dischargers Interest % of Sales
			(kkg)	(%)	(%)	(%)	(%)
2. Wool finishing	Integrated	Medium	20.0	7.1	3.3	7.9	3.6
4. Woven fabric finishing	Own fabric	Medium (C)	26.0	NA	NA	2.4	1.3
		Large (C)	130.0	2.4	1.3	NA	NA
	Integrated	Large (D)	50.0	4.5	2.1	4.0	1.8
5. Knit fabric finishing	Integrated	Large (C)	18.6	1.8	1.2	2.3	3.7
5c. Hosiery product 2/	Integrated	Medium	6.0	3.1	1.7	NA	NA
		Large	13.6	NA	NA	3.1	1.7
6. Carpet finishing	Integrated	Small	20.0	2.6	1.4	NA	NA
		Medium	49.0	NA	NA	1.8	1.2
7. Stock & yarn finishing	Own yarn	Medium	3/	1.4	0.9	2.3	1.3
8. Nonwoven manufacturing		Medium	3/	5.0	2.4	5.0	2.4
9. Felt fabric processing		Medium	3/	4.4	2.1	4.4	2.1

1/ Type processing applicable to woven and knit fabric finishing is shown for each model in these subcategories. These include "C" for complex and "D" for complex desizing.
2/ Hosiery products is a subdivision of the Knit Fabric Finishing Subcategory.
3/ For these models, there is a size difference between direct and indirect. For Stock & Yarn models the sizes are 23.0 kkg and 9.3 kkg for the direct and indirect models respectively; nonwoven manufacturing models are 10.4 and 57.0 kkg respectively; and Felt Fabric Processing models, 2.0 and 4.4 kkg respectively.
Source: DPRA estimates based on survey and published data.

F. Model Plant Income and Annual Cash Flow Characteristics

For each model plant, the following were computed: its after-tax income, return on sales, return on total assets, and annual cash flow (dollar amount as well as percent of sales, and as a percent of total assets). These are presented in Table VI-17 for the existing direct discharging models, Table VI-18 for the existing indirect discharging models, and Tables VI-19 and 20 for the new source models. It should be noted that these incomes and annual cash flows represent mills under the conditions of 1977 and, accordingly, the models are "baseline models". The existing direct discharging models reflect BPT controls (except as noted in Chapter VII) while the indirect models reflect no controls (pretreatment).

The baseline income and cash flow characteristics are discussed below for the three categories of model plants.

1. Existing Direct Discharging Models

As shown in Table VI-17, after-tax income ranged from a loss of $43,000 for the small wool scouring model (1) to a profit of over $5 million for the extra-large integrated woven fabric model (4b). The returns on sales for the small plants for all subcategories and types of mills were all less than 2 percent, with four of the small models having returns of less than 1 percent. The most profitable model was the large integrated wool model (1) with a return on sales of close to 4 percent (after-tax). The commission mills were the least profitable, with most of the size models having returns on sales of less than 2 percent.

The existing direct discharging models' cash flow were positive in all cases. The smallest cash flow was the small wool scouring model (1) with a cash flow of $33,000. The largest cash flow generated was for the extra-large integrated woven fabric model (4b), with its annual cash flow nearly $10 million.

2. Existing Indirect Discharging Models

The after-tax incomes for the medium and large models in this category correspond fairly closely to those of the medium and large models in the previous category. As shown in Table VI-18, the incomes ranged from a loss of about $78,000 for the small wool scouring model (1) to a positive income of close to $5 million for the extra-large integrated woven fabric model (4c). As a percent of sales, the returns for the small models were slightly lower than those of the existing direct discharging models.

The annual cash flows for the existing indirect discharging models were all positive with a low of $12,000 for the small wool scouring model (1) to a high of over $8 million for the extra-large woven fabric model (4c).

Table VI-17. The textile industry, representative existing direct discharging model plants' profitabilities and annual cash flows

Subcategory	Type mill	Size	Type processing	Daily capacity	After-tax income	After-tax returns: Sales	After-tax returns: Total assets	Annual cash flow: Amount	Annual cash flow: Sales	Annual cash flow: Total assets
				(kkg)	($000)	(%)	(%)	($000)	(%)	(%)
1. Wool scouring	Commission	Small		16.2	-43.3	-1.3	-2.0	33.3	1.0	1.6
		Medium		35.6	126.1	1.7	2.4	499.8	6.7	9.4
		Large		80.9	364.5	2.7	3.8	796.5	5.9	8.3
2. Wool finishing	Commission	Small		8.0	54.6	1.9	3.4	66.3	2.3	4.1
	Integrated	Small		8.0	243.7	1.1	2.6	553.5	2.5	5.8
		Medium		20.0	565.1	1.8	3.2	918.7	2.9	5.1
		Large		40.0	3,139.0	3.7	6.7	5,001.4	5.9	10.6
4. Woven fabric finishing	Commission	Small	Simple	5.3	25.5	1.5	3.3	34.0	2.0	4.4
		Medium	Complex	26.0	96.9	1.4	2.0	445.3	6.4	9.4
		Large	Complex	130.0	503.1	1.6	2.3	1,758.4	5.6	7.9
	Own fabric	Small	Simple	5.3	118.3	1.3	3.8	258.9	3.0	8.3
		Medium	Complex	26.0	587.7	1.3	2.9	1,206.1	2.7	6.0
		Large	Complex	130.0	1,785.8	1.6	2.8	3,262.7	2.9	5.2
	Integrated	Small	Simple	5.3	130.2	1.4	2.7	364.1	3.9	7.6
		Medium	Desize	20.0	443.5	1.9	3.3	845.2	3.6	6.3
		Large	Desize	50.0	1,297.1	2.3	4.1	2,904.6	5.1	9.1
		X-large	Complex	220.0	5,519.3	2.3	5.0	9,519.2	4.0	8.6
5. Knit fabric finishing	Commission	Medium	Simple	7.7	13.7	0.5	1.1	98.7	3.5	7.7
		Medium	Complex	7.7	56.6	1.9	4.2	77.3	2.6	5.8
		Large	Complex	18.6	153.5	2.6	4.4	596.7	10.0	17.0
	Integrated	Medium	Simple	7.7	263.8	1.8	4.7	474.5	3.2	8.4
		Medium	Complex	7.7	296.3	2.1	3.7	491.6	3.5	6.1
		Large	Complex	18.6	875.5	2.9	5.6	2,141.1	7.1	13.7
5c. Hosiery products 1/	Own hosiery	Small		2.7	28.6	0.5	1.9	112.6	1.9	7.6
		Medium		6.0	412.0	2.3	4.5	667.6	3.7	7.3
	Integrated	Small		2.7	137.5	1.3	2.3	321.7	3.0	5.4
		Medium		6.0	412.1	2.3	6.1	685.8	3.8	10.2
6. Carpet finishing	Integrated	Small		20.0	354.7	1.4	3.5	758.5	3.0	7.6
		Medium		49.0	769.9	1.5	4.5	1,371.8	2.7	8.0
		Large		120.0	2,337.5	1.7	2.9	4,233.5	3.1	5.2
7. Stock & yarn finishing	Commission	Small		9.4	31.9	1.8	3.8	93.5	5.3	11.2
		Medium		23.0	78.9	1.8	6.4	236.1	5.3	19.1
		Large		57.0	216.4	1.8	6.5	643.1	5.3	19.2
	Own yarn	Small		9.4	74.8	0.8	2.1	147.5	1.6	4.1
		Medium		23.0	189.9	1.2	3.3	367.6	2.3	6.4
		Large		38.0	496.8	1.8	3.0	1,313.8	4.7	8.0
		X-large		57.0	900.9	2.7	4.8	1,402.8	4.2	7.4
	Integrated	Small		9.4	89.1	1.4	2.8	266.1	4.2	8.4
		Large		38.0	468.0	1.7	3.3	1,014.3	3.7	7.1
8. Nonwoven manufacturing		Medium		10.4	224.6	3.1	5.6	413.1	5.7	10.3
9. Felt fabric processing		Medium		2.0	52.1	1.0	1.8	211.4	4.0	7.1

1/ Hosiery products is a subdivision of the knit fabric finishing subcategory.

Source: DPRA estimates based on survey and published data.

Table VI-18. The textile industry, representative existing indirect discharging model plants' profitabilities and annual cash flows

Subcategory	Type mill	Size	Type processing	Daily capacity	After-tax income	After-tax returns: Sales	After-tax returns: Total assets	Annual cash flow: Amount	Annual cash flow: Sales	Annual cash flow: Total assets
				(kkg)	($000)	(%)	(%)	($000)	(%)	(%)
1. Wool scouring	Commission	Small		16.0	-77.9	-2.0	-3.1	12.0	0.3	0.5
		Large		81.0	372.0	2.6	3.7	822.4	5.8	8.2
2. Wool finishing	Commission	Small		3.3	24.7	2.1	3.9	29.3	2.5	4.6
	Integrated	Small		3.3	78.2	1.1	2.6	175.0	2.5	5.9
		Medium		20.0	638.6	1.8	3.2	1,039.3	2.9	5.1
		Large		40.0	2,857.3	3.6	6.4	4,626.6	5.8	10.4
4. Woven fabric finishing	Commission	Small	Simple	2.4	6.8	1.2	2.6	9.7	1.7	3.7
		Medium	Complex	26.0	92.7	1.5	2.2	397.5	6.5	9.6
		Large	Complex	130.0	614.4	1.7	2.4	2,058.9	5.7	8.0
	Own fabric	Small	Simple	2.4	44.2	1.5	4.2	91.6	3.1	8.7
		Medium	Complex	20.0	515.9	1.3	2.9	1,057.0	2.7	6.0
		Large	Complex	130.0	2,392.6	1.8	3.3	4,092.1	3.1	5.6
	Integrated	Small	Simple	2.4	49.6	1.6	3.0	128.6	4.1	7.9
		Medium	Desize	20.0	447.5	1.7	3.0	943.1	3.6	6.3
		Large	Desize	50.0	1,267.4	2.2	4.0	2,874.8	5.0	9.0
		X-large	Desize	170.0	4,965.5	2.3	4.9	8,644.9	4.0	8.4
5. Knit fabric finishing	Commission	Medium	Simple	7.7	29.7	0.8	1.1	141.9	3.8	5.1
		Large	Complex	18.6	190.1	2.4	5.3	245.4	3.1	6.8
	Integrated	Small	Complex	1.5	53.2	1.4	4.0	114.3	3.0	8.5
		Medium	Simple	7.7	252.4	1.9	5.0	441.7	3.3	8.7
		Large	Complex	18.6	827.2	2.2	3.9	1,348.8	3.6	6.3
		X-large	Simple	31.0	1,491.8	2.8	5.5	3,702.9	7.0	13.6
5c. Hosiery products 1/	Own hosiery	Small		2.7	19.0	0.3	1.3	103.1	1.7	7.0
		Large		13.6	669.2	2.2	8.0	1,089.6	3.6	13.0
	Integrated	Small		2.7	126.2	1.2	2.1	310.6	2.9	5.2
		Large		13.6	556.3	2.2	6.0	929.1	3.7	10.1
6. Carpet finishing	Integrated	Small		8.9	135.5	1.2	3.0	314.3	2.8	7.1
		Medium		49.0	595.3	1.1	3.1	1,272.8	2.3	6.6
		Large		122.0	2,219.8	1.7	2.9	4,019.8	3.1	5.2
7. Stock & yarn finishing	Commission	Small		4.2	11.6	1.6	2.5	36.9	5.1	7.8
		Medium		9.4	30.4	1.9	3.8	86.4	5.4	10.8
		Large		23.0	80.9	1.9	4.2	232.4	5.4	11.9
	Own yarn	Small		4.2	38.4	1.0	2.6	68.3	1.8	4.6
		Medium		9.4	73.3	1.3	3.6	136.5	2.4	6.7
		Large		23.0	238.2	1.5	2.7	685.8	4.4	7.7
	Integrated	Medium		9.4	88.2	1.5	3.1	249.1	4.3	8.7
		Large		23.0	254.8	1.7	3.2	554.1	3.7	7.0
8. Nonwoven manufacturing		Small		24.0	414.8	3.0	4.6	897.1	6.5	10.0
		Medium		57.0	511.1	1.6	2.5	1,053.4	3.3	5.1
9. Felt fabric processing		Small		0.9	91.3	2.4	3.8	263.6	7.0	11.1
		Medium		4.4	91.9	1.6	2.6	226.0	4.0	6.3
		Large		10.7	184.0	1.4	2.2	341.5	2.6	4.1

1/ Hosiery products is a subdivision of the knit fabric finishing subcategory.

Source: DPRA estimates based on survey and published data.

Table VI-19. The textile industry, representative new source direct discharging model plants' profitabilities and annual cash flows

Subcategory	Type Mill	Size	Type Processing	Daily Capacity	After tax Income	After-tax Returns % of Sales	After-tax Returns Total Assets	Annual Cash Flows Amount	Annual Cash Flows Sales	Annual Cash Flows Total Assets
				(kkg)	($1,000)	(%)	(%)	($1,000)	(%)	(%)
2. Wool finishing	Integrated	Medium		20.0	625.3	2.0	1.0	2,902.4	9.0	4.8
4. Woven fabric finishing	Own fabric	Medium	Complex	130.0	3,274.1	2.9	3.3	6,049.4	5.3	6.1
	Integrated	Large	Desize	50.0	3,757.6	6.5	5.1	6,352.0	11.1	8.7
5. Knit fabric finishing	Integrated	Large	Complex	18.6	1,682.3	5.6	8.8	2,838.8	9.4	14.8
5c. Hosiery product1/	Integrated	Large		6.0	1,039.6	5.7	6.2	1,609.0	8.8	9.6
6. Carpet finishing	Integrated	Medium		20.0	1,100.9	4.4	5.6	1,746.5	6.9	8.9
7. Stock & yarn finishing	Own yarn	Medium		23.0	687.2	4.3	7.9	914.0	5.7	10.5
8. Nonwoven manufacturing		Medium		10.4	289.7	4.0	2.1	849.7	11.7	6.1
9. Felt fabric processing		Medium		2.0	249.0	4.7	3.5	514.5	9.7	7.1

1/ Hosiery products is a subdivision of the knit fabric finishing subcategory.

Source: DPRA estimates based on survey and published data.

Table VI-20. The textile industry, representative new source indirect discharging model plants' profitabilities and annual cash flows

Subcategory	Type Mill	Size	Type Processing	Daily Capacity	After tax Income	After-tax Returns % of Sales	After-tax Returns Total Assets	Annual Cash Flows Amount	Annual Cash Flows Sales	Annual Cash Flows Total Assets
				(kkg)	($1,000)	(%)	(%)	($1,000)	(%)	(%)
2. Wool finishing	Integrated	Medium		20.0	446.6	1.2	.6	3,314.0	9.1	4.5
4. Woven fabric finishing	Own fabric	Medium	Complex	26.0	1,457.5	3.8	4.6	2,384.0	6.2	7.6
	Integrated	Large	Desize	50.0	3,253.2	5.7	4.9	5,528.2	9.6	8.3
5. Knit fabric finishing	Integrated	Large	Complex	18.6	2,052.5	5.5	6.9	2,906.9	7.8	9.8
5c. Hosiery product 1/	Integrated	Large		13.6	1,410.8	5.7	6.2	2,186.2	8.8	9.6
6. Carpet finishing	Integrated	Medium		49.0	2,049.9	3.6	6.0	3,056.0	5.4	9.0
7. Stock & yarn finishing	Own yarn	Medium		9.4	213.0	3.7	5.0	348.0	6.1	8.2
8. Nonwoven manu-facturing		Medium		57.0	2,176.8	6.8	5.4	3,578.2	11.2	8.8
9. Felt fabric processing		Medium		4.4	429.6	7.7	5.7	709.0	12.7	9.3

1/ Hosiery products is a subdivision of the knit fabric finishing subcategory.

Source: DPRA estimates based on survey and published data.

3. New Source Models

The after-tax income for the new source models are shown in Tables VI-17 and VI-20 for direct and indirect dischargers, respectively. The direct discharger models incurred slightly higher returns on sales than the indirect dischargers primarily because they represent larger mills. The wool finishing models (2) incurred the lowest returns on sales among the subcategories in each of the discharging categories. These models also reflected the lowest returns on total assets caused by the extremely high replacement costs associated with wool finishing facilities.

Because of the higher annual depreciation associated with the new source models, their annual cash flows were all higher than those for the existing models.

VII. WASTEWATER CONTROL COSTS

This chapter outlines the discharge status of the textile industry, selected alternative treatment technologies, costs associated with these technologies, options considered for proposal, and options reccommended for proposal. The supportive data and analyses for the information presented in this chapter are presented in the Development Document 1/.

A. Discharge and Wastewater Treatment Status

1. Current Levels of Wastewater Treatment

As discussed in Chapter VI, an estimated 20 percent of the mills generating process-related wastewater are classified as direct dischargers with their wastewater being discharged directly into receiving water; the remaining 80 percent are indirect dischargers with wastewater being discharged to publicly owned treatment works (POTW's). These estimates were based on a survey conducted by the Technical Contractor which involved close to 2,000 production facilities. The results of this survey are shown in Table VII-1. Hosiery products (5c) had the largest percentage of indirect dischargers with a total of 152 which amounted to 95 percent of the total mills surveyed in this subcategory. The wool scouring subcategory (1) had the least percentage of indirect dischargers with less than 60 percent of the total number of these mills surveyed being indirect dischargers. Within the other subcategories, the percentage of indirect dischargers varied between 70 and 85 percent.

The control measures and treatment technologies that are being utilized in the textile industry includes a broad range of in-plant controls and end-of-pipe treatment. The in-plant control measures range from minor water conservation to complete change of process such as the replacement of batch processing with continuous systems and aqueous dyeing with nonaqueous. The treatment technologies employed range from no treatment to complete recycle systems. The technologies, as listed below, include no treatment; preliminary treatment (neutralization, screening, equalization, heat exchange, disinfection, primary sedimentation, and flotation); biological or BPT equivalent treatment (aerated and unaerated lagoons, biological filtration,

---

1/ Development Document for Proposed Effluent Limitations Guidelines, New Source Performance Standards and Pretreatment Standards for the Textile Mills Point Source Category, U.S. Environmental Protection Agency, Effluent Guidelines Division, EPA 440/1-79-022b, October 1979.

Table VII-1. The textile industry - discharge status 1/

Segment	Direct dischargers: No. of mills	Direct dischargers: Percent of total	Indirect dischargers: No. of mills	Indirect dischargers: Percent of total	Total
1. Wool scouring	7	41	10	59	17
2. Wool finishing	10	29	24	71	34
4. Woven fabric finishing	82	27	224	73	306
5. Knit fabric finishing	48	18	221	82	269
5c. Hosiery products 2/	8	5	152	95	160
6. Carpet finishing	13	24	42	76	55
7. Stock & yarn finishing	36	17	175	83	211
8. Nonwoven manufacturing	12	32	25	68	37
9. Felt fabric processing	5	26	14	74	19
TOTAL	221	20	887	80	1,108

1/ Excludes 808 mills classified as "low water use processing" and 57 mills for which the type discharge was not known.

2/ Hosiery products is a subdivision of the knit fabric finishing subcategory.

Source: Effluent Guidelines Division, U.S. Environmental Protection Agency, Development Document.

activated sludge, and chemical coagulation/sedimentation without preceding biological treatment); and advanced treatment (filtration, chemical coagulation, and/or granular or powdered carbon). As shown below, slightly less than 10 percent of the direct dischargers are operating with advanced treatment technologies while about two-thirds are operating with BPT equivalent systems. About 30 percent provide no treatment or preliminary treatment only. However, it is expected that many of these are awaiting to connect the POTW's currently under construction or in the design stage.

Wastewater Treatment Status

	Direct Dischargers	Indirect Dischargers
	(Percent)	
No treatment	18	58
Preliminary	7	33
Biological (BPT)	67	9
Advanced	8	--
	100	100

Approximately 60 percent of the indirect dischargers provide no treatment while over 30 percent provide preliminary treatment. Nearly 10 percent of the indirect dischargers operate with biological or BPT equivalent treatment systems.

2. Plants Requiring Expenditures

As discussed in Chapter III, 1,165 textile mills were determined to be wet processors subject to the effluent limitation requirements. As a result of the survey discussed in the preceding section, the type of discharge could not be determined for 57 mills. For the purposes of this report, 18 of these facilities were assumed to be direct dischargers while the remaining 39 were assumed to be indirect dischargers. The distribution of the wet processors between the type dischargers and the subcategories is shown in Table VII-2.

Direct dischargers. As shown in Table VII-2, the number of direct dischargers totals 239. Of these, 18 have BAT technology in-place while 4 can meet the BAT requirements using biological systems. Consequently, of the 239, 217 or 90 percent may be required to expend funds on additional pollution control. In most subcategories, the mills have met BPT requirements. However, 9 mills in 3 subcategories--hosiery products (5c), nonwoven manufacturing (8) and felt fabric processing (9)--have not met the requirements and will be required to expend funds on BPT.

Indirect dischargers. A total of 926 mills were estimated to be discharging wastewater to POTW's. Most of these indirect dischargers provide no end-of-pipe treatment other than that required to comply with the prohibitive discharge limitations, including the elimination of the discharge of gross suspended solids, slug loads, extreme pH values, and explosive wastes.

Table VII-2. The textile industry - plants requiring pollution control expenditures (BATEA and PSES)

Subcategory	Direct dischargers: No. of mills (1977)	Direct dischargers: Mills requiring pollution control expenditures 2/	Indirect dischargers: No. of mills (1977)	Indirect dischargers: Mills requiring pollution control expenditures
1. Wool scouring	7	7	10	3
2. Wool finishing	11	11	26	22
4. Woven fabric finishing	92	86	244	31
5. Knit fabric finishing	52	45	230	27
5c. Hosiery products 1/	8	6	152	---
6. Carpet finishing	14	13	44	---
7. Stock & yarn finishing	38	33	179	24
8. Nonwoven manufacturing	12	11	26	---
9. Felt fabric processing	5	5	15	---
TOTAL	239	217	926	107

1/ Subdivision of knit fabric finishing subcategory.

2/ Includes 9 plants in three subcategories which require expenditures for BPT: hosiery products (4 plants); nonwoven manufacturing (3 plants); and felt fabric processing (2 plants).

Source: Sverdrup & Parcel and Associates, Inc., and Development Planning and Research Associates, Inc. Estimates based on responses to industry surveys.

Although the mills are not providing end-of-pipe treatment, they can generally comply with the PSES limitations with appropriate in-plant control. Those mills that will be required to expend funds for treatment are those that discharge heavy metals in their wastewater. An estimated 107 mills are discharging these metals and will be required to pretreat their wastewater. The number of mills requiring expenditure for pollution control is shown in Table VII-2 for each of the subcategories.

B. Alternative Treatment Technologies

As discussed in the Development Document, a broad range of alternative treatment technologies were selected for the development of costs and for the analysis of these costs and resulting benefits in terms of pollutant reductions. The technologies selected for analysis are described in Table VII-3 for existing sources and Table VII-4 for new sources. Some treatment alternatives were based on individual technologies and others on combinations of two or more components. The technologies include chemical coagulation, filtration, flotation, activated carbon adsorption, and ozonation.

The applicability of the various technologies for the existing source direct dischargers within the segments is illustrated in Table VII-5. For these models, it was assumed that the BPT level of treatment was in place (except as noted previously for the base case) which includes screening, extended-aeration,activated sludge, and secondary sedimentation with solids recycled to the aeration basin.

The applicability of the various technologies for the existing indirect sources are shown in Table VII-6. The alternatives for each of the levels of control included screening and equalization along with one or a combination of the following technologies: chemical coagulation, multi-media filtration, dissolved air flotation, activated carbon adsorption, and ozonation. It was assumed that under baseline the models were not providing any treatment.

Alternative treatment technologies for the new source direct dischargers were described in Table VII-4 and their application to the model plants in each segment are shown in Table VII-7. Alternative R is equivalent to Alternative D for existing sources and comprises BPT treatment. Alternative T combines the processes included in Alternatives R and S.

Alternative treatment technologies for new source indirect dischargers are also described in Table VII-7. These alternatives modify those of the new source direct dischargers by eliminating the activated sludge process and providing segregation of toxic pollutants.

Table VII-3. The textile industry, alternative treatment technologies existing sources (direct and indirect dischargers)

Technology	Description
A* Direct	BPT - Screening, extended aeration activated sludge, sedimentation, and solids recycle to aeration basin
Indirect	No treatment
B	Chemical coagulation and sedimentation
C	Multi-media filtration
D	Chemical coagulation, sedimentation, and multi-media filtration
E	Multi-media filtration and granular activated carbon
F	Chemical coagulation, sedimentation, multi-media filtration and granular activated carbon
G	Ozonation
H	Chemical coagulation, sedimentation, and ozonation
J	Multi-media filtration and ozonation
K	Chemical coagulation, sedimentation, multi-media filtration, and ozonation
M**	Chemical coagulation and dissolved air flotation
N**	Chemical coagulation, dissolved air flotation, multi-media filtration, and granular activated carbon
P**	Chemical coagulation, dissolved air flotation, and ozonation

* Alternative A is considered in place. All other alternatives are added on to A and for indirect dischargers include screening and equalization.
** Alternatives M, N, and P apply to wool scouring only.

Source: Effluent Guidelines Division, U.S. Environmental Protection Agency, Development Document.

Table VII-4. The textile industry, alternative treatment technologies new sources

Type discharge	Technology	Description
Direct	R	Screening, 24-hour extended-aeration activated sludge with solids recycle, chemical coagulation, sedimentation, and multi-media filtration.
	S	Larger flows: Priority pollutant stream - Screening, equalization, multi-media filtration, and granular activated carbon adsorption. Other streams - Screening and 8-hour activated sludge with solids recycle. Smaller flows: Total mill waste flow - Screening, 24-hour extended-aeration activated sludge with solids recycle, multi-media filtration and granular activated carbon adsorption.
	T	Larger flows: Priority pollutant stream - Screening, equalization, chemical coagulation, sedimentation, multi-media filtration, and granular activated carbon adsorption. Other streams - Screening and 8-hour activated sludge with solids recycle. Smaller flows: Total mill waste flow - Screening, 24-hour extended-aeration activated sludge with solids recycle, chemical coagulation, sedimentation, multi-media filtration, and granular activated carbon adsorption.
Indirect	R	Priority pollutant stream - Screening, equalization, chemical coagulation, sedimentation, and multi-media filtration. Other streams - Screening.
	S	Priority pollutant stream - Screening, equalization, multi-media filtration, and granular activated carbon adsorption. Other streams - Screening.
	T	Priority pollutant stream - Screening, equalization, chemical coagulation, sedimentation, multi-media filtration, and granular activated carbon adsorption. Other streams - Screening.

Source: Effluent Guidelines Division, U.S. Environmental Protection Agency, Development Document.

Table VII-5. The textile industry, model plant wastewater control technology for existing direct dischargers

Subcategory	Alternative Treatment Technologies (BATEA)										
	B	C	D	E	F	G	H	J	K	M	N	P
1. Wool scouring										X	X	X
2. Wool finishing	X		X		X	X	X		X			
4. Woven fabric finishing												
a. Simple processing	X	X	X	X	X	X	X	X	X			
b. Complex processing	X	X	X	X	X	X	X	X	X			
c. Complex processing plus desizing	X	X	X	X	X	X	X	X	X			
5. Knit fabric finishing												
a. Simple processing	X	X	X	X	X	X	X	X	X			
b. Complex processing	X	X	X	X	X	X	X	X	X			
5c. Hosiery products 1/	X		X		X		X		X			
6. Carpet finishing	X	X	X	X	X	X	X	X	X			
7. Stock & yarn finishing	X	X	X	X	X	X	X	X	X			
8. Nonwoven manufacturing	X	X	X	X	X	X	X	X	X			
9. Felt fabric finishing	X		X		X	X	X		X			

1/ Hosiery products is a subdivision of the knit fabric finishing subcategory.

Source: Effluent Guidelines Division, U.S. Environmental Protection Agency, Development Document.

Table VII-6. The textile industry, model plant wastewater control technology for existing indirect dischargers

Subcategory	Alternative Treatment Technologies (PSES)							
	B	D	F	H	J	M	N	P
1. Wool scouring						X	X	X
2. Wool finishing	X	X	X	X	X			
4. Woven fabric finishing								
a. Simple processing	X	X	X	X	X			
b. Complex processing	X	X	X	X				
c. Complex processing plus desizing	X	X	X	X				
5. Knit fabric finishing								
a. Simple processing	X	X	X	X	X			
b. Complex processing	X	X	X	X	X			
5c. Hosiery products 1/	X	X	X	X	X			
6. Carpet finishing	X	X	X	X	X			
7. Stock & yarn finishing	X	X	X	X	X			
8. Nonwoven manufacturing	X	X	X	X	X			
9. Felt fabric processing	X	X	X	X				

1/ Hosiery products is a subdivision of knit fabric finishing.

Source: Effluent Guidelines Division, U.S. Environmental Protection Agency, Development Document.

Table VII-7. The textile industry, model plant wastewater control technology for new sources

Subcategory	Direct Dischargers (NSPS)			Indirect Dischargers (PSNS)		
	R	S	T	R	S	T
2. Wool finishing	X	X	X	X	X	X
4. Woven fabric finishing						
b. Complex processing	X	X	X	X	X	X
c. Complex processing plus desizing	X	X	X	X	X	X
5b. Knit fabric finishing (complex processing)	X	X	X	X	X	X
5c. Hosiery products 1/	X		X	X	X	X
6. Carpet finishing	X	X	X	X	X	X
7. Stock & yarn finishing	X	X	X	X	X	X
8. Nonwoven manufacturing	X	X	X	X	X	X
9. Felt fabric finishing	X	X	X	X	X	X

1/ Hosiery products is a subdivision of the knit fabric finishing subcategory.

Source: Effluent Guidelines Division, U.S. Environmental Protection Agency, Development Document.

C. Wastewater Treatment Costs

The costs of the alternative treatment technologies developed for the model plants were based on the models' production levels, estimated wastewater flows, and wastewater characteristics as discussed in the Development Document 1/.

1. Investment Costs

Investment costs included installed costs of treatment components and monitoring equipment plus allowances for contingencies and engineering. A contingency allowance of 15 percent of the installed cost was used to cover unexpected costs due to local mill conditions. No allowance was made for the possibility of temporary mill shutdowns during construction. Engineering costs were estimated by using a percentage of installed costs plus contingencies.

The installed costs included costs for both equipment and construction. The break-out of the percentages for each of these components for the major processes is shown below.

Process	Equipment	Construction
Chemical coagulation	20%	80%
Filtration	20	80
Dissolved air flotation	35	65
Activated carbon	50	50
Ozonation	50	50
Vacuum filtration	35	65

The same bases were used in developing the costs for models in all categories. It should be noted that according to the Development Document all technologies considered have small space requirements and accordingly no land costs were included.

The investment costs for the existing sources are contained in Tables VII-8 and VII-9 for direct and indirect dischargers, respectively. Costs for new source models are shown in Table VII-10. Investment costs of the alternatives are also shown and expressed as percent of fixed assets in Tables VII-11, VII-12, and VII-13. Since these controls are considered a part of the mills assets, this method of expressing the requirements illustrates the relative magnitude of the treatment costs.

2. Total Yearly Costs

Total yearly wastewater treatment costs consist of annual operating and maintenance expenditures, cost of capital, and depreciation. Operating and maintenance expenditures are shown for the existing models in

---

1/ Op. cit.

Table VII-8. The textile industry, model plant wastewater controls' investment requirement - direct dischargers

Subcategory	Type Mill	Size/ Type 1/	Daily Capacity	Alternative Treatment Technology (BATEA) - Existing Sources												
				A	B	C	D	E	F	G	H	J	K	M2/	N2/	P2/
			(kkg)	($000)												
1. Wool scouring	Commission	Small	16.2											178	273	235
		Medium	35.6											221	377	326
		Large	80.9											322	1,172	519
2. Wool finishing	Commission	Small	8.0	NA	275	NA	461	NA	1,295	395	644	NA	829			
	Integrated	Small	8.0	NA	275	NA	461	NA	1,295	395	644	NA	829			
		Medium	20.0	NA	404	NA	720	NA	2,046	788	1,165	NA	1,481			
		Large	40.0	NA	588	NA	1,089	NA	3,038	1,317	1,871	NA	2,376			
4. Woven fabric finishing	Commission	Small (C)	5.3	NA	155	100	229	181	310	127	261	206	334			
		Medium (C)	26.0	NA	275	223	461	1,059	1,295	395	644	596	829			
		Large (C)	130.0	NA	576	564	1,078	2,525	3,028	1,317	1,861	1,848	2,365			
	Own fabric	Small (S)	5.3	NA	155	100	229	181	310	127	261	206	334			
		Medium (C)	26.0	NA	275	223	461	1,059	1,295	395	644	596	829			
		Large (C)	130.0	NA	576	564	1,078	2,525	3,028	1,317	1,861	1,848	2,365			
	Integrated	Small (S)	5.3	NA	155	100	229	181	310	127	261	206	334			
		Medium (D)	20.0	NA	276	223	461	1,059	1,295	395	644	596	829			
		Large (D)	50.0	NA	399	376	718	1,691	2,040	788	1,166	1,130	1,481			
		X-Large (C)	220.0	NA	839	769	1,293	3,709	4,477	1,926	2,726	2,743	3,424			
5. Knit fabric finishing	Commission	Medium (S)	7.7	NA	198	150	318	892	1,053	215	396	350	514			
		Medium (C)	7.7	NA	198	146	318	892	1,053	222	396	350	514			
		Large (C)	18.6	NA	276	223	461	1,059	1,295	395	644	595	829			
	Integrated	Medium (S)	7.7	NA	198	150	318	892	1,053	215	396	350	514			
		Medium (C)	7.7	NA	198	146	318	892	1,053	222	396	350	514			
		Large (C)	18.6	NA	276	223	461	1,059	1,295	395	644	595	829			
5c. Hosiery Products 3/	Own hosiery	Small	2.7	181	310	NA	354	NA	404	259	368	NA	412			
		Medium	6.0	233	388	NA	462	NA	543	360	494	NA	567			
	Integrated	Small	2.7	181	310	NA	354	NA	404	259	368	NA	412			
		Medium	6.0	233	388	NA	462	NA	543	360	499	NA	567			
6. Carpet finishing	Integrated	Small	20.0	NA	198	151	318	892	1,053	213	397	350	514			
		Medium	49.0	NA	276	223	461	1,059	1,295	395	644	596	829			
		Large	120.0	NA	399	370	718	1,691	2,040	788	1,160	1,130	1,481			
7. Stock & yarn finishing	Commission	Small	9.4	NA	191	151	318	892	1,054	222	396	350	514			
		Medium	23.0	NA	275	223	461	1,059	1,295	395	644	596	829			
		Large	57.0	NA	399	370	718	1,691	2,040	788	1,160	1,130	1,481			
	Own yarn	Small	9.4	NA	191	151	318	892	1,054	222	396	350	514			
		Medium	23.0	NA	275	223	461	1,059	1,295	395	644	596	829			
		Large	38.0	NA	337	292	584	1,313	1,605	592	904	860	1,147			
		X-Large	57.0	NA	399	370	718	1,691	2,040	788	1,160	1,130	1,481			
	Integrated	Small	9.4	NA	191	151	318	892	1,054	222	396	350	514			
		Large	38.0	NA	337	292	584	1,313	1,605	592	904	860	1,147			
8. Nonwoven manufacturing		Medium	10.4	233	388	333	462	414	543	360	494	439	567			
9. Felt fabric processing		Medium	2.0	233	388	NA	462	NA	543	360	494	NA	567			

1/ Type processing (or subdivision) applicable to woven and knit fabric finishing is shown for each model in these subcategories. These include "S" for simple; "C" for complex; and "D" for complex-desizing.
2/ Treatment technologies M, N, and P are applicable to wool scouring only.
3/ Hosiery products is a subdivision of the knit fabric finishing subcategory.
NA = Not Applicable
Source: Effluent Guidelines Division, U.S. Environmental Protection Agency, Development Document.

Table VII-9. The textile industry, model plant wastewater controls' investment requirement - indirect dischargers

Subcategory	Type Mill	Size/ Mill 1/	Daily Capacity	Wastewater Treatment Technologies (PSES) - Existing Sources B	D	F	H	J	M2/	N2/	P2/
			(kkg)	($1,000)							
1. Wool scouring	Commission	Small	16.0						226	320	284
		Large	81.0						427	1,271	625
2. Wool finishing	Commission	Small	3.3	269	381	1,123	468	486			
	Integrated	Small	3.3	269	381	1,123	468	486			
		Medium	20.0	573	393	2,214	1,334	1,370			
		Large	40.0	842	1,345	3,292	2,126	2,179			
4. Woven fabric finishing	Commission	Small (S)	2.4	174	219	268	230	238			
		Medium (C)	26.0	380	564	1,400	747	NA			
		Large (C)	130.0	865	1,368	3,290	2,150	NA			
	Own fabric	Small (S)	2.4	174	219	268	230	238			
		Medium (C)	26.0	380	564	1,400	747	NA			
		Large (C)	130.0	865	1,368	3,290	2,150	NA			
	Integrated	Small (S)	2.4	174	219	268	230	238			
		Medium (D)	20.0	380	564	1,400	747	NA			
		Large (D)	50.0	585	905	2,226	1,346	NA			
		X-Large (D)	170.0	1,231	1,927	4,869	3,118	NA			
5. Knit fabric finishing	Commission	Medium (S)	7.7	269	387	1,123	468	486			
		Large (C)	18.6	380	564	1,400	747	762			
	Integrated	Small (C)	1.5	173	219	268	231	238			
		Medium (S)	7.7	269	387	1,123	468	486			
		Large (C)	18.6	380	564	1,400	747	762			
		X-Large (S)	31.0	476	720	1,736	1,038	1,059			
5c. Hosiery Products 3/	Own hosiery	Small	2.7	172	219	268	230	238			
		Large	13.6	268	387	1,123	468	486			
	Integrated	Small	2.7	172	219	268	230	238			
		Large	13.6	269	387	1,123	468	483			
6. Carpet finishing	Integrated	Small	8.9	211	284	366	315	326			
		Medium	49.0	380	554	1,400	747	762			
		Large	122.0	577	900	2,220	1,340	1,370			
7. Stock and yarn finishing	Commission	Small	4.2	211	284	366	315	328			
		Medium	9.4	269	387	1,123	468	486			
		Large	23.0	380	[illegible]64	1,400	747	762			
	Own yarn	Small	4.2	211	285	366	315	328			
		Medium	9.4	269	387	1,123	468	486			
		Large	23.0	380	564	1,400	747	762			
	Integrated	Medium	9.4	269	387	1,123	468	486			
		Large	23.0	380	564	1,400	747	762			
8. Nonwoven manufacturing		Small	24.0	269	387	1,123	637	486			
		Medium	57.0	380	564	1,400	747	762			
9. Felt fabric processing		Small	0.9	172	219	268	230	NA			
		Medium	4.4	269	387	1,123	637	NA			
		Large	10.7	380	564	1,400	745	NA			

1/ Type processing (or subdivision) applicable to woven and knit fabric finishing is shown for each model in these subcategories. These include "S" for simple; "C" for complex; and "D" for complex-desizing.
2/ Alternative technologies M, N, and P apply to wool scouring only.
3/ Hosiery products is a subdivision of the knit fabric finishing subcategory.
NA = Not Applicable.
Source: Effluent Guidelines Division, U.S. Environmental Protection Agency, Development Document.

Table VII-10. The textile industry, new source model plant wastewater controls, investment requirements

				Alternative Treatment Technologies							
				Direct dischargers (NSPS)				Indirect dischargers (PSNS)			
Subcategory	Type mill	Size	Type processing	Daily capacity	R	S	T	Daily capacity	R	S	T
				(kkg)	------($000)--------			(kkg)	-------($000)-------		
2. Wool finishing	Integrated	Medium		20.0	2,409	1,597	1,901	20.0	745	1,521	1,760
4. Woven fabric finishing	Own fabric	Medium	Complex	NA	NA	NA	NA	26.0	503	1,147	1,289
		Large	Complex	130.0	3,775	2,323	2,749		NA	NA	NA
	Integrated	Large	Desize	50.0	2,403	1,597	1,906	50.0	750	1,521	1,765
5. Knit fabric finishing	Integrated	Large	Complex	18.6	801	1,165	1,372	18.6	503	1,147	1,289
5c. Hosiery products 1/	Integrated	Medium		6.0	374	NA	454		NA	NA	NA
		Large		NA	NA	NA	NA	13.6	358	963	1,043
6. Carpet finishing	Integrated	Small		20.0	532	1,095	1,270		NA	NA	NA
		Medium		NA	NA	NA	NA	49.0	503	1,147	1,289
7. Stock & yarn finishing	Own yarn	Medium		23.0	801	1,165	1,372	9.4	358	963	1,043
8. Nonwoven manufacturing		Medium		10.4	532	1,095	1,270	57.0	503	1,147	1,289
9. Felt fabric processing		Medium		2.0	532	1,095	1,270	4.4	358	963	1,043

1/ Hosiery products is a subdivision of knit fabric finishing subcategory.

Source: Effluent Guidelines Division, U.S. Environmental Protection Agency, Development Document.

Table VII-11. The textile industry, model plant wastewater controls' investment requirements expressed as a percentage of the model's fixed assets - direct dischargers

Subcategory	Type mill	Size/ type 1/	Daily capacity	Alternative treatment technology (BATEA) - existing sources												
				A	B	C	D	E	F	G	H	J	K	M 2/	N 2/	P 2/
			(kkg)	(percent)												
1. Wool scouring	Commission	Small	16.2											22.4	34.3	29.5
		Medium	35.6											8.5	14.4	12.5
		Large	80.9											6.3	23.0	10.2
2. Wool finishing	Commission	Small	3.0	NA	84.8	NA	142.1	NA	399.7	121.9	198.3	NA	255.9			
	Integrated	Small	8.0	NA	11.3	NA	18.9	NA	53.1	16.2	26.4	NA	34.0			
		Medium	20.0	NA	7.6	NA	13.6	NA	38.5	14.8	21.9	NA	27.9			
		Large	40.0	NA	4.7	NA	8.8	NA	24.4	10.6	15.0	NA	19.1			
4. Woven fabric finishing	Commission	Small(S)	5.3	NA	39.3	25.7	58.8	46.5	79.7	32.7	67.1	53.0	85.9			
		Medium(C)	26.0	NA	29.5	23.9	49.4	113.4	138.7	42.3	69.0	63.8	88.8			
		Large(C)	130.0	NA	15.6	15.2	29.1	68.2	81.8	35.6	50.3	49.9	63.9			
	Own fabric	Small(S)	5.3	NA	10.7	6.9	15.8	12.5	21.4	8.8	18.0	14.2	23.0			
		Medium(C)	26.0	NA	3.8	3.1	6.4	14.8	18.1	5.5	9.0	8.3	11.6			
		Large(C)	130.0	NA	2.5	2.5	4.8	11.2	13.4	5.8	8.2	8.2	10.5			
	Integrated	Small(S)	5.3	NA	7.1	4.6	10.5	8.3	14.2	5.8	12.0	9.5	15.3			
		Medium(D)	20.0	NA	5.0	4.0	8.3	19.1	23.4	7.1	11.6	10.8	15.0			
		Large(D)	50.0	NA	3.0	2.8	5.4	12.7	15.3	5.9	8.7	8.5	11.1			
		X-large(C)	220.0	NA	1.6	1.5	2.5	7.2	8.7	3.7	5.3	5.3	6.6			
5. Knit fabric finishing	Commission	Medium(S)	7.7	NA	60.3	45.6	96.8	271.1	320.1	65.4	120.4	106.4	156.2			
		Medium(C)	7.7	NA	58.2	42.9	93.5	262.4	309.7	65.3	116.5	102.9	151.2			
		Large(C)	18.6	NA	25.9	20.9	43.2	99.3	121.4	37.0	60.4	55.8	77.7			
	Integrated	Medium(S)	7.7	NA	8.9	6.8	14.3	40.2	47.4	9.7	17.8	15.8	23.2			
		Medium(C)	7.7	NA	5.4	4.1	8.7	24.3	28.7	6.1	10.8	9.5	14.0			
		Large(C)	18.6	NA	3.4	2.8	5.7	13.1	16.0	4.9	8.0	7.4	10.2			
5c. Hosiery products 3/	Own hosiery	Small	2.7	39.7	68.0	NA	77.6	NA	88.6	56.8	80.7	NA	90.4			
		Medium	6.0	16.8	28.0	NA	33.3	NA	39.2	26.0	35.6	NA	40.9			
	Integrated	Small	2.7	10.7	18.3	NA	20.9	NA	23.9	15.3	21.3	NA	24.4			
		Medium	6.0	11.7	19.5	NA	23.2	NA	27.3	18.1	24.8	NA	28.5			
6. Carpet finishing	Integrated	Small	20.0	NA	5.0	3.8	8.0	22.4	26.4	5.3	10.0	8.8	12.9			
		Medium	49.0	NA	5.0	4.0	8.3	19.2	23.5	7.2	11.7	10.8	15.0			
		Large	120.0	NA	1.6	1.5	2.9	6.8	8.2	3.2	4.6	4.5	5.9			
7. Stock and yarn finishing	Commission	Small	9.4	NA	34.4	27.2	57.3	160.7	189.9	40.0	71.4	63.1	92.6			
		Medium	23.0	NA	30.3	24.6	50.9	116.9	142.9	43.6	71.1	65.8	91.5			
		Large	38.0	NA	12.7	11.8	22.9	53.8	65.0	25.1	36.9	36.0	47.2			
	Own yarn	Small	9.4	NA	14.9	11.8	24.8	69.6	82.3	17.3	30.9	27.3	40.1			
		Medium	23.0	NA	15.0	12.2	25.2	57.8	70.7	21.6	35.2	32.5	45.3			
		Large	38.0	NA	4.6	4.0	8.0	17.9	21.9	8.1	12.3	11.7	15.7			
		X-large	57.0	NA	4.3	4.5	8.7	20.5	24.8	9.6	14.1	13.7	18.0			
	Integrated	Small	9.4	NA	25.5	20.2	42.4	119.1	140.7	29.6	52.9	46.7	68.6			
		Large	38.0	NA	4.7	4.1	8.2	18.5	22.6	8.3	12.7	12.1	16.2			
8. Nonwoven manufacturing		Medium	10.4	12.2	20.3	17.4	24.2	21.7	28.4	18.8	25.8	23.0	29.7			
9. Felt fabric processing		Medium	2.0	10.7	17.9	NA	21.3	NA	25.0	16.6	22.8	NA	26.1			

1/ Type processing (or subdivision) applicable to woven and knit fabric finishing is shown for each model in these subcategories. These include "S" for simple; "C" for complex; and "D" for complex-desizing.

2/ Alternative technologies M, N, and P apply to wool scouring only.

3/ Hosiery products is a subdivision of the knit fabric finishing subcategory.

NA - Not Applicable

Source: Development Planning and Research Associates, Inc. estimates based on investment requirements depicted in Table VII-8 and model plant fixed assets presented in Table VI-10.

Table VII-12. The textile industry, model plant wastewater controls' investment requirements expressed as a percentage of the model's fixed assets - indirect dischargers

Subcategory	Type Mill	Size/ type 1/	Daily Capacity	Wastewater Treatment Technologies (PSES) - Existing Sources							
				B	D	G	H	J	M2/	N2/	P2/
			(kkg)	(percent)							
1. Wool scouring	Commission	Small	16.0						20.0	28.3	25.1
		Large	81.0						8.0	23.9	11.7
2. Wool finishing	Commission	Small	3.3	211.3	299.3	884.3	368.5	382.7			
	Integrated	Small	3.3	35.3	50.0	147.4	61.4	63.8			
		Medium	20.0	9.5	14.8	36.8	22.2	22.8			
		Large	40.0	7.1	11.4	27.9	18.0	18.4			
4. Woven fabric finishing	Commission	Small (S)	2.4	132.5	166.8	204.6	175.6	181.7			
		Medium (C)	26.0	46.5	69.0	171.4	91.4	NA			
		Large (C)	130.0	20.3	32.1	77.3	50.5	NA			
	Own fabric	Small (C)	2.4	129.2	162.6	148.5	170.4	176.3			
		Medium (C)	26.0	6.8	10.1	25.0	13.4	NA			
		Large (C)	130.0	3.7	5.9	14.1	9.2	NA			
	Integrated	Small (S)	2.4	23.7	29.8	36.5	31.3	32.4			
		Medium (D)	20.0	10.6	15.7	39.0	20.8	NA			
		Large (D)	50.0	4.4	6.8	16.7	10.1	NA			
		X-Large (D)	170.0	2.6	4.1	10.3	6.6	NA			
5. Knit fabric finishing	Commission	Medium (S)	7.7	34.2	49.2	142.9	59.5	61.8			
		Large (C)	18.6	41.8	62.1	154.0	82.2	83.8			
	Integrated	Small (C)	1.5	26.5	33.6	41.0	35.4	36.5			
		Medium (S)	7.7	13.5	19.4	56.3	23.5	24.4			
		Large (C)	18.6	3.9	5.8	14.3	7.6	7.8			
		X-Large (S)	31.0	3.4	5.1	12.3	7.3	7.5			
5c. Hosiery Products 3/	Own hosiery	Small	2.7	37.7	48.0	58.8	50.4	52.2			
		Large	13.6	7.9	11.4	33.1	13.8	14.3			
	Integrated	Small	2.7	10.2	13.0	15.9	13.6	14.1			
		Large	13.6	9.9	14.3	41.4	17.2	17.8			
6. Carpet finishing	Integrated	Small	8.9	12.0	16.1	20.7	17.9	18.5			
		Medium	49.0	6.1	8.9	22.5	12.0	12.3			
		Large	122.0	2.0	3.1	7.7	4.6	4.8			
7. Stock and yarn finishing	Commission	Small	4.2	189.1	254.5	326.8	281.3	292.9			
		Medium	9.4	83.4	120.0	347.7	144.9	150.5			
		Large	23.0	42.2	62.7	155.6	83.0	84.7			
	Own yarn	Small	4.2	40.0	53.9	69.5	59.8	62.2			
		Medium	9.4	41.3	59.4	172.2	71.8	74.5			
		Large	23.0	11.3	16.8	41.6	22.2	22.6			
	Integrated	Medium	9.4	39.5	56.8	164.9	68.7	71.4			
		Large	23.0	11.2	16.6	41.2	22.0	22.4			
8. Nonwoven manufacturing		Small	24.0	7.7	11.1	32.3	18.3	14.0			
		Medium	57.0	4.0	5.9	14.7	7.9	8.0			
9. Felt fabric processing		Small	.9	16.5	21.0	25.7	22.1	NA			
		Medium	4.4	14.7	21.1	61.2	34.7	NA			
		Large	10.7	11.8	17.5	43.4	23.1	NA			

1/ Type processing (or subdivision) applicable to woven and knit fabric finishing is shown for each model in these subcategories. These include "S" for simple; "C" for complex; and "D" for complex-desizing.
2/ *Alternative technologies M, N, and P apply to wool scouring only.*
3/ Hosiery products is a subdivision of the knit fabric finishing subcategory.
NA = Not Applicable
Source: Development Planning and Research Associates, Inc. estimates based on investment requirements in Table VII-9 and fixed assets in Table VI-11.

Table VII-13. The textile industry, representative new source model plant wastewater control investment requirements expressed as a percent of the models' fixed assets

				Wastewater Treatment Technologies					
				Direct dischargers (NSPS)			Indirect dischargers (PSNS)		
Subcategory	Type mill	Size/type 1/	Daily capacity	R	S	T	R	S	T
			(kkg)	(percent)					
2. Wool finishing	Integrated	Medium	20.0	5.0	3.3	4.0	1.2	2.5	2.9
4. Woven fabric finishing	Own fabric	Medium (C)	26.0	NA	NA	NA	2.6	5.9	6.6
		Large (C)	130.0	6.5	4.0	4.7	NA	NA	NA
	Integrated	Large (D)	50.0	4.1	2.9	3.5	1.6	3.2	3.7
5. Knit fabric finishing	Integrated	Large (C)	18.6	5.7	8.3	9.8	2.8	6.4	7.2
5c. Hosiery products 2/	Integrated	Medium	6.0	3.1	NA	3.8	NA	NA	NA
		Large	13.6	NA	NA	NA	2.2	5.9	6.4
6. Carpet finishing	Integrated	Small	20.0	3.9	8.1	9.4	NA	NA	NA
		Medium	44.0	NA	NA	NA	2.4	5.4	6.1
7. Stock & yarn finishing	Own yarn	Medium	3/	16.8	24.5	28.8	12.6	34.0	36.8
8. Nonwoven manufacturing		Medium	3/	4.5	9.3	10.8	1.7	3.9	4.1
9. Felt fabric processing		Medium	3/	9.5	19.5	22.7	6.1	16.4	17.8

1/ Type processing applicable to woven and knit fabric finishing is shown for each model in these subcategories. These include "C" for complex and "D" for complex desizing.
2/ Hosiery products is a subdivision of the knit fabric finishing subcategory.
3/ For these models there is a size difference between direct and indirect dischargers. For stock and yarn models the sizes are 23.0 kkg and 9.4 kkg for the direct and indirect models respectively; nonwoven manufacturing models are 10.4 and 57.0 kkg respectively; and felt fabric processing models, 2.0 and 4.4 kkg respectively.

Source: Development Planning and Research Associates, Inc. estimates based on investment requirements in Table VII-10 and fixed assets in Tables VI-11 and VI-12.

Tables VII-14 and VII-15 for the direct and indirect dischargers, respectively; those for the new source models are included in Table VII-16. The operating and maintenance expenditures include labor (a rate of $15 per hour was used as the total cost for wages, benefits, and payroll processing expense), sludge disposal (ranging from 1 to 18 dollars per ton), energy and power, chemicals, and monitoring.

Capital cost was assumed to be 10 percent of the total investment. Depreciation was calculated on a straight-line basis for the assumed life of each alternative which was generally 15 years.

The total yearly costs are shown in Tables VII-17, VII-18 and VII-19, and represent the maximum costs, in 1977 dollars, that would occur during the life of the pollution control facilities. It was assumed in the subsequent analysis, that the required outlays would be made over a period of time, usually between 3 to 6 years. Consequently, the yearly costs were increased in increments to correspond with the expected outlays. The data in the above tables reflect the costs after all the outlays have been made and when the facilities are in full operation.

To depict the magnitude of the treatment alternatives' total yearly costs for each model, Tables VII-20, VII-21 and VII-22 present the costs expressed as a percent of the models' respective total sales.

D. Treatment Options Considered for Proposal

After a cost analysis of each of the alternative treatment technologies described previously, specific options were identified for consideration as the limitation guidelines and standards of performance. From the analysis (described in the Development Document), the more sophisticated technologies involving activated carbon and ozone were excluded from further consideration because they were determined to be too costly, energy intensive, and the pollutant reductions associated with the more sophisticated technologies were obtainable with the other technologies. The available options which correspond, in most cases, to the alternative treatment technologies are listed and described in Table VII-23. The aggregate investment and annualized costs associated with those plants requiring additional expenditures are listed below for each BATEA and PSES option considered. The costs of BATEA Option 1 reflect the BPT expenditures required for those plants presently not meeting BPT treatment levels in the hosiery products (5c), nonwoven manufacturing (8), and felted fabric processing (9) subcategories.

	Option	Investment	Annualized
		------(million dollars)-------	
BATEA	1	1.9	0.9
	2	41	18
	3	55	33
	4	92	44
PSES	1	(Currently in-place)	
	2	38	19
	3	55	24

E. Treatment Options Proposed

From analyses of the treatment options described previously, recommended options were selected by the U.S. Environmental Protection Agency for each of the subcategories as the basis for proposal of effluent limitations and performance standards (Table VII-24). The total industry investment and annualized costs for implementation of these options are listed below.

Estimated Aggregated Cost of Compliance for
Recommended Treatment Options

	Investment	Annualized Cost
	------------($million)------------	
BATEA	48	21
PSES	38	19
TOTAL	86	40

Table VII-14. The textile industry, model plant wastewater controls' annual operating and maintenance expense - direct dischargers.

Subcategory	Type mill	Size/type[1/]	Daily capacity	Alternative treatment technology (BATEA) - existing sources												
				A	B	C	D	E	F	G	H	J	K	M[2/]	N[2/]	P[2/]
			(kkg)	($000)												
1. Wool scouring	Commission	Small	16.2											36	133	104
		Medium	35.5											106	208	130
		Large	30.9											146	192	198
2. Wool finishing	Commission	Small	3.0	NA	118	NA	139	NA	217	104	189	NA	211			
	Integrated	Small	3.0	NA	118	NA	139	NA	217	104	189	NA	211			
		Medium	20.0	NA	180	NA	219	NA	408	192	333	NA	372			
		Large	40.0	NA	272	NA	333	NA	684	331	558	NA	619			
4. Woven fabric finishing	Commission	Small (S)	5.3	NA	75	35	81	41	178	51	99	59	105			
		Medium (C)	26.0	NA	118	58	138	136	216	104	189	130	210			
		Large (C)	130.0	NA	273	120	335	471	686	331	559	407	621			
	Own fabric	Small (S)	5.3	NA	75	35	81	41	178	51	99	59	105			
		Medium (C)	26.0	NA	118	58	138	136	216	104	189	130	210			
		Large (C)	130.0	NA	273	120	335	471	686	331	559	407	621			
	Integrated	Small (S)	5.3	NA	75	35	81	41	178	51	99	59	105			
		Medium (D)	20.0	NA	118	58	138	136	216	104	189	130	210			
		Large (D)	50.0	NA	179	86	218	335	402	192	332	239	371			
		X-large (C)	220.0	NA	389	156	475	743	1,038	515	355	622	940			
5. Knit fabric finishing	Commission	Medium (S)	7.7	NA	87	41	99	76	133	67	125	80	137			
		Medium (C)	7.7	NA	87	42	99	77	133	67	125	81	137			
		Large (C)	18.6	NA	118	58	138	127	216	104	189	130	210			
	Integrated	Medium (S)	7.7	NA	87	41	99	76	133	67	126	80	137			
		Medium (C)	7.7	NA	87	42	99	77	133	67	126	81	137			
		Large (C)	18.6	NA	118	58	138	127	216	104	189	130	210			
5c. Hosiery products[3/]	Own hosiery	Small	2.7	55	124	NA	128	NA	172	99	142	NA	146			
		Medium	6.0	67	142	NA	148	NA	245	118	166	NA	172			
	Integrated	Small	2.7	55	124	NA	128	NA	172	99	142	NA	146			
		Medium	6.0	67	142	NA	148	NA	245	118	166	NA	172			
6. Carpet finishing	Integrated	Small	20.0	NA	87	42	99	77	133	67	126	81	137			
		Medium	49.0	NA	118	58	138	136	216	104	189	130	210			
		Large	120.0	NA	179	86	218	336	402	192	332	240	371			
7. Stock and yarn finishing	Commission	Small	9.4	NA	87	42	99	76	133	67	126	81	137			
		Medium	23.0	NA	118	57	138	135	216	104	189	129	210			
		Large	57.0	NA	179	85	218	335	402	192	332	239	371			
	Own yarn	Small	9.4	NA	87	42	99	76	133	67	126	81	137			
		Medium	23.0	NA	118	57	138	135	216	104	189	129	210			
		Large	38.0	NA	144	70	172	196	300	144	252	179	281			
		X-large	57.0	NA	179	85	218	335	402	192	332	239	371			
	Integrated	Small	9.4	NA	87	42	99	76	133	67	126	81	137			
		Large	38.0	NA	144	70	172	196	300	144	252	179	281			
8. Nonwoven manufacturing		Medium	10.4	67	142	102	148	108	245	118	166	126	172			
9. Felt fabric processing		Medium	2.0	67	142	NA	148	NA	249	118	166	NA	172			

1/ Type processing (or subdivision) applicable to woven and knit fabric finishing is shown for each model in these subcategories. These include "S" for simple; "C" for complex; and "D" for complex-desizing.
2/ Alternative technologies M, N, and P apply to wool scouring only.
3/ Hosiery products is a subdivision of the knit fabric finishing subcategory.

Source: Effluent Guidelines Division, U.S. Environmental Protection Agency, Development Document.

Table VII-15. The textile industry, model plant wastewater controls' annual operating and maintenance expense - indirect dischargers

Subcategory	Type Mill	Size/ Type 1/	Daily Capacity	Wastewater Treatment Technologies (PSES) - Existing Sources B	D	F	H	J	M2/	N2/	P2/
			(kkg)	($1,000)							
1. Wool scouring	Commission	Small	16.0						82	138	100
		Large	81.0						144	190	182
2. Wool finishing	Commission	Small	3.3	86	97	132	125	120			
	Integrated	Small	3.3	86	97	132	125	120			
		Medium	20.0	196	235	407	361	314			
		Large	40.0	305	364	719	609	497			
4. Woven fabric finishing	Commission	Small (S)	2.4	63	66	110	80	80			
		Medium (C)	26.0	124	146	223	196	NA			
		Large (C)	130.0	301	363	715	588	NA			
	Own fabric	Small (S)	2.4	63	66	110	80	80			
		Medium (C)	26.0	124	146	223	196	NA			
		Large (C)	130.0	301	363	715	588	NA			
	Integrated	Small (S)	2.4	63	66	110	80	80			
		Medium (D)	20.0	124	146	223	165	NA			
		Large (D)	50.0	197	237	420	350	NA			
		X-Large (D)	170.0	440	527	1,112	904	NA			
5. Knit fabric finishing	Commission	Medium (S)	7.7	86	97	132	125	120			
		Large (C)	18.6	123	145	222	195	182			
	Integrated	Small (C)	1.5	63	66	110	80	80			
		Medium (S)	7.7	86	97	132	125	120			
		Large (C)	18.6	123	146	223	195	182			
		X-Large (S)	31.0	156	185	312	265	242			
5c. Hosiery Products 3/	Own hosiery	Small	2.7	63	66	110	80	80			
		Large	13.6	86	98	133	125	120			
	Integrated	Small	2.7	63	66	110	80	80			
		Large	13.6	86	98	133	125	120			
6. Carpet finishing	Integrated	Small	8.9	71	77	229	94	93			
		Medium	49.0	114	136	214	185	172			
		Large	122.0	197	236	421	349	315			
7. Stock and yarn finishing	Commission	Small	4.2	71	77	174	93	93			
		Medium	9.4	86	97	132	125	119			
		Large	23.0	123	145	222	195	182			
	Own yarn	Small	4.2	71	77	174	93	93			
		Medium	9.4	86	97	132	125	119			
		Large	23.0	123	145	222	195	182			
	Integrated	Medium	9.4	86	97	132	125	119			
		Large	23.0	123	145	222	195	182			
8. Nonwoven manufacturing		Small	24.0	86	98	133	125	120			
		Medium	57.0	123	145	223	195	182			
9. Felt fabric processing		Small	0.9	63	66	70	81	NA			
		Medium	4.4	87	98	133	125	NA			
		Large	10.7	124	145	223	196	NA			

1/ Type processing (or subdivision) applicable to woven and knit fabric finishing is shown for each model in these subcategories. These include "S" for simple; "C" for complex; and "D" for complex-desizing.
2/ Alternative technologies M, N, and P apply to wool scouring only
3/ Hosiery products is a subdivision of the knit fabric finishing subcategory.
NA = Not Applicable
Source: *Effluent Guidelines Division. U.S. Environmental Protection Agency, Development Document.*

Table VII-16. The textile industry, new source model plant wastewater controls, annual operating and maintenance expenses

Subcategory	Type mill	Size	Type processing	Alternative Treatment Technologies: Direct dischargers (NSPS: Daily capacity	R	S	T	Indirect dischargers (PSNS): Daily capacity	R	S	T
				(kkg)	($000)			(kkg)	($000)		
2. Wool finishing	Integrated	Medium		20.0	335	298	401	20.0	209	280	334
4. Woven fabric finishing	Own fabric	Medium	Complex	NA	NA	NA	NA	26.0	140	169	159
		Large	Complex	130.0	508	447	597		NA	NA	NA
	Integrated	Large	Desize	50.0	369	298	398	50.0	210	280	334
5. Knit fabric finishing	Integrated	Large	Complex	18.6	215	175	241	18.6	140	169	159
5c. Hosiery products 1/	Integrated	Medium		6.0	119	NA	213	NA	NA	NA	NA
		Large		NA	NA	NA	NA	13.6	95	114	124
6. Carpet finishing	Integrated	Small		20.0	149	126	183	NA	NA	NA	NA
		Medium		NA	NA	NA	NA	49.0	140	169	159
7. Stock & yarn finishing	Own yarn	Medium		23.0	216	175	241	9.4	115	114	123
8. Nonwoven manufacturing		Medium		10.4	149	126	183	57.0	140	169	159
9. Felt fabric processing		Medium		2.0	149	126	183	4.4	103	114	125

1/ Hosiery products is a subdivision of the knit fabric finishing subcategory.

Source: Effluent Guidelines Division, U.S. Environmental Protection Agency, Development Document.

Table VII-17. The textile industry, direct discharging model plant wastewater controls' estimated total yearly costs - direct dischargers

Subcategory	Type mill	Size/ type 1/	Daily capacity	Alternative treatment technology (BATEA) - existing sources												
				A	B	C	D	E	F	G	H	J	K	M2/	N2/	P2/
			(kkg)	($1,000)												
1. Wool scouring	Commission	Small	16.2											115	176	141
		Medium	35.6											141	268	182
		Large	30.9											198	370	278
2. Wool finishing	Commission	Small	8.0	NA	163	NA	213	NA	414	162	286	NA	339			
	Integrated	Small	8.0	NA	163	NA	213	NA	414	162	286	NA	339			
		Medium	20.0	NA	245	NA	336	NA	719	307	509	NA	598			
		Large	40.0	NA	367	NA	510	NA	1,146	524	842	NA	980			
4. Woven fabric finishing	Commission	Small(S)	5.3	NA	100	51	118	68	227	70	139	90	156			
		Medium(C)	26.0	NA	163	94	212	294	413	162	286	220	338			
		Large(C)	130.0	NA	366	211	510	862	1,147	524	837	683	980			
	Own fabric	Small(S)	5.3	NA	100	51	118	68	227	70	139	90	156			
		Medium(C)	26.0	NA	163	94	212	294	413	162	286	220	338			
		Large(C)	130.0	NA	365	211	510	862	1,147	524	837	683	980			
	Integrated	Small(S)	5.3	NA	100	51	118	68	227	70	139	90	156			
		Medium(D)	20.0	NA	163	94	212	294	413	162	286	220	338			
		Large(C)	50.0	NA	243	146	334	597	712	308	508	407	595			
		X-large(C)	220.0	NA	525	280	684	1,319	1,720	798	1,263	1,027	1,461			
5. Knit fabric finishing	Commission	Medium(S)	7.7	NA	119	65	150	208	290	99	186	133	216			
		Medium(C)	7.7	NA	119	66	150	209	290	99	186	134	216			
		Large(C)	18.6	NA	163	94	212	285	413	162	286	220	338			
	Integrated	Medium(S)	7.7	NA	119	65	150	208	290	99	186	133	216			
		Medium(C)	7.7	NA	119	66	150	209	290	99	186	134	216			
		Large(C)	18.6	NA	163	94	212	285	413	162	286	220	338			
5c. Hosiery products 3/	Own hosiery	Small	2.7	84	174	NA	184	NA	236	140	200	NA	211			
		Medium	6.0	104	204	NA	222	NA	331	174	243	NA	260			
	Integrated	Small	2.7	84	174	NA	184	NA	236	140	200	NA	211			
		Medium	6.0	104	204	NA	222	NA	331	174	243	NA	260			
6. Carpet finishing	Integrated	Small	20.0	NA	119	66	150	209	290	98	186	134	216			
		Medium	49.0	NA	163	94	212	293	413	162	286	220	338			
		Large	120.0	NA	243	145	334	598	712	307	508	408	595			
7. Stock & yarn finishing	Commission	Small	9.4	NA	118	66	150	208	290	99	186	134	216			
		Medium	23.0	NA	163	93	212	298	413	162	186	219	338			
		Large	57.0	NA	243	144	334	597	712	307	508	407	595			
	Own yarn	Small	9.4	NA	118	66	150	208	290	99	186	134	216			
		Medium	23.0	NA	163	93	212	293	413	162	286	219	338			
		Large	38.0	NA	198	117	266	395	543	230	388	309	455			
		X-large	57.0	NA	243	144	334	597	712	307	508	407	595			
	Integrated	Small	9.4	NA	118	66	150	208	290	99	186	134	216			
		Large	38.0	NA	198	117	266	395	543	230	388	309	455			
8. Nonwoven manufacturing		Small	10.4	104	204	155	222	172	331	174	243	194	260			
9. Felt fabric processing		Medium	2.0	104	204	NA	222	NA	331	174	243	NA	260			

1/ Type processing (or subdivision) applicable to woven and knit fabric finishing is shown for each model in these subcategories. These include "S" for simple; "C" for complex; and "D" for complex - desizing.

2/ Alternative technologies M, N, and P apply to wool scouring only.

3/ Hosiery products is a subdivision of the knit fabric finishing subcategory.

NA - Not Applicable

Source: Effluent Guidelines Division, U.S. Environmental Protection Agency, Development Document.

Table VII-18. The textile industry, indirect discharging model plant wastewater controls' estimated total yearly costs - indirect dischargers

Subcategory	Type Mill	Size/ Mill 1/	Daily Capacity	Wastewater Treatment Technologies (PSES) - Existing Sources							
				B	D	F	H	J	M2/	N2/	P2/
			(kkg)	($1,000)							
1. Wool scouring	Commission	Small	16.0						119	188	144
		Large	81.0						213	383	278
2. Wool finishing	Commission	Small	3.3	129	160	299	197	194			
	Integrated	Small	3.3	129	160	299	197	194			
		Medium	20.0	288	379	743	563	527			
		Large	40.0	441	581	1,220	932	822			
4. Woven fabric finishing	Commission	Small (S)	2.4	90	101	152	116	116			
		Medium (C)	26.0	185	237	435	312	NA			
		Large (C)	130.0	441	585	1,216	915	NA			
	Own fabric	Small (S)	2.4	90	101	152	116	116			
		Medium (C)	26.0	185	237	435	312	NA			
		Large (C)	130.0	441	585	1,216	915	NA			
	Integrated	Small (S)	2.4	90	101	152	116	116			
		Medium (D)	20.0	185	237	435	281	NA			
		Large (D)	50.0	291	383	759	555	NA			
		X-Large (D)	170.0	639	840	1,853	1,379	NA			
5. Knit fabric finishing	Commission	Medium (S)	7.7	129	160	299	197	194			
		Large (C)	18.6	184	236	434	311	297			
	Integrated	Small (C)	1.5	90	101	152	116	116			
		Medium (S)	7.7	129	160	299	197	194			
		Large (C)	18.6	184	237	435	311	297			
		X-Large (S)	31.0	233	301	576	423	403			
5c. Hosiery Products 3/	Own hosiery	Small	2.7	90	101	152	116	116			
		Large	13.6	129	161	300	197	197			
	Integrated	Small	2.7	90	101	152	116	116			
		Large	13.6	129	161	300	197	197			
6. Carpet finishing	Integrated	Small	8.9	105	122	287	143	142			
		Medium	49.0	175	226	422	301	287			
		Large	122.0	291	382	758	552	519			
7. Stock and yarn finishing	Commission	Small	4.2	105	122	232	142	143			
		Medium	9.4	129	160	299	197	193			
		Large	23.0	184	236	434	311	297			
	Own yarn	Small	4.2	105	122	232	142	143			
		Medium	9.4	129	160	299	197	193			
		Large	23.0	184	236	434	311	297			
	Integrated	Medium	9.4	129	160	299	197	193			
		Large	23.0	184	236	434	311	297			
8. Nonwoven manufacturing		Small	24.0	129	161	300	222	194			
		Medium	57.0	184	236	435	308	297			
9. Felt fabric processing		Small	0.9	90	101	113	116	NA			
		Medium	4.4	130	161	300	222	NA			
		Large	10.7	185	236	435	309	NA			

1/ Type processing (or subdivision) applicable to woven and knit fabric finishing is shown for each model in these subcategories. These include "S" for simple; "C" for complex; and "D" for complex-desizing.
2/ Alternative technologies M, N, and P apply to wool scouring only.
3/ Hosiery products is a subdivision of the knit fabric finishing subcategory.
NA = Not Applicable
Source: Effluent Guidelines Division, U.S. Environmental Protection Agency, Development Document.

Table VII-19. The textile industry, new source model plant wastewater controls, total yearly costs

Subcategory	Type mill	Size/type 1/	Daily capacity	Wastewater Treatment Technologies: Direct dischargers (NSPS) R	S	T	Indirect dischargers (PSNS) R	S	T
			(kkg)	($000)					
2. Wool finishing	Integrated	Medium	20.0	726	536	690	327	507	596
4. Woven fabric finishing	Own fabric	Medium (C)	26.0	NA	NA	NA	217	340	351
		Large (C)	130.0	1,122	793	1,015	NA	NA	NA
	Integrated	Large (D)	50.0	759	536	688	328	507	598
5. Knit fabric finishing	Integrated	Large (C)	18.6	345	349	445	217	340	351
5c. Hosiery products 2/	Integrated	Medium	6.0	179	NA	284	NA	NA	NA
		Large	13.6	NA	NA	NA	150	257	279
6. Carpet finishing	Integrated	Small	20.0	235	293	376	NA	NA	NA
		Medium	49.0	NA	NA	NA	217	340	351
7. Stock & yarn finishing	Own yarn	Medium	3/	346	349	445	170	257	278
8. Nonwoven manufacturing		Medium	3/	235	293	376	217	340	351
9. Felt fabric processing		Medium	3/	235	293	376	158	257	280

1/ Type processing applicable to woven and knit fabric finishing is shown for each model in these subcategories. These include "C" for complex and "D" for complex-desizing.
2/ Hosiery products is a subdivision of the knit fabric finishing subcategory.
3/ For these models there is a size difference between direct and indirect dischargers. For stock and yarn models the sizes are 23.0 kkg and 9.4 kkg for the direct and indirect models respectively; nonwoven manufacturing models are 10.4 and 57.0 kkg respectively; and felted fabric processing models, 2.0 and 4.4 kkg, respectively.

Source: Effluent Guidelines Division, U.S. Environmental Protection Agency, Development Document.

Table VII-20. The textile industry, model plant wastewater controls' estimated total yearly costs expressed as a percent of the models' sales - direct dischargers.

Subcategory	Type mill	Size/type 1/	Daily capacity	Alternative treatment technology (BATEA) - Existing sources: A	B	C	D	E	F	G	H	J	K	M 2/	N 2/	P 2/
			(kkg)	(percent)												
1. Wool scouring	Commission	Small	16.2											3.5	5.3	4.2
		Medium	35.6											1.9	3.6	2.4
		Large	80.9											1.5	2.7	2.1
2. Wool finishing	Commission	Small	8.0	NA	5.6	NA	7.3	NA	14.1	5.5	9.3	NA	11.6			
	Integrated	Small	3.0	NA	0.7	NA	1.0	NA	1.9	0.7	1.3	NA	1.5			
		Medium	20.0	NA	0.8	NA	1.0	NA	2.2	1.0	1.6	NA	1.9			
		Large	40.0	NA	0.4	NA	0.6	NA	1.4	0.6	1.0	NA	1.2			
4. Woven fabric finishing	Commission	Small (S)	5.3	NA	5.9	3.0	7.0	4.0	13.4	4.1	8.2	5.3	9.2			
		Medium (C)	26.0	NA	2.3	1.3	3.0	4.2	5.9	2.3	4.1	3.2	4.9			
		Large (C)	130.0	NA	1.2	0.7	1.6	2.7	3.7	1.7	2.7	2.2	3.1			
	Own fabric	Small (S)	5.3	NA	1.1	0.6	1.3	0.8	2.6	0.8	1.6	1.0	1.8			
		Medium (C)	26.0	NA	0.4	0.2	0.5	0.7	0.9	0.4	0.6	0.5	0.8			
		Large (C)	130.0	NA	0.3	0.2	0.4	0.8	1.0	0.5	0.7	0.6	0.9			
	Integrated	Small (S)	5.3	NA	1.1	0.5	1.3	0.7	2.4	0.7	1.5	1.0	1.7			
		Medium (D)	20.0	NA	0.7	0.4	0.9	1.2	1.7	0.7	1.2	0.9	1.4			
		Large (D)	50.0	NA	0.4	0.3	0.6	1.0	1.2	0.5	0.9	0.7	1.0			
		X-large (C)	220.0	NA	2.2	1.2	2.9	5.6	7.3	3.4	5.4	4.4	6.2			
5. Knit fabric finishing	Commission	Medium (S)	7.7	NA	4.2	2.3	5.3	7.3	10.2	3.5	6.6	4.7	7.6			
		Medium (C)	7.7	NA	4.0	2.2	5.1	7.1	9.8	3.3	6.3	4.5	7.3			
		Large (C)	18.6	NA	2.7	1.6	3.5	4.8	6.9	2.7	4.8	3.7	5.6			
	Integrated	Medium (S)	7.7	NA	0.8	0.4	1.0	1.4	1.9	0.7	1.2	0.9	1.4			
		Medium (C)	7.7	NA	0.9	0.5	1.1	1.5	2.1	0.7	1.3	1.0	1.5			
		Large (C)	18.6	NA	0.5	0.3	0.7	0.9	1.4	0.5	0.9	0.7	1.1			
5c. Hosiery products 3/	Own hosiery	Small	2.7	1.4	2.9	NA	3.1	NA	3.9	2.3	3.3	NA	3.5			
		Large	6.0	0.6	1.1	NA	1.2	NA	1.8	1.0	1.3	NA	1.4			
	Integrated	Small	2.7	0.8	1.6	NA	1.7	NA	2.2	1.3	1.9	NA	2.0			
		Large	6.0	0.6	1.1	NA	1.2	NA	1.8	1.0	1.3	NA	1.4			
6. Carpet finishing	Integrated	Small	20.0	NA	0.5	0.3	0.6	0.8	1.1	0.4	0.7	0.5	0.9			
		Medium	49.0	NA	0.3	0.2	0.4	0.6	0.8	0.3	0.6	0.4	0.7			
		Large	120.0	NA	0.2	0.1	0.2	0.4	0.5	0.2	0.4	0.3	0.4			
7. Stock and yarn finishing	Commission	Small	9.4	NA	6.7	3.8	8.5	11.8	16.5	5.6	10.6	7.6	12.3			
		Medium	23.0	NA	3.6	2.1	4.7	6.5	9.2	3.6	6.4	4.9	7.5			
		Large	57.0	NA	2.0	1.2	2.7	4.9	5.8	2.5	4.2	3.3	4.9			
	Own yarn	Small	9.4	NA	1.3	0.7	1.7	2.3	3.2	1.1	2.0	1.5	2.4			
		Medium	23.0	NA	1.0	0.6	1.3	1.8	2.6	1.0	1.8	1.4	2.1			
		Large	38.0	NA	0.7	0.4	0.9	1.4	1.9	0.8	1.4	1.1	1.6			
		X-large	57.0	NA	0.7	0.4	1.0	1.8	2.1	0.9	1.5	1.2	1.8			
	Integrated	Small	9.4	NA	1.9	1.0	2.4	3.3	4.6	1.6	2.9	2.1	3.4			
		Large	38.0	NA	0.7	0.4	1.0	1.4	2.0	0.8	1.4	1.1	1.7			
8. Nonwoven manufacturing		Medium	10.4	1.4	2.8	2.1	3.1	2.4	4.6	2.4	3.4	2.7	3.6			
9. Felt fabric processing		Medium	2.0	2.0	3.8	NA	4.2	NA	6.2	3.3	4.6	NA	4.9			

1/ Type processing (or subdivision) applicable to woven and knit fabric finishing is shown for each model in these subcategories. These include "S" for simple; "C" for complex; and "D" for complex-desizing.
2/ Alternative technologies M, N, and P apply to wool scouring only.
3/ Hosiery products is a subdivision of the knit fabric finishing subcategory.

Source: Development Planning and Research Associates, Inc. estimates based on yearly costs in Table VII-17 and model plant sales data in Appendix B.

Table VII-21. The textile industry, model plant wastewater controls' estimated total yearly costs expressed as a percentage of the sales - indirect dischargers

Subcategory	Type Mill	Size/ type 1/	Daily Capacity	Wastewater Treatment Technologies (PSES) - Existing Sources							
				B	D	F	H	J	M2/	N2/	P2/
			(kkg)	(Percent)							
1. Wool scouring	Commission	Small	16.0						3.1	4.8	3.7
		Large	81.0						1.5	2.7	2.0
2. Wool finishing	Commission	Small	3.3	11.2	13.9	26.0	17.1	16.9			
	Integrated	Small	3.3	1.9	2.3	4.3	2.8	2.8			
		Medium	20.0	0.8	1.0	2.0	1.5	1.4			
		Large	40.0	0.5	0.7	1.5	1.2	1.0			
4. Woven fabric finishing	Commission	Small (S)	2.4	15.8	17.7	26.7	20.4	20.4			
		Medium (C)	26.0	3.0	3.9	7.1	5.1	NA			
		Large (C)	130.0	1.2	1.6	3.4	2.5	NA			
	Own fabric	Small (S)	2.4	3.0	3.4	5.1	3.9	3.9			
		Medium (C)	26.0	0.5	0.6	1.1	0.8	NA			
		Large (C)	130.0	0.3	0.4	0.9	0.7	NA			
	Integrated	Small (S)	2.4	2.8	3.2	4.8	3.7	3.7			
		Medium (D)	20.0	0.7	0.9	1.7	1.1	NA			
		Large (D)	50.0	0.5	0.7	1.3	1.0	NA			
		X-Large (D)	170.0	0.3	0.4	0.9	0.6	NA			
5. Knit fabric finishing	Commission	Medium (S)	7.7	3.4	4.3	8.0	5.3	5.2			
		Large (C)	18.6	2.3	3.0	5.5	3.9	3.8			
	Integrated	Small (C)	1.5	2.4	1.7	2.9	2.1	2.1			
		Medium (S)	7.7	1.0	1.2	2.2	1.5	1.4			
		Large (C)	18.6	0.5	0.6	1.2	0.8	0.8			
		X-Large (S)	31.0	0.4	0.6	1.1	0.8	0.8			
5c. Hosiery Products 3/	Own hosiery	Small	2.7	1.5	1.7	2.5	1.9	1.9			
		Large	13.6	0.4	0.5	1.0	0.7	0.7			
	Integrated	Small	2.7	0.8	0.9	1.4	1.1	1.1			
		Large	13.6	0.5	0.6	1.2	0.8	0.8			
6. Carpet finishing	Integrated	Small	8.9	0.9	1.1	2.6	1.3	1.3			
		Medium	49.0	0.3	0.4	0.7	0.5	0.5			
		Large	122.0	0.2	0.3	0.6	0.4	0.4			
7. Stock and yarn finishing	Commission	Small	4.2	14.5	16.8	32.0	19.6	19.7			
		Medium	9.4	8.1	10.0	18.7	12.3	12.1			
		Large	23.0	4.3	5.5	10.0	7.2	6.9			
	Own yarn	Small	4.2	2.8	3.3	6.2	3.8	3.8			
		Medium	9.4	2.2	2.8	5.2	3.4	3.4			
		Large	23.0	1.2	1.6	2.8	2.0	2.0			
	Integrated	Medium	9.4	2.2	2.8	5.2	3.4	3.4			
		Large	23.0	1.2	1.6	2.9	2.1	2.0			
8. Nonwoven manufacturing		Small	24.0	0.9	1.2	2.2	1.6	1.4			
		Medium	57.0	0.6	0.7	1.4	1.0	0.9			
9. Felt fabric processing		Small	0.9	2.4	2.7	3.0	3.1	NA			
		Medium	4.4	2.3	2.9	5.4	4.0	NA			
		Large	10.7	1.4	1.8	3.3	2.4	NA			

1/ Type processing (or subdivision) applicable to woven and knit fabric finishing is shown for each model in these subcategories. These include "S" for simple; "C" for complex; and "D" for complex-desizing.
2/ Alternative technologies M, N, and P apply to wool scouring only.
3/ Hosiery products is a subdivision of the knit fabric finishing subcategory.
NA = Not Applicable
Source: Development Planning and Research Associates, Inc. estimates based on yearly costs presented in Table VII-18 and model plant sales data presented in Appendix B.

Table VII-22. The textile industry, representative new source model plant wastewater controls estimate total yearly costs expressed as percent of the model plant sales

Subcategory	Type mill	Size/type 1/	Daily capacity	Direct dischargers (NSPS) R	Direct dischargers (NSPS) S	Direct dischargers (NSPS) T	Indirect dischargers (PSNS) R	Indirect dischargers (PSNS) S	Indirect dischargers (PSNS) T
			(kkg)	(percent)					
2. Wool finishing	Integrated	Medium	20.0	2.3	1.7	2.1	0.9	1.4	1.6
4. Woven fabric finishing	Own fabric	Medium (C)	26.0	NA	NA	NA	0.6	0.9	0.9
		Large (C)	130.0	1.0	0.7	0.9	NA	NA	NA
	Integrated	Large (D)	50.0	1.3	0.9	1.2	0.6	0.9	1.0
5. Knit fabric finishing	Integrated	Large (C)	18.6	1.1	1.2	1.5	0.6	0.9	0.9
5c. Hosiery products 2/	Integrated	Medium	6.0	1.0	NA	1.6	NA	NA	NA
		Large	13.6	NA	NA	NA	0.6	1.0	1.1
6. Carpet finishing	Integrated	Small	20.0	0.9	1.2	1.5	NA	NA	NA
		Medium	44.0	NA	NA	NA	0.4	0.6	0.6
7. Stock & yarn finishing	Own yarn	Medium	3/	2.1	2.2	2.8	3.0	4.5	4.8
8. Nonwoven manufacturing		Medium	3/	3.2	4.0	5.2	0.7	1.1	1.1
9. Felt fabric processing		Medium	3/	4.4	5.5	7.1	2.8	4.6	5.0

1/ Type processing applicable to woven and knit fabric finishing is shown for each model in these subcategories. These include "C" for complex and "D" for complex-desizing.
2/ Hosiery products is a subdivision of the knit fabric finishing subcategory.
3/ For these models there is a size difference between direct and indirect dischargers. For stock and yarn models the sizes are 23.0 kkg and 9.4 kkg for the direct and indirect models respectively; nonwoven manufacturing models are 10.4 and 57.0 kkg respectively; and felt fabric processing models, 2.0 and 4.4 kkg, respectively.

Source: Development Planning and Research Associates, Inc. estimates based on yearly costs in Table VII-19 and model plant sales data in Appendix B.

Table VII-23. Treatment options considered for the textile industry

Performance standards	Option	End-of-pipe treatment technology	Alternative treatment technology
(Existing sources)			
BATEA	1	Biological treatment (BPT)	A
	2	BPT plus filtration	C
	3	BPT plus chemical coagulation	B
	4	BPT plus chemical coagulation and filtration	D
PSES	1	Pretreatment standards based on screening, equalization, and/or neutralization	*
	2	Pretreatment plus chemical coagulation	B
	3	Pretreatment plus chemical coagulation and filtration	D
(New sources)			
NSPS	1	BPT	-
	2	BPT plus chemical coagulation and filtration	R
	3	Segregate toxic pollutant waste streams from other process-related and non-process related waste streams. Provide chemical coagulation, filtrating and carbon adsorption for toxic pollutant waste streams and biological treatment for other waste stream.	T
PSNS	1	Pretreatment standards based on screening, equalization, and/or neutralization as necessary for compliance with prohibitive discharge provisions (same as PSES Option 1).	-
	2	Pretreatment of all waste plus segregation and chemical coagulation and filtration of toxic pollutant waste streams.	R
	3	Option 2 plus the addition of activated carbon adsorption to the treatment train applied to the toxic stream.	T

* Currently in place.

Source: Effluent Guidelines Division, U.S. Environmental Protection Agency, Development Document.

Table VII-24. Treatment options proposed

	Options selected 1/	Applicable subcategory
BATEA	2	Woven fabric finishing
		Knit fabric finishing except hosiery products
		Carpet finishing
		Stock & yarn finishing
		Nonwoven manufacturing
	4	Wool scouring
		Wool finishing
		Hosiery products
	1	Felted fabric processing
PSES	2	All 2/
NSPS	2	All 2/
PSNS	2	All 2/

1/ Options include dissolved air flotation in place of filtration for the wool scouring subcategory.

2/ All subcategories except low water use (Subcategory 3).

Source: Effluent Guidelines Division, U.S. Environmental Protection Agency, Development Document.

VIII. PROJECTED ECONOMIC IMPACTS

The imposition of wastewater control requirements on the textile industry will result in at least some economic impacts for the industry as they will be required to make expenditures which, for all practical purposes, will not result in improved operating efficiency. Thus, the industry's profitability will be reduced even if only by a very small amount. As the capital and annual operating and maintenance expenditures for wastewater controls increase, the resulting economic impacts become more significant. The purpose of this chapter is to describe the various economic impacts associated with the treatment alternatives described in Chapter VII and to project the economic ramifications of mills incurring the associated expenditures.

For purposes of this analysis, economic impacts were assessed for each of the models described in Chapter VI utilizing the various wastewater control alternatives' costs presented in Chapter VII. The economic impact methodology, described in Chapter II, was primarily based on a net present value (NPV) analysis to determine the models' required price increases necessary to offset control expenditures and the financial impacts attributable to the control expenditures. Utilizing this information and other industry economic characteristics described in this report, the industry's ability to increase prices was assessed. Other economic impacts such as plant closures, production impacts, employment losses, community effects, dislocation effects, and balance of trade effects were assessed for each of the treatment options described in the preceeding chapter. It should be noted the impacts projected in this chapter are reflective of the industry conditions during 1977/78.

A. Price Effects

1. Required Price Increases

An implicit indicator of the expected price effects attributable to the imposition of wastewater controls used in this analysis was the amount of sales price increase required to maintain a profitability, after control expenditures, at a level equal to that prior to control expenses. The method of the computation of this required price increase was described in detail in Chapter II (Methodology) of this report. The ability of mills to pass on such required price increases is evaluated in the next section of this chapter.

a. Existing Models

The required price increases for the existing models are shown in Tables VIII-1 and VIII-2 for direct and indirect discharging models, respectively. In the direct category, the largest increases were generally required under Treatment F with the greatest model increases required by the small commission

Table VIII-1. The textile industry, representative existing model plants impacts, average required price increase necessary to offset expenditures for wastewater controls - direct dischargers

Subcategory	Type Mill	Size/ Type 1/	Daily Capacity	A	B	C	D	E	F	G	H	J	K	M 3/	N 3/	P 3/
				Alternative treatment technologies (BAILA) 2/												
			(kkg)	(percent)												
1. Wool scouring	Commission	Small	16.2											1.1	1.4	1.3
		Medium	35.6											1.0	1.4	1.1
		Large	80.9											0.8	1.2	0.8
2. Wool finishing	Commission	Small	8.0	NA	1.6	NA	2.0	NA	3.8	1.9	2.3	NA	2.5			
	Integrated	Small	8.0	NA	0.4	NA	0.6	NA	0.8	0.5	0.6	NA	0.6			
		Medium	20.0	NA	0.4	NA	0.5	NA	0.6	0.6	0.7	NA	0.8			
		Large	40.0	NA	0.3	NA	0.4	NA	0.6	0.4	0.5	NA	0.5			
4. Woven fabric finishing	Commission	Small (S)	5.3	NA	1.8	1.3	2.1	1.8	3.3	1.2	2.2	1.9	2.4			
		Medium (C)	26.0	NA	1.3	0.9	1.6	2.7	2.5	1.4	1.9	1.9	2.1			
		Large (C)	130.0	NA	0.7	0.5	0.9	1.7	1.7	1.0	1.3	1.4	1.5			
	Own fabric	Small (S)	5.3	NA	0.6	0.4	0.7	0.5	1.0	0.5	0.7	0.6	0.8			
		Medium (C)	26.0	NA	0.2	0.2	0.3	0.5	0.5	0.3	0.3	0.3	0.4			
		Large (C)	130.0	NA	0.2	0.2	0.3	0.5	0.5	0.3	0.4	0.4	0.4			
	Integrated	Small (S)	5.3	NA	0.6	0.4	0.7	0.5	1.0	0.5	0.7	0.6	0.8			
		Medium (D)	20.0	NA	0.4	0.3	0.5	0.8	0.9	0.5	0.6	0.6	0.7			
		Large (D)	50.0	NA	0.3	0.3	0.4	0.7	0.7	0.4	0.5	0.5	0.6			
		X-Large (C)	220.0	NA	0.2	0.1	0.2	0.4	0.4	0.3	0.3	0.3	0.3			
5. Knit fabric finishing	Commission	Medium (S)	7.7	NA	1.4	1.2	1.6	3.3	2.9	1.3	1.9	1.6	2.0			
		Medium (C)	7.7	NA	1.7	1.4	1.7	3.3	2.8	1.7	1.7	2.0	1.8			
		Large (C)	18.6	NA	1.5	1.2	1.8	2.8	2.8	1.7	2.1	2.0	2.3			
	Integrated	Medium (S)	7.7	NA	0.5	0.3	0.5	0.8	0.8	0.4	0.6	0.5	0.6			
		Medium (C)	7.7	NA	0.5	0.3	0.5	0.9	0.9	0.4	0.6	0.5	0.6			
		Large (C)	18.6	NA	0.4	0.4	0.5	0.7	0.7	0.4	0.5	0.5	0.6			
5c. Hosiery Products 4/	Own hosiery	Small	2.7	1.1	1.4	NA	1.4	NA	1.5	1.3	1.4	NA	1.4			
		Medium	6.0	0.5	0.7	NA	0.8	NA	0.9	0.7	0.8	NA	0.8			
	Integrated	Small	2.7	0.6	1.0	NA	1.0	NA	1.1	0.9	1.1	NA	1.1			
		Medium	6.0	0.5	0.7	NA	0.8	NA	0.9	0.7	0.8	NA	0.8			
6. Carpet finishing	Integrated	Small	20.0	NA	0.3	0.2	0.3	0.5	0.6	0.3	0.4	0.3	0.4			
		Medium	49.0	NA	0.2	0.2	0.2	0.4	0.4	0.2	0.3	0.3	0.3			
		Large	120.0	NA	0.2	0.1	0.2	0.3	0.3	0.2	0.2	0.2	0.2			
7. Stock & yarn finishing	Commission	Small	9.4	NA	2.9	2.2	2.9	4.4	5.4	3.1	2.9	3.4	3.2			
		Medium	23.0	NA	1.9	1.2	2.2	2.8	3.5	2.1	2.7	2.5	2.8			
		Large	57.0	NA	1.1	0.8	1.2	2.0	2.4	1.5	2.0	1.7	2.1			
	Own yarn	Small	9.4	NA	0.7	0.4	0.8	1.0	1.4	0.6	0.9	0.8	0.9			
		Medium	23.0	NA	0.6	0.4	0.6	0.8	1.0	0.6	0.8	0.7	0.8			
		Large	38.0	NA	0.4	0.4	0.5	0.7	0.9	0.6	0.7	0.7	0.8			
		X-Large	57.0	NA	0.4	0.3	0.5	0.8	0.9	0.6	0.8	0.7	0.8			
	Integrated	Small	9.4	NA	1.0	0.7	1.2	1.5	2.0	0.9	1.3	1.2	1.3			
		Large	38.0	NA	0.4	0.3	0.4	0.7	0.8	0.6	0.6	0.6	0.8			
8. Nonwoven manufacturing		Medium	10.4	1.2	1.8	1.6	1.9	1.7	2.3	1.6	1.9	1.7	1.9			
9. Felt fabric processing		Medium	2.0	1.6	2.2	NA	2.2	NA	2.0	2.1	2.1	NA	2.1			

1/ Type processing (or subdivision) applicable to woven and knit fabric finishing is shown for each model in these categories. These include "S" for simple; "C" for complex; and "D" for complex-desizing.
2/ For those models with treatment alternative A (BPT), impacts for alternatives B through K include the impacts associated with compliance of alternative A.
3/ Alternative technologies M, N, and P apply to wool scouring only.
4/ Hosiery Products is a subdivision of the Knit Fabric Finishing Subcategory.

Source: Development, Planning and Research Associates, Inc. estimates based on the imposition of wastewater control expenditures described in Chapter VII on the model plants described in Chapter VI utilizing the methodology presented in Chapter II.

Table VIII-2. The textile industry, representative existing model impacts, average required price increase necessary to offset expenditures for wastewater controls - indirect dischargers

Subcategory	Type mill	Size/ type 1/	Daily capacity	Alternative Treatment Technologies (PSES) B	D	F	H	J	M 2/	N 2/	P 2/
			(kkg)	(Percent)							
1. Wool scouring	Commission	Small	16.0						0.9	1.5	1.0
		Large	81.0						0.7	1.3	1.0
2. Wool finishing	Commission	Small	3.3	3.3	3.7	11.4	5.2	5.2			
	Integrated	Small	3.3	0.9	1.0	2.4	1.3	1.3			
		Medium	20.0	0.4	0.5	0.9	0.7	0.6			
		Large	40.0	0.3	0.4	0.7	0.6	0.5			
4. Woven fabric finishing	Commission	Small (S)	2.4	4.3	4.5	6.1	5.3	5.2			
		Medium (C)	26.0	1.6	1.8	2.9	2.0	0.2			
		Large (C)	130.0	0.7	0.8	1.4	1.1	0.2			
	Own fabric	Small (S)	2.4	1.1	1.1	0.9	1.1	1.2			
		Medium (C)	26.0	0.3	0.3	0.5	0.4	0.1			
		Large (C)	130.0	0.2	0.2	0.4	0.3	0.1			
	Integrated	Small (S)	2.4	1.3	1.3	1.6	1.5	1.5			
		Medium (D)	20.0	0.4	0.4	0.8	0.5	0.1			
		Large (D)	50.0	0.4	0.4	0.6	0.5	0.1			
		X-large	170.0	0.2	0.2	0.4	0.3	0.1			
5. Knit fabric finishing	Commission	Medium (S)	7.7	1.1	1.2	2.7	1.4	1.4			
		Large (C)	18.6	1.1	1.2	2.2	1.4	1.4			
	Integrated	Small (C)	1.5	1.0	1.0	0.8	1.0	1.0			
		Medium (S)	7.7	0.5	0.5	1.0	0.6	0.6			
		Large (C)	18.6	0.3	0.3	0.5	0.4	0.3			
		X-large (S)	31.0	0.4	0.4	0.6	0.5	0.4			
5c. Hosiery products 3/	Own hosiery	Small	2.7	0.7	0.6	0.6	0.6	0.7			
		Large	13.6	0.2	0.2	0.2	0.2	0.2			
	Integrated	Small	2.7	0.4	0.4	0.5	0.5	0.5			
		Large	13.6	0.2	0.2	0.3	0.2	0.3			
6. Carpet finishing	Integrated	Small	8.9	0.5	0.5	0.9	0.6	0.6			
		Medium	49.0	0.2	0.2	0.3	0.3	0.3			
		Large	122.0	0.2	0.2	0.3	0.2	0.2			
7. Stock and yarn finishing	Commission	Small	4.2	4.3	4.5	7.3	5.1	5.2			
		Medium	9.4	2.8	2.8	6.0	3.0	2.9			
		Large	23.0	2.0	2.3	3.9	2.7	2.6			
	Own yarn	Small	4.2	1.1	1.1	1.3	1.0	1.0			
		Medium	9.4	1.0	1.1	2.1	1.3	1.2			
	-	Large	23.0	0.7	0.7	1.2	0.9	0.3			
	Integrated	Medium	9.4	1.1	1.2	2.2	1.3	1.3			
		Large	23.0	0.6	0.7	1.2	0.8	0.8			
8. Nonwoven manufacturing		Small	24.0	0.6	0.6	1.1	0.7	0.7			
		Medium	57.0	0.3	0.4	0.6	0.4	0.4			
9. Felt fabric processing		Small	0.9	1.2	1.2	1.2	1.4	NA			
		Medium	4.4	1.1	1.2	2.4	1.5	NA			
		Large	10.7	0.7	0.8	1.4	0.9	NA			

Source: Development, Planning and Research Associates, Inc. estimates based on the imposition of wastewater control expenditures described in Chapter VII on the model plants described in Chapter VI utilizing the methodology presented in Chapter II.

1/ Type processing (or subdivision) applicable to woven and knit fabric finishing is shown for each model in these subcategories. These include "S" for simple' "C" for complex; and "D" for complex-desizing.
2/ Alternative technologies M, N, and P apply to wool scouring only.
3/ Hosiery products is a subdivision of the knit fabric finishing subcategory.

models. For the small commission models, required price increases ranged from 2.9 percent for the knit fabric commission (5) models to 5.4 for the stock and yarn commission (7) models. The smallest required price increases were associated with the integrated mills. Under treatment F for these models, required price increases ranged from 0.3 percent for the large carpet (6) model to 2.0 percent for the small stock and yarn (7) model, with the majority of the integrated mills requiring increases less than one percent. Treatment alternative K, with the second highest treatment costs, had required increases of about a tenth to a third less than those under treatment F.

For the indirect discharging models, required price increases were appreciably higher than those for the direct dischargers. Under treatment F, price increases ranged from 2.7 percent to 11.4 percent among the small commission models. Among the integrated models, increases were generally less than 1 percent with the highest increase amounting to 2.4 percent.

b. New Source Models

Table VIII-3 shows the required price increases associated with the new source direct and indirect discharging models. Required increases were the highest in felt fabric processing (9) regardless of treatment alternatives for both direct and indirect dischargers. Among the direct dischargers in the other subcategories, required increases were slightly higher under treatment R for the wool finishing (2) and woven fabric (4) models and under treatment alternative T for the other models. Under treatment R, price increases ranged between 0.8 percent for the hosiery (5c) model and 3.4 percent for the felt fabric processing (9) model.

For the new source indirect dischargers, the required price increases were highest under treatment alternative T for all subcategories, ranging from 0.6 percent for the carpet finishing (6) model to 4.7 percent for the felt fabric processing (9) model. The price increases under treatment alternative R were only about half the size of those under treatment alternative T for the new source indirect models.

2. Expected Price Increases

The textile industry consists of numerous subcategories which supply their goods both to common and specialized markets. Competition within most subcategories is relatively strong and the industry also has encountered notable competition from imported textile goods. The industry has consistantly earned relatively low profit margins, with profits being approximately one-half those of a composite of all manufacturing industries. Prices of textile goods have increased during the past decade, however these prices have increased at a rate considerably less than the rates for most industrial goods.

Table VIII-3. The textile industry, representative new source model plant impacts, average required price increase necessary to offset expenditures for wastewater controls

				Alternative Treatment Technologies					
				Direct Dischargers (NSPS)			Indirect Dischargers (PSNS)		
Subcategory	Type mill	Size/type1/	Daily capacity	R	S	T	R	S	T
			(kkg)	percent					
2. Wool finishing	Integrated	Medium	20.0	2.2	1.7	2.0	1.0	1.5	1.7
4. Woven fabric finishing	Own fabric	Medium (C)	26.0	NA	NA	NA	0.5	0.9	0.9
		Large (C)	130.0	0.9	0.7	0.8	NA	NA	NA
	Integrated	Large (D)	50.0	1.3	1.0	1.2	0.6	0.9	1.0
5. Knit fabric finishing	Integrated	Large (C)	18.6	0.9	1.1	1.3	0.5	0.9	0.9
5c. Hosiery products2/	Integrated	Medium	6.0	0.8	NA	1.2	NA	NA	NA
		Large	13.6	NA	NA	NA	0.6	1.1	1.1
6. Carpet finishing	Integrated	Small	20.0	0.8	1.1	1.4	NA	NA	NA
		Medium	49.0	NA	NA	NA	0.4	0.6	0.6
7. Stock & yarn finishing	Own yarn	Medium	3/	1.6	1.9	2.3	2.2	4.1	4.4
8. Nonwoven manufacturing		Medium	3/	2.7	3.9	4.8	0.7	1.1	1.2
9. Felt fabric processing		Medium	3/	3.4	5.1	6.2	2.3	4.2	4.7

1/ Type processing applicable to woven and knit fabric finishing is shown for each model in these subcategories. These include "C" for complex and "D" for complex desizing.
2/ Hosiery products is a subdivision of the Knit Fabric Finishing Subcategory.
3/ For these models, there is a size difference between direct and indirect. For Stock & Yarn models the sizes are 23.0 kkg and 9.3 kkg for the direct and indirect models respectively; nonwoven manufacturing models are 10.4 and 57.0 kkg respectively; and Felt Fabric Processing models, 2.0 and 4.4 kkg respectively.

Source: Development Planning and Research Associates, Inc. estimates based on the imposition of wastewater control expenditures described in Chapter VII on the model plants described in Chapter VI utilizing the methodology presented in Chapter II.

In the assessment of the expected price increases which can be associated with the imposition of wastewater control requirements, the above factors exert considerable influence. Furthermore as was presented in Tables VIII-1, 2, and 3, the required price increases for each model was not equal; thus some plants will require considerably higher price increases than others. As was discussed in Chapter V, Prices, the industry is very competitive with prices being determined typically by supply and demand relationships. If firms competing on common markets require different price increases, then it would be unlikely the firms with the higher required price increases could increase their respective prices by the required amount and still be able to compete with those firms requiring smaller price increases. Accordingly, it would be logical that prices would not increase by amounts in excess of the lower required price increases within a given segment. However, competition from non-impacted foreign textile goods producers may limit even further the abilities of domestic textile firms to increase prices.

Furthermore, as was discussed in Chapter VII, Discharge Status, many plants in the industry will not be required to make wastewater control expenditures. This further contributes to the lack of uniformity of required price increases among the industry facilities. In summary, it is anticipated the textile industry will be limited in its ability to increase prices to recoup expenditures for wastewater controls. While within some subcategories, particularly those with little foreign competition and uniform control expenditure requirements, small price increases may occur, the overall ability of the industry to increase prices is expected to be limited.

B. Financial Effects

As discussed in the preceeding section, the textile industry is expected to be limited in its ability to increase prices to recoup expenditure requirements for wastewater controls. Accordingly, this section and all subsequent sections describe impacts based on the assumption of no price increases. While some price increases may actually occur, the assumption of no increases enables this study to be somewhat conservative in its impact estimates; thus, possibly depicting a slightly worse case than will actually occur (assuming no changes in demand).

Based on the model profiles described in Chapter VI and the estimated cost of wastewater control described in Chapter VII, the following financial indicators were computed for the base case (without wastewater controls considered) and the impacted case (with wastewater controls considered).

- After-tax Return on Sales
- After-tax Return on Total Assets
- Annual Cash Flow
- Net Present Value
- Model Plant Closures

These indicators were computed for each model according to the net present value (NPV) and accounting procedures outlined in Chapter II, Methodology. It should be noted that unlevel discounted cash flow procedures were used in determining the models' NPV's. That is, for each of the twenty-one years, independent cash flows were computed based on certain assumptions of inflation, profitability, depreciation, and reinvestment. Accordingly, the after-tax returns on sales and total assets varied slightly from year to year. To compensate for this, a 21-year average was computed for each return. Annual cash flows and NPV's also varied from year to year; however, for these indicators, the respective amounts in year 21 were used. This procedure was used to view the cash flow and NPV effects of wastewater control expenditures at the end of a 21-year period. Because of the above described procedures, the base case financial indicators may differ slightly from similar indicators presented in Chapter VI, Model Plants.

1. Return on Sales

After-tax return on sales reflects the general level of profitability in an industry. The returns of the models reflect the low level of profits typically experienced by the textile industry. The imposition of wastewater control requirements on the industry contributes to a further deterioration of its returns.

a. Existing Models

The 21-year average after-tax returns on sales for the existing models both before and after expenditures for wastewater controls are shown in Tables VIII-4 and VIII-5 for direct and indirect dischargers, respectively. In the case of the direct dischargers, the returns reached the lowest levels under treatment F. The returns of all of the small commission mills changed from positive values in the base case to negative values after imposition of treatment alternative F. As shown in Table VIII-6, these reductions amounted to 400 and 600 percent reductions in profits reflecting the exceptionally low returns in the base case. The reductions of returns for the integrated models under treatment alternative F were substantially less than those for the commission models. For most of the small models, the reductions varied between 30 and 50 percent. For the large integrated mills the reductions amounted to around 15 percent. Treatment alternative K generally was associated with the next greatest impact on profits with reduction among the small commission mills reaching about 30 percent less than treatment F. Under treatment alternative K, reductions in returns of the small integrated models amounted to about 12 percent of that under the base case except for the stock and yarn (7) model. The return of this model was reduced about 90 percent from the base case.

For the indirect dischargers, the impacted returns of the small models reached levels substantially lower than those of the direct dischargers. Under treatment alternative F, the returns of the small commission models in all subcategories were around negative 20 percent of sales reflecting substantial

Table VIII-4. The textile industry, representative existing model plant impacts, effects of wastewater control expenditures on average after-tax returns on sales - direct dischargers

Subcategory	Type Mill	Size/ Type 1/	Daily Capacity	Base Case	A	B	C	D	E	F	G	H	J	K	M 3/	N 3/	P 3/
					Alternative treatment technologies (BATEA) 2/												
			(kkg)	(percent)													
1. Wool scouring	Commission	Small	16.2	-0.9											-3.8	-4.9	-4.3
		Medium	35.6	2.6											1.7	1.0	1.5
		Large	80.9	3.0											2.3	1.8	2.1
2. Wool finishing	Commission	Small	8.0	1.7	NA	-2.4	NA	-3.6	NA	-8.7	-2.5	-5.4	NA	-6.4			
	Integrated	Small	8.0	1.5	NA	1.1	NA	1.0	NA	0.7	1.1	0.9	NA	0.8			
		Medium	20.0	2.0	NA	1.6	NA	1.5	NA	1.3	1.5	1.3	NA	1.2			
		Large	40.0	4.2	NA	3.9	NA	3.9	NA	3.6	3.8	3.7	NA	3.7			
4. Woven fabric finishing	Commission	Small (S)	5.3	1.6	NA	-3.0	-0.5	-3.8	-1.5	-8.7	-1.6	-4.4	-2.7	-5.4			
		Medium (C)	26.0	2.4	NA	1.2	1.7	0.9	-0.1	-0.8	1.2	0.4	0.7	0.0			
		Large (C)	130.0	2.7	NA	2.0	2.3	1.8	1.2	1.0	1.7	1.4	1.5	1.2			
	Own fabric	Small (S)	5.3	1.6	NA	1.0	1.3	0.9	1.2	0.4	1.2	0.9	1.0	0.8			
		Medium (C)	26.0	1.5	NA	1.3	1.4	1.3	1.1	1.1	1.3	1.2	1.2	1.1			
		Large (C)	130.0	1.6	NA	1.4	1.5	1.4	1.2	1.1	1.3	1.2	1.3	1.2			
	Integrated	Small (S)	5.3	2.0	NA	1.4	1.7	1.3	1.6	0.9	1.5	1.3	1.4	1.2			
		Medium (D)	20.0	2.4	NA	2.0	2.1	1.9	1.7	1.5	2.0	1.8	1.8	1.7			
		Large (D)	50.0	3.1	NA	2.8	2.9	2.7	2.5	2.4	2.7	2.6	2.6	2.5			
		X-Large (C)	220.0	2.6	NA	2.4	2.5	2.4	2.3	2.2	2.4	2.3	2.3	2.3			
5. Knit fabric finishing	Commission	Medium (S)	7.7	1.2	NA	-2.1	-0.5	-2.8	-5.0	-6.5	-1.5	-3.7	-2.4	-4.2			
		Medium (C)	7.7	1.9	NA	-0.6	0.7	-1.3	-3.4	-4.8	-0.1	-2.2	-1.0	-2.7			
		Large (C)	18.6	5.9	NA	4.6	5.0	4.2	3.6	3.0	4.5	3.8	4.1	3.5			
	Integrated	Medium (S)	7.7	1.9	NA	1.4	1.6	1.4	1.1	1.0	1.5	1.3	1.4	1.2			
		Medium (C)	7.7	2.4	NA	1.9	2.1	1.8	1.6	1.4	2.0	1.7	1.9	1.7			
		Large (C)	18.6	4.0	NA	3.7	3.8	3.6	3.5	3.4	3.7	3.5	3.6	3.5			
5c. Hosiery Products 4/	Own hosiery	Small	2.7	0.8	-0.3	-1.6	NA	-1.7	NA	-2.3	-1.1	-1.9	NA	-2.0			
		Medium	6.0	2.4	2.1	1.8	NA	1.8	NA	1.5	1.9	1.7	NA	1.7			
	Integrated	Small	2.7	1.6	1.1	0.7	NA	0.7	NA	0.5	0.9	0.6	NA	0.6			
		Medium	6.0	2.6	2.2	1.9	NA	1.9	NA	1.7	2.0	1.9	NA	1.8			
6. Carpet finishing	Integrated	Small	20.0	1.8	NA	1.5	1.6	1.4	1.3	1.2	1.5	1.4	1.4	1.3			
		Medium	49.0	2.1	NA	1.9	1.9	1.9	1.8	1.7	1.9	1.8	1.8	1.8			
		Large	120.0	2.3	NA	2.1	2.2	2.1	2.0	2.0	2.1	2.0	2.1	2.0			
7. Stock & yarn finishing	Commission	Small	9.4	2.7	NA	-1.8	0.6	-3.0	-5.2	-9.1	-1.1	-4.6	-2.5	-5.2			
		Medium	23.0	3.4	NA	1.6	2.4	1.2	0.4	-1.1	1.5	0.4	1.0	0.1			
		Large	57.0	3.5	NA	2.5	2.9	2.3	1.4	1.0	2.2	1.5	1.9	1.3			
	Own yarn	Small	9.4	1.3	NA	0.6	0.9	0.5	0.3	-0.4	0.7	0.3	0.6	0.3			
		Medium	23.0	1.2	NA	0.7	0.9	0.6	0.4	0.1	0.7	0.4	0.5	0.3			
		Large	38.0	2.5	NA	2.1	2.2	2.0	1.8	1.6	2.0	1.8	1.9	1.7			
		X-Large	57.0	2.8	NA	2.4	2.6	2.4	2.0	1.9	2.3	2.1	2.2	2.0			
	Integrated	Small	9.4	1.8	NA	0.8	1.2	0.6	0.2	-0.8	0.9	0.3	0.7	0.2			
		Large	38.0	2.1	NA	1.7	1.8	1.6	1.4	1.2	1.6	1.4	1.5	1.3			
8. Nonwoven manufacturing		Medium	10.4	3.6	2.8	2.1	2.4	2.0	2.3	1.4	2.3	1.9	2.2	1.9			
9. Felt fabric processing		Medium	2.0	1.6	0.3	-1.2	NA	-1.4	NA	-3.0	-0.7	-1.6	NA	-1.8			

1/ Type processing (or subdivision) applicable to woven and knit fabric finishing is shown for each model in these categories. These include "S" for simple; "C" for complex; and "D" for complex-desizing.
2/ For those models with treatment alternative A (BPT), impacts for alternatives B through K include the impacts associated with compliance of alternative A.
3/ Alternative technologies M, N, and P apply to wool scouring only.
4/ Hosiery Products is a subdivision of the Knit Fabric Finishing Subcategory.

Source: Development, Planning and Research Associates, Inc. estimates based on the imposition of wastewater control expenditures described in Chapter VII on the model plants described in Chapter VI utilizing the methodology presented in Chapter II.

Table VIII-5. The textile industry, representative existing model plant impacts, effects of wastewater control expenditures on average after-tax returns on sales - indirect dischargers

Subcategory	Type mill	Size/ type 1/	Daily capacity	Base case	Alternative Treatment Technologies (PSES) B	D	F	H	J	M 2/	N 2/	P 2/
			(kkg)	(Percent)								
1. Wool scouring	Commission	Small	16.0	-1.6						-4.0	-5.6	-4.4
		Large	81.0	3.0						2.2	1.7	2.0
2. Wool finishing	Commission	Small	3.3	2.0	-7.0	-8.6	-21.2	-11.8	-11.6			
	Integrated	Small	3.3	1.5	0.6	0.4	-1.5	0.0	0.1			
		Medium	20.0	2.0	1.7	1.6	1.1	1.3	1.4			
		Large	40.0	4.1	3.7	3.7	3.3	3.5	3.5			
4. Woven fabric finishing	Commission	Small (S)	2.4	1.5	-11.8	-12.6	-18.8	-14.8	-15.1			
		Medium (C)	26.0	2.5	1.0	0.7	-1.3	0.2	2.4			
		Large (C)	130.0	2.8	2.1	2.0	1.3	1.6	2.7			
	Own fabric	Small (S)	2.4	1.6	-0.2	-0.3	-1.5	-0.7	-0.8			
		Medium (C)	26.0	1.5	1.3	1.2	1.0	1.2	1.5			
		Large (C)	130.0	1.9	1.7	1.6	1.4	1.5	1.8			
	Integrated	Small (S)	2.4	2.1	0.6	0.5	-0.4	0.2	0.2			
		Medium (D)	20.0	2.2	1.8	1.8	1.5	1.7	2.2			
		Large (D)	50.0	3.0	2.7	2.6	2.4	2.5	2.9			
		X-Large (D)	170.0	2.6	2.4	2.3	2.1	2.2	2.5			
5. Knit fabric finishing	Commission	Medium (S)	7.7	1.1	-1.4	-1.9	-5.0	-2.6	-2.5			
		Large (C)	18.6	2.5	1.4	1.2	0.0	0.9	0.9			
	Integrated	Small (C)	1.5	1.5	0.3	0.2	-0.7	0.0	-0.1			
		Medium (S)	7.7	2.0	1.5	1.4	1.0	1.3	1.3			
		Large (C)	18.6	2.5	2.2	2.1	2.0	2.1	2.1			
		X-large (S)	31.0	4.0	3.7	3.7	3.4	3.6	3.6			
5c. Hosiery products 3/	Own hosiery	Small	2.7	0.7	-0.3	-0.4	-1.0	-0.6	-0.6			
		Large	13.6	2.5	2.3	2.3	2.3	2.3	2.3			
	Integrated	Small	2.7	1.5	1.0	1.0	0.8	1.0	0.9			
		Large	13.6	2.6	2.3	2.3	2.3	2.3	2.3			
6. Carpet finishing	Integrated	Small	8.9	1.5	1.1	1.0	0.4	0.9	0.9			
		Medium	49.0	1.6	1.4	1.4	1.3	1.3	1.3			
		Large	122.0	2.3	2.1	2.1	2.0	2.0	2.0			
7. Stock and yarn finishing	Commission	Small	4.2	2.6	-9.0	-10.3	-21.3	-12.6	-12.8			
		Medium	9.4	2.8	-2.7	-3.8	-11.0	-5.4	-5.2			
		Large	23.0	2.9	0.8	0.3	-3.0	-0.6	-0.4			
	Own yarn	Small	4.2	1.1	-0.7	-1.0	-3.1	-1.4	-1.5			
		Medium	9.4	1.5	0.4	0.1	-1.8	-0.2	-0.2			
		Large	23.0	2.2	1.6	1.5	1.0	1.3	1.3			
	Integrated	Medium	9.4	1.9	0.8	0.6	-1.1	0.3	0.4			
		Large	23.0	2.1	1.4	1.3	0.8	1.1	1.2			
8. Nonwoven manufacturing		Small	24.0	3.9	3.4	3.3	2.9	3.2	3.2			
		Medium	57.0	1.9	1.6	1.5	1.2	1.4	1.4			
9. Felt fabric processing		Small	0.9	3.6	2.4	2.4	2.3	2.2	NA			
		Medium	4.4	1.9	0.8	0.6	-1.2	0.1	NA			
		Large	10.7	1.4	0.7	0.6	-0.3	0.4	NA			

Source: Development, Planning and Research Associates, Inc. estimates based on the imposition of wastewater control expenditures described in Chapter VII on the model plants described in Chapter VI utilizing the methodology presented in Chapter II.

1/ Type processing (or subdivision) applicable to woven and knit fabric finishing is shown for each model in these subcategories. These include "S" for simple; "C" for complex' and "D" for complex-desizing.
2/ Alternative technologies M, N, and P apply to wool scouring only.
3/ Hosiery products is a subdivision of the knit fabric finishing subcategory.

Table VIII-6. The textile industry, representative model plant impacts, percentage reductions in model's income due to wastewater control expenditures - direct dischargers

Subcategory	Type Mill	Size/ Type 1/	Daily Capacity	A	B	C	D	E	F	G	H	J	K	M 3/	N 3/	P 3/
				Alternative treatment technologies (BATEA)												
			(kkg)	(percent)												
1. Wool scouring	Commission	Small	16.2											322	444	378
		Medium	35.6											35	62	42
		Large	80.9											23	40	30
2. Wool finishing	Commission	Small	8.0	NA	241	NA	312	NA	612	247	418	NA	476			
	Integrated	Small	8.0	NA	27	NA	33	NA	53	27	40	NA	47			
		Medium	20.0	NA	20	NA	25	NA	35	25	35	NA	40			
		Large	40.0	NA	7	NA	7	NA	14	10	12	NA	12			
4. Woven fabric finishing	Commission	Medium (S)	5.3	NA	288	131	338	194	644	200	375	269	438			
		Medium (C)	26.0	NA	50	29	63	104	133	50	83	71	100			
		Large (C)	130.0	NA	26	15	33	56	63	37	48	44	56			
	Own fabric	Medium (S)	5.3	NA	38	19	44	25	75	25	44	38	50			
		Medium (C)	26.0	NA	13	7	13	27	27	13	20	20	27			
		Large (C)	130.0	NA	12	6	12	25	31	19	25	19	25			
	Integrated	Small (S)	5.3	NA	30	15	35	20	55	25	35	30	40			
		Medium (D)	20.0	NA	17	12	21	29	38	17	25	25	29			
		Large (D)	50.0	NA	10	6	13	19	23	13	16	16	19			
		X-Large (C)	220.0	NA	8	4	8	12	15	8	12	12	12			
5. Knit fabric finishing	Commission	Medium (S)	7.7	NA	275	142	333	517	642	225	408	300	450			
		Medium (C)	7.7	NA	132	63	168	279	353	105	216	153	242			
		Large (C)	18.6	NA	22	15	29	39	49	24	36	31	41			
	Integrated	Medium (S)	7.7	NA	26	16	26	42	47	21	32	26	37			
		Medium (C)	7.7	NA	21	12	25	33	42	17	29	21	29			
		Large (C)	18.6	NA	8	5	10	12	15	8	12	10	12			
5c. Hosiery Products 4/	Own hosiery	Small	2.7	138	300	NA	313	NA	388	238	338	NA	350			
		Medium	6.0	13	25	NA	25	NA	38	21	29	NA	29			
	Integrated	Small	2.7	31	56	NA	56	NA	69	44	63	NA	63			
		Medium	6.0	15	27	NA	27	NA	35	23	27	NA	31			
6. Carpet finishing	Integrated	Small	20.0	NA	17	11	22	28	33	17	22	22	28			
		Medium	49.0	NA	10	10	10	14	19	10	14	14	14			
		Large	120.0	NA	9	4	9	13	13	9	13	9	13			
7. Stock & yarn finishing	Commission	Small	9.4	NA	167	78	211	293	437	141	270	193	293			
		Medium	23.0	NA	53	29	65	88	132	56	88	71	97			
		Large	57.0	NA	29	17	34	60	71	37	57	46	63			
	Own yarn	Small	9.4	NA	54	31	62	77	131	46	77	54	77			
		Medium	23.0	NA	42	25	50	67	92	42	67	58	75			
		Large	38.0	NA	16	12	20	28	36	20	28	24	32			
		X-Large	57.0	NA	14	7	14	29	32	18	25	21	29			
	Integrated	Small	9.4	NA	56	33	67	89	144	50	80	61	89			
		Large	38.0	NA	19	14	24	33	43	24	33	29	38			
8. Nonwoven manufacturing		Medium	10.4	22	42	33	44	36	61	36	47	39	47			
9. Felt fabric processing		Medium	2.0	81	175	NA	188	NA	288	144	200	NA	213			

1/ Type processing (or subdivision) applicable to woven and knit fabric finishing is shown for each model in these categories. These include "S" for simple; "C" for complex; and "D" for complex-desizing.
2/ For those models with treatment alternative A (BPT), impacts for alternatives B through K include the impacts associated with compliance of alternative A.
3/ Alternative technologies M, N, and P apply to wool scouring only.
4/ Hosiery Products is a subdivision of the Knit Fabric Finishing Subcategory.

Source: Development, Planning and Research Associates, Inc. estimates based on the imposition of wastewater control expenditures described in Chapter losses among these models. The reductions in profit levels from the base case, as shown in Table VIII-7, ranged between 900 and 1,300 percent for the small commission models. The profit impacts of treatment alternative F on the large integrated models were only slightly greater than those of the direct dischargers for this treatment alternative. The reductions in most cases amounted to about 20 percent. The reductions in returns for all of the indirect discharger models were about the same under treatment alternatives H and J. The reductions were about a fourth less than the reductions under treatment alternative F.

b. New Source Models

The effects of this imposition of the various treatment technologies on the 21-year average after-tax return on sales for the new source direct and indirect discharging models are shown in Table VIII-8. The greatest reductions in returns for the new source models occurred under treatment alternative T, both for the direct and indirect dischargers. As illustrated in Table VIII-9, the returns of the new source wool finishing (2) models were reduced by about half for both the direct and indirect dischargers. The return of the direct discharging new source stock and yarn (7) model was reduced by 36 percent while that of the indirect discharging model was reduced by over 70 percent. Under treatment alternative T the direct discharging felt fabric processing (9) model had its return on sales reduced by 75 percent, while the indirect model had its return reduced only by 35 percent. The direct discharging new source nonwoven (8) model had its return reduced by close to 60 percent while the indirect model had its return reduced by 11 percent. The returns of the remaining new source models were reduced between 10 to 20 percent under treatment alternative T. The large integrated woven fabric (4c) model had the lowest reduction with an 11 percent profit reduction. Reductions under treatment alternatives R and S were slightly below those of treatment alternative T. The least reduction in profits occurred in the return of the indirect discharging large integrated woven fabric (4c) model with a 6 percent decrease of its return under treatment alternative R. The greatest reduction occurred in the return of the indirect stock and yarn finishing (7) model with a decrease of 66 percent under treatment alternative S.

2. Return on Total Assets

Due to the relative age of most of the mills, their respective assets have been substantially depreciated. Consequently, several of the models' average returns on total assets were relatively high in the base case. The imposition of wastewater control expenditures on the models resulted in impacts (e.g. reductions in the returns) similar to those impacts associated with the models' returns on sales. The 21-year average returns on total assets both before and after control expenditures are shown in Tables VIII-10 and 11 for the existing direct discharging and indirect discharging models, respectively, and Table VIII-12 for the new source models.

Table VIII-7. The textile industry, representative existing model impacts, percentage reductions in models' after tax income due to wastewater control expenditures - indirect dischargers

Subcategory	Type mill	Size/ type 1/	Daily capacity	Alternative Treatment Technologies (PSES)							
				B	D	F	H	J	M 2/	N 2/	P 2/
			(kkg)	(Percent)							
1. Wool scouring	Commission	Small	16.0						150	250	175
		Large	81.0						27	43	33
2. Wool finishing	Commission	Small	3.3	450	530	1,160	690	690			
	Integrated	Small	3.3	60	73	200	100	93			
		Medium	20.0	15	20	45	35	30			
		Large	40.0	10	10	20	15	15			
4. Woven fabric finishing	Commission	Small (S)	2.4	887	940	1,353	1,087	1,107			
		Medium (C)	26.0	60	72	152	92	4			
		Large (C)	130.0	25	29	54	43	4			
	Own fabric	Small (S)	2.4	113	119	194	144	150			
		Medium (C)	26.0	13	20	33	20	0			
		Large (C)	130.0	11	16	26	21	5			
	Integrated	Small (S)	2.4	71	76	119	90	90			
		Medium (D)	20.0	18	18	32	23	0			
		Large (D)	50.0	10	13	20	17	3			
		X-large (D)	170.0	8	12	19	15	4			
5. Knit fabric finishing	Commission	Medium (S)	7.7	227	273	555	336	327			
		Large (C)	18.6	44	52	100	64	64			
	Integrated	Small (C)	1.5	80	87	147	100	107			
		Medium (S)	7.7	25	30	50	35	35			
		Large (C)	18.6	12	16	20	16	16			
		X-large (S)	31.0	8	8	15	10	10			
5c. Hosiery products 3/	Own hosiery	Small	2.7	143	157	243	186	186			
		Large	13.6	8	8	8	8	8			
	Integrated	Small	2.7	33	33	47	33	40			
		Large	13.6	12	12	12	12	12			
6. Carpet finishing	Integrated	Small	8.9	27	33	73	40	40			
		Medium	49.0	13	13	19	19	19			
		Large	122.0	9	9	13	13	13			
7. Stock and yarn finishing	Commission	Small	4.2	446	496	919	585	592			
		Medium	9.4	196	236	493	293	286			
		Large	23.0	72	90	203	121	114			
	Own yarn	Small	4.2	164	191	382	227	236			
		Medium	9.4	73	93	220	113	113			
		Large	23.0	27	32	55	41	41			
	Integrated	Medium	9.4	58	68	158	84	79			
		Large	23.0	33	38	62	48	43			
8. Nonwoven manufacturing		Small	24.0	13	15	26	18	18			
		Medium	57.0	16	21	37	26	26			
9. Felt fabric processing		Small	0.9	33	33	36	39	NA			
		Medium	4.4	58	68	163	95	NA			
		Large	10.7	50	57	121	71	NA			

Source: Development, Planning and Research Associates, Inc. estimates based on the imposition of wastewater control expenditures described in Chapter VII on the model plants described in Chapter VI utilizing the methodology presented in Chapter II.

1/ Type processing (or subdivision) applicable to woven and knit fabric finishing is shown for each model in these subcategories. These include "S" for simple; "C" for complex; and "D" for complex-desizing.
2/ Alternative technologies M, N, and P apply to wool scouring only.
3/ Hosiery products is a subdivision of the knit fabric finishing subcategory.

Table VIII-8. The textile industry, representative new source model plant impacts, effects of wastewater control expenditures on average after-tax returns on sales.

Subcategory	Type mill	Size/type 1/	Daily capacity	Alternative Treatment Technologies: Direct Dischargers (NSPS) Baseline	R	S	T	Indirect Dischargers (PSNS) Baseline	R	S	T
			(kkg)	percent							
2. Wool finishing	Integrated	Medium	20.0	3.3	1.8	2.1	1.8	2.7	1.9	1.6	1.5
4. Woven fabric finishing	Own fabric	Medium (C)	26.0	NA	NA	NA	NA	4.2	3.8	3.6	3.6
		Large (C)	130.0	3.3	2.7	2.8	2.7	NA	NA	NA	NA
	Integrated	Large (D)	50.0	7.3	6.5	6.7	6.5	6.3	5.9	5.7	5.6
5. Knit fabric finishing	Integrated	Large (C)	18.6	7.4	6.7	6.7	6.5	6.4	6.0	5.8	5.8
5c. Hosiery products 2/	Integrated	Medium	6.0	6.3	5.6	NA	5.3	NA	NA	NA	NA
		Large	13.6	NA	NA	NA	NA	6.2	5.8	5.5	5.5
6. Carpet finishing	Integrated	Small	20.0	4.8	4.2	4.1	3.9	NA	NA	NA	NA
		Medium	49.0	NA	NA	NA	NA	4.0	3.7	3.6	3.6
7. Stock & yarn finishing	Own yarn	Medium	3/	4.5	3.3	3.2	2.9	4.1	2.4	1.4	1.2
8. Nonwoven manufacturing		Medium	3/	5.4	3.4	2.9	2.3	7.6	7.1	6.8	6.8
9. Felt fabric processing		Medium	3/	5.5	3.0	2.3	1.4	8.5	6.8	5.7	5.5

1/ Type processing applicable to woven and knit fabric finishing is shown for each model in these subcategories. These include "C" for complex and "D" for complex desizing.

2/ Hosiery products is a subdivision of the Knit Fabric Finishing subcategory.

3/ For these models, there is a size difference between direct and indirect. For Stock & Yarn models the sizes are 23.0 kkg and 9.3 kkg for the direct and indirect models respectively; Nonwoven Manufacturing models are 10.4 and 57.0 kkg respectively; and Felt Fabric Processing models, 2.0 and 4.4 kkg respectively.

Source: Development Planning and Research Associates, Inc. estimates based on the imposition of wastewater control expenditures described in Chapter VII on the model plants described in Chapter VI utilizing the methodology presented in Chapter II

Table VIII-9. The textile industry, new source model plant impacts, percentage reductions in model's income due to wastewater control expenditures

Subcategory	Type mill	Size/type 1/	Daily capacity	Alternative Treatment Technologies: Direct Dischargers (NSPS) R	S	T	Indirect Dischargers (PSNS) R	S	T
			(kkg)	percent					
2. Wool finishing	Integrated	Medium	20.0	45	36	45	30	41	44
4. Woven fabric finishing	Own fabric	Medium (C)	26.0	NA	NA	NA	10	14	14
		Large (C)	130.0	18	15	18	NA	NA	NA
		Large (D)	50.0	11	8	11	6	10	11
5. Knit fabric finishing	Integrated	Large (C)	18.6	9	9	12	6	9	9
5c. Hosiery products 2/	Integrated	Medium	6.0	11	NA	16	NA	NA	NA
		Large	13.6	NA	NA	NA	6	11	11
6. Carpet finishing	Integrated	Small	20.0	13	15	19	NA	NA	NA
		Medium	49.0	NA	NA	NA	8	10	10
7. Stock & yarn finishing	Own yarn	Medium	3/	27	29	36	41	66	71
8. Nonwoven manufacturing		Medium	3/	37	46	57	7	11	11
9. Felt fabric processing		Medium	3/	45	58	75	20	33	35

1/ Type processing applicable to woven and knit fabric finishing is shown for each model in these subcategories. These include "C" for complex and "D" for complex desizing.
2/ Hosiery products is a subdivision of the Knit Fabric Finishing subcategory.
3/ For these models, there is a size difference between direct and indirect. For Stock & Yarn models the sizes are 23.0 kkg and 9.3 kkg for the direct and indirect models respectively; Nonwoven Manufacturing models are 10.4 and 57.0 kkg respectively; and Felt Fabric Processing models, 2.0 and 4.4 kkg respectively.

Source: Development Planning and Research Associates, Inc. estimates based on the imposition of wastewater control expenditures described in Chapter VII on the model plants described in Chapter VI utilizing the methodology presented in Chapter II.

Table VIII-10. The textile industry, representative existing model plant impacts, effects of wastewater control expenditures on average after-tax returns on total assets - direct dischargers

Subcategory	Type Mill	Size/ Type 1/	Daily Capacity	Base Case	Alternative treatment technologies (BATEA) 2/ A	B	C	D	E	F	G	H	J	K	M 3/	N 3/	P 3/
			(kkg)	(percent)													
1. Wool scouring	Commission	Small	16.2	-2.3											-10.6	-13.7	-12.0
		Medium	35.6	6.9											4.4	2.6	3.9
		Large	80.9	7.9											5.8	4.3	5.3
2. Wool finishing	Commission	Small	8.0	5.6	NA	-8.1	NA	-11.7	NA	-24.1	-8.4	-17.2	NA	-19.7			
	Integrated	Small	8.0	5.7	NA	4.9	NA	4.5	NA	2.7	4.8	3.8	NA	3.5			
		Medium	20.0	7.0	NA	5.6	NA	5.2	NA	4.5	5.1	4.3	NA	4.0			
		Large	40.0	14.1	NA	13.2	NA	12.9	NA	11.6	12.7	12.2	NA	12.0			
4. Woven fabric finishing	Commission	Small (S)	5.3	6.7	NA	-11.9	-1.9	-14.4	-5.9	-32.4	-6.2	-16.8	-10.2	-19.8			
		Medium (C)	26.0	6.6	NA	3.4	4.6	2.6	0.3	-1.5	3.2	1.2	2.0	0.3			
		Large (C)	130.0	7.2	NA	5.5	6.1	4.9	3.3	2.5	4.7	3.7	4.0	3.2			
	Own fabric	Small (S)	5.3	8.3	NA	5.2	6.6	4.7	5.9	2.1	6.0	4.3	5.1	3.8			
		Medium (C)	26.0	6.4	NA	5.4	5.7	5.2	4.6	4.3	5.4	4.9	5.1	4.7			
		Large (C)	130.0	5.5	NA	4.8	5.0	4.6	4.0	3.7	4.5	4.1	4.3	3.9			
	Integrated	Small (S)	5.3	7.3	NA	5.2	6.1	4.9	5.7	3.2	5.7	4.6	5.3	4.3			
		Medium (D)	20.0	7.9	NA	6.6	7.0	6.3	5.4	4.9	6.5	5.8	6.1	5.4			
		Large (D)	50.0	10.4	NA	9.4	9.7	9.2	8.3	8.0	9.2	8.7	8.8	8.4			
		X-Large (C)	220.0	10.3	NA	9.7	9.9	9.5	8.9	8.6	9.4	9.0	9.1	8.9			
5. Knit fabric finishing	Commission	Medium (S)	7.7	5.0	NA	-7.1	-1.1	-9.8	-15.3	-19.7	-5.0	-13.0	-8.3	-14.6			
		Medium (C)	7.7	7.9	NA	-2.5	2.7	-5.3	-11.6	-16.3	-0.5	-8.8	-4.0	-10.5			
		Large (C)	18.6	16.9	NA	13.1	14.6	12.0	9.6	7.9	12.8	10.5	11.6	9.6			
	Integrated	Medium (S)	7.7	9.2	NA	7.0	7.8	6.5	5.2	4.4	7.2	6.0	6.7	5.7			
		Medium (C)	7.7	7.8	NA	6.2	6.8	5.9	4.9	4.4	6.4	5.5	6.0	5.3			
		Large (C)	18.6	14.0	NA	12.9	13.2	12.6	11.9	11.5	12.8	12.2	12.5	12.0			
5c. Hosiery Products 4/	Own hosiery	Small	2.7	5.9	-1.0	-10.1	NA	-10.6	NA	-14.7	-6.7	-12.2	NA	-12.6			
		Medium	6.0	9.1	7.7	6.7	NA	6.5	NA	5.6	7.0	6.3	NA	6.2			
	Integrated	Small	2.7	5.5	3.8	2.5	NA	2.4	NA	1.7	3.0	2.1	NA	2.0			
		Medium	6.0	12.9	11.0	9.6	NA	9.4	NA	8.1	10.0	9.0	NA	8.9			
6. Carpet finishing	Integrated	Small	20.0	8.3	NA	7.0	7.4	6.7	5.9	5.4	7.1	6.4	6.8	6.2			
		Medium	49.0	11.8	NA	10.6	11.0	10.4	9.7	9.3	10.6	10.0	10.2	9.8			
		Large	120.0	7.3	NA	6.8	6.9	6.7	6.4	6.3	6.7	6.5	6.6	6.4			
7. Stock & yarn finishing	Commission	Small	9.4	10.5	NA	-5.2	2.5	-9.3	-14.1	-23.3	-2.7	-14.1	-7.5	-15.9			
		Medium	23.0	20.6	NA	9.8	14.1	7.0	2.6	-3.8	9.0	2.9	5.9	1.1			
		Large	57.0	21.2	NA	15.2	17.3	13.4	7.7	5.4	12.9	8.8	10.8	7.4			
	Own yarn	Small	9.4	6.2	NA	3.0	4.2	2.3	0.9	-1.9	3.3	1.4	2.5	1.0			
		Medium	23.0	6.3	NA	3.5	4.6	2.8	1.7	0.0	3.4	1.8	2.6	1.3			
		Large	38.0	8.0	NA	6.7	7.1	6.4	5.6	4.9	6.4	5.7	6.0	5.4			
		X-Large	57.0	9.4	NA	8.0	8.4	7.6	6.4	5.8	7.5	6.6	7.1	6.3			
	Integrated	Small	9.4	6.5	NA	2.9	4.3	2.1	0.5	-2.7	3.2	1.2	2.4	0.6			
		Large	38.0	7.5	NA	6.0	6.5	5.7	4.8	4.0	5.6	4.9	5.2	4.4			
8. Nonwoven manufacturing		Medium	10.4	12.1	9.1	6.8	7.8	6.5	7.4	4.4	7.4	6.1	7.0	5.9			
9. Felt fabric processing		Medium	2.0	5.3	1.4	-3.0	NA	-3.7	NA	-8.8	-1.6	-4.5	NA	-5.0			

1/ Type processing (or subdivision) applicable to woven and knit fabric finishing is shown for each model in these categories. These include "S" for simple; "C" for complex; and "D" for complex-desizing.

2/ For those models with treatment alternative A (BPT), impacts for alternatives B through K include the impacts associated with compliance of alternative A.

3/ Alternative technologies M, N, and P apply to wool scouring only.

4/ Hosiery Products is a subdivision of the Knit Fabric Finishing Subcategory.

Source: Development, Planning and Research Associates, Inc. estimates based on the imposition of wastewater control expenditures described in Chapter VII on the model plants described in Chapter VI utilizing the methodology presented in Chapter II.

Table VIII-11. The textile industry, representative existing model plant impacts, effects of wastewater control expenditures on average after-tax returns on total assets - indirect dischargers

Subcategory	Type mill	Size/ type 1/	Daily capacity	Base case	Alternative Treatment Technologies (PSES) B	D	F	H	J	M 2/	N 2/	P 2/
			(kkg)	(Percent)								
1. Wool scouring	Commission	Small	16.0	-4.3						-11.2	-15.3	-12.3
		Large	81.0	7.7						5.7	4.0	4.9
2. Wool finishing	Commission	Small	3.3	6.7	-21.6	-25.0	-43.6	-32.5	-31.9			
	Integrated	Small	3.3	6.5	2.4	1.7	-5.5	0.2	0.3			
		Medium	20.0	7.0	5.6	5.2	3.5	4.4	4.5			
		Large	40.0	13.6	12.5	12.2	10.7	11.4	11.6			
4. Woven fabric finishing	Commission	Small (S)	2.4	6.6	-39.3	-40.2	-57.4	-46.8	-47.1			
		Medium (C)	26.0	6.9	2.9	2.0	-2.8	0.6	6.7			
		Large (C)	130.0	7.4	5.7	5.2	3.3	4.3	7.2			
	Own fabric	Small (S)	2.4	8.3	-0.7	-1.6	-7.5	-3.7	-3.9			
		Medium (C)	26.0	6.4	5.2	5.0	4.0	4.7	6.2			
		Large (C)	130.0	6.3	5.6	5.4	4.7	5.1	6.2			
	Integrated	Small (S)	2.4	7.5	2.2	1.8	-1.4	0.8	0.7			
		Medium (D)	20.0	7.5	6.1	5.9	4.7	5.7	7.3			
		Large (D)	50.0	10.2	9.1	8.9	7.9	8.5	10.0			
		X-Large (D)	170.0	10.1	9.3	9.2	8.3	8.7	9.9			
5. Knit fabric finishing	Commission	Medium (S)	7.7	2.8	-3.3	-4.4	-10.9	-6.1	-6.1			
		Large (C)	18.6	10.5	5.5	4.4	-0.5	2.9	3.2			
	Integrated	Small (C)	1.5	7.8	1.3	0.7	-3.8	-0.3	-0.5			
		Medium (S)	7.7	9.7	7.2	[illegible]	4.1	6.1	6.2			
		Large (C)	18.6	8.2	7.3	7.0	6.2	6.8	6.8			
		X-large (S)	31.0	13.8	12.9	12.6	11.7	12.3	12.3			
5c. Hosiery products 3/	Own hosiery	Small	2.7	5.1	-1.7	-2.3	-6.6	-3.8	-4.1			
		Large	13.6	16.6	15.3	15.2	14.7	15.0	15.0			
	Integrated	Small	2.7	5.1	3.6	3.5	2.8	3.2	3.2			
		Large	13.6	12.9	11.7	11.6	11.2	11.5	11.5			
6. Carpet finishing	Integrated	Small	8.9	7.2	4.9	4.6	1.9	4.3	4.2			
		Medium	49.0	9.2	8.1	8.0	6.9	7.5	7.5			
		Large	122.0	7.3	6.7	6.7	6.2	6.4	6.5			
7. Stock and yarn finishing	Commission	Small	4.2	7.6	-21.3	-23.6	-46.9	-28.3	-28.6			
		Medium	9.4	10.1	-8.0	-11.3	-25.9	-15.7	-15.1			
		Large	23.0	11.7	3.4	1.5	-9.0	-1.7	-1.1			
	Own yarn	Small	4.2	5.3	-3.3	-4.6	-14.2	-6.5	-6.7			
		Medium	9.4	7.8	1.8	0.6	-8.3	-1.4	-1.2			
		Large	23.0	7.7	5.2	4.7	2.9	4.1	4.2			
	Integrated	Medium	9.4	6.8	2.7	2.0	-3.7	1.0	1.1			
		Large	23.0	7.3	5.0	4.5	2.4	3.8	3.9			
8. Nonwoven manufacturing		Small	24.0	11.2	9.7	9.4	7.8	8.8	9.1			
		Medium	57.0	5.5	4.5	4.3	3.5	4.0	4.1			
9. Felt fabric processing		Small	0.9	10.4	6.9	6.7	6.4	6.1	NA			
		Medium	4.4	5.6	2.1	1.5	-3.3	0.0	NA			
		Large	10.7	4.1	1.9	1.5	-1.1	0.8	NA			

Source: Development, Planning and Research Associates, Inc. estimates based on the imposition of wastewater control expenditures described in Chapter VII on the model plants described in Chapter VI utilizing the methodology presented in Chapter II.

1/ Type processing (or subdivision) applicable to woven and knit fabric finishing is shown for each model in these subcategories. These include "S" for simple; "C" for complex; and "D" for complex-desizing.
2/ Alternative technologies M, N, and P apply to wool scouring only.
3/ Hosiery products is a subdivision of the knit fabric finishing subcategory.

Table VIII-12. The textile industry, representative new source model plant impacts, effects of wastewater control expenditures on average after-tax returns on total assets.

				Alternative Treatment Technologies							
				Direct Dischargers (NSPS)				Indirect Dischargers (PSNS)			
Subcategory	Type mill	Size/type[1/]	Daily capacity	Baseline	R	S	T	Baseline	R	S	T
			(kkg)	percent							
2. Wool finishing	Integrated	Medium	20.0	3.3	1.9	2.2	2.0	2.6	2.0	1.7	1.6
4. Woven fabric finishing	Own fabric	Medium (C)	26.0	NA	NA	NA	NA	9.6	8.7	8.2	8.1
		Large (C)	130.0	7.1	5.7	6.1	5.8	NA	NA	NA	NA
	Integrated	Large (D)	50.0	10.8	9.4	9.7	9.5	10.3	9.6	9.2	9.1
5. Knit fabric finishing	Integrated	Large (C)	18.6	21.7	19.4	19.1	18.5	15.3	14.3	13.7	13.6
5c. Hosiery products[2/]	Integrated	Medium	6.0	12.8	11.4	NA	10.8	NA	NA	NA	NA
		Large	13.6	NA	NA	NA	NA	12.7	11.8	11.1	11.0
6. Carpet finishing	Integrated	Small	20.0	11.6	10.1	9.6	9.2	NA	NA	NA	NA
		Medium	49.0	NA	NA	NA	NA	12.4	11.5	11.0	10.9
7. Stock & yarn finishing	Own yarn	Medium	3/	15.7	11.0	10.6	9.4	10.3	5.8	3.3	2.8
8. Nonwoven manufacturing		Medium	3/	5.4	3.4	2.8	2.2	11.1	10.3	9.9	9.9
9. Felt fabric processing		Medium	3/	7.6	4.1	3.0	1.8	11.7	9.2	7.5	7.1

1/ Type processing applicable to woven and knit fabric finishing is shown for each model in these subcategories. These include "C" for complex and "D" for complex desizing.

2/ Hosiery products is a subdivision of the Knit Fabric Finishing subcategory.

3/ For these models, there is a size difference between direct and indirect. For Stock & Yarn models the sizes are 23.0 kkg and 9.3 kkg for the direct and indirect models respectively; Nonwoven Manufacturing models are 10.4 and 57.0 kkg respectively; and Felt Fabric Processing models, 2.0 and 4.4 kkg respectively.

Source: Development Planning and Research Associates, Inc. estimates based on the imposition of wastewater control expenditures described in Chapter VII on the model plants described in Chapter VI utilizing the methodology presented in Chapter II

a. Existing Models

For the existing direct discharging models, base case average after-tax returns on total assets ranged from -2.3 percent for the small commission wool scouring (1) model to 21.2 percent for the large commission stock and yarn (7) model (Table VIII-10). However, for most models base case returns ranged between 5 and 12 percent. The imposition of wastewater control expenditures on the models reduced all the returns with the impacted returns associated with treatment alternative F, the most expensive, ranging from -32.4 percent for the small commission woven fabric finishing (4a) model to 11.5 percent for the large integrated knit fabric finishing (5b) model. For treatment alternative F, the majority of the models' returns ranged between 0.0 and 8.0 percent.

For the indirect models, average after-tax returns on total assets for the base case ranged from -4.3 percent for the small commission wool scouring (1) model to 16.6 percent for the large own fabric hosiery (5c) model (Table VIII-11). With the imposition of treatment alternative F, returns were reduced to a range of -57.4 percent for the small commission woven fabric finishing (4) model to 14.7 percent for the large own hosiery (5c) model.

b. New Sources

For the new source models, the imposition of wastewater control requirements reduced the average after-tax returns on total assets for both direct and indirect dischargers but none to negative levels (Table VIII-12). In most cases for both discharge methods the returns were reduced by 1 to 3 percentage points for treatment alternatives R, S, and T.

3. Annual Cash Flows

The models' annual cash flows were based on data reflective of the 21st year and were computed by adding the models' after-tax profits to their respective depreciations. Cash flows are significant in that they represent an inflow (or outflow) of dollars to the models' operations. Thus, even if the mills' profits were negative, they could maintain operations in the short-run if they could sustain positive cash flows. The effects of wastewater control expenditures on the models' cash flows are discussed below.

a. Existing Models

The existing models' annual cash flows for year 21 are shown in Tables VIII-13 and VIII-14 for the direct and indirect dischargers, respectively. As shown, for both the direct and indirect models, all base case cash flows were positive. With the imposition of controls, the cash flows of the small commission mills in both categories became negative under most of the treatments. In addition, the cash flows of the medium commission

Table VIII-13. The textile industry, representative existing model impacts, effects of wastewater control expenditures on annual cash flows (year 21) - direct dischargers

Subcategory	Type Mill	Size/ Type1/	Daily Capacity	Base Case	Alternative treatment technologies (BATEA)2/ A	B	C	D	E	F	G	H	J	K	M3/	N3/	P3/
			(kkg)	------	------	------	------	------	------	------($1,000)------	------	------	------	------	------	------	------
1. Wool scouring	Commission	Small	16.2	143											-191	-340	-258
		Medium	35.6	1,139											942	745	890
		Large	80.9	2,249											1,952	1,717	1,854
2. Wool finishing	Commission	Small	8.0	185	NA	-199	NA	-328	NA	-878	-213	-533	NA	-652			
	Integrated	Small	8.0	2,011	NA	1,753	NA	1,687	NA	1,406	1,746	1,581	NA	1,521			
		Medium	20.0	3,364	NA	2,968	NA	2,846	NA	2,600	2,853	2,586	NA	2,484			
		Large	40.0	16,402	NA	15,822	NA	15,628	NA	14,738	15,546	15,134	NA	14,975			
4. Woven fabric finishing	Commission	Small (S)	5.3	115	NA	-133	14	-178	-44	-480	-48	-226	-109	-280			
		Medium (C)	26.0	978	NA	742	849	675	519	385	735	563	644	494			
		Large (C)	130.0	5,332	NA	4,788	5,033	4,595	3,995	3,644	4,518	4,104	4,263	3,891			
	Own fabric	Small (S)	5.3	771	NA	617	693	594	663	437	661	569	614	541			
		Medium (C)	26.0	3,939	NA	3,675	3,782	3,608	3,452	3,317	3,668	3,496	3,577	3,426			
		Large (C)	130.0	10,185	NA	9,566	9,812	9,374	8,775	8,423	9,297	8,883	9,043	8,671			
	Integrated	Small (S)	5.3	1,143	NA	990	1,066	967	1,036	811	1,034	942	1,003	915			
		Medium (D)	20.0	3,073	NA	2,811	2,919	2,743	2,589	2,448	2,802	2,636	2,713	2,563			
		Large (D)	50.0	9,458	NA	9,097	9,254	8,973	8,534	8,414	8,983	8,720	8,824	8,588			
		X-Large (C)	220.0	30,360	NA	29,500	29,886	29,282	28,232	27,746	29,034	28,418	28,661	28,143			
5. Knit fabric finishing	Commission	Medium (S)	7.7	237	NA	-2	136	-81	-280	-461	50	-180	-42	-244			
		Medium (C)	7.7	245	NA	23	139	-55	-254	-435	72	-155	-19	-218			
		Large (C)	18.6	966	NA	773	875	705	580	436	766	599	686	540			
	Integrated	Medium (S)	7.7	1,410	NA	1,221	1,304	1,181	1,081	988	1,249	1,130	1,201	1,098			
		Medium (C)	7.7	1,686	NA	1,494	1,575	1,453	1,353	1,260	1,520	1,402	1,472	1,370			
		Large (C)	18.6	5,282	NA	5,110	5,212	5,042	4,917	4,773	5,103	4,936	5,023	4,877			
5c. Hosiery Products4/	Own hosiery	Small	2.7	310	171	-78	NA	-99	NA	-236	23	-148	NA	-169			
		Medium	6.0	2,169	1,988	1,832	NA	1,810	NA	1,653	1,877	1,767	NA	1,757			
	Integrated	Small	2.7	1,090	947	806	NA	796	NA	725	859	770	NA	760			
		Medium	6.0	2,211	2,036	1,879	NA	1,857	NA	1,701	1,924	1,814	NA	1,804			
6. Carpet finishing	Integrated	Small	20.0	2,478	NA	2,291	2,370	2,250	2,147	2,052	2,319	2,197	2,268	2,166			
		Medium	49.0	5,380	NA	5,121	5,222	5,053	4,914	4,775	5,113	4,947	5,032	4,887			
		Large	120.0	16,810	NA	16,374	16,518	16,248	15,842	15,716	16,257	15,990	16,116	15,886			
7. Stock & yarn finishing	Commission	Small	9.4	235	NA	37	135	-45	-197	-434	75	-146	-10	-205			
		Medium	23.0	436	NA	203	313	138	31	-133	195	31	118	-22			
		Large	57.0	1,240	NA	919	1,073	811	441	267	800	513	664	409			
	Own yarn	Small	9.4	624	NA	437	518	395	319	145	461	343	413	313			
		Medium	23.0	1,090	NA	832	942	767	661	496	825	660	747	607			
		Large	38.0	4,093	NA	3,805	3,921	3,731	3,532	3,324	3,730	3,539	3,626	3,423			
		X-Large	57.0	4,504	NA	4,111	4,265	4,003	3,632	3,459	3,992	3,705	3,856	3,601			
	Integrated	Small	9.4	669	NA	489	570	447	371	207	513	395	465	365			
		Large	38.0	3,272	NA	2,970	3,086	2,895	2,697	2,488	2,895	2,703	2,790	2,587			
8. Nonwoven manufacturing		Medium	10.4	1,275	1,102	946	1,018	924	993	761	991	896	963	877			
9. Felt fabric processing		Medium	2.0	591	419	249	NA	207	NA	-108	307	152	NA	116			

1/ Type processing (or subdivision) applicable to woven and knit fabric finishing is shown for each model in these categories. These include "S" for simple; "C" for complex; and "D" for complex-desizing.
2/ For those models with treatment alternative A (BPT), impacts for alternatives B through K include the impacts associated with compliance of alternative A.
3/ Alternative technologies M, N, and P apply to wool scouring only.
4/ Hosiery Products is a subdivision of the Knit Fabric Finishing Subcategory.

Source: Development, Planning and Research Associates, Inc. estimates based on the imposition of wastewater control expenditures described in Chapter VII on the model plants described in Chapter VI utilizing the methodology presented in Chapter II.

Table VIII-14. The textile industry, representative existing model impacts, effects of wastewater control expenditures on annual cash flows (year 21) - indirect dischargers

Subcategory	Type mill	Size/ type 1/	Daily capacity	Base case	Alternative Treatment Technologies (PSES) B	D	F	H	J	M 2/	N 2/	P 2/
			(kkg)	($1,000)								
1. Wool scouring	Commission	Small	16.0	82						-252	-456	-314
		Large	31.0	2,321						2,015	1,751	1,895
2. Wool finishing	Commission	Small	3.3	81	-264	-334	-802	-457	-451			
	Integrated	Small	3.3	615	418	382	23	319	322			
		Medium	20.0	3,810	3,375	3,242	2,685	2,956	3,018			
		Large	40.0	15,181	14,524	14,320	13,252	13,786	13,943			
4. Woven fabric finishing	Commission	Small (S)	2.4	42	-214	-235	-370	-280	-285			
		Medium (C)	26.0	877	612	547	258	447	893			
		Large (C)	130.0	6,254	5,616	5,432	4,548	4,973	6,287			
	Own fabric	Small (S)	2.4	255	111	94	-40	50	46			
		Medium (C)	26.0	3,448	3,157	3,093	2,808	2,993	3,439			
		Large (C)	130.0	12,808	12,086	11,902	11,018	11,442	12,757			
	Integrated	Small (S)	2.4	384	248	238	162	214	212			
		Medium (D)	20.0	3,374	3,085	3,021	2,736	2,966	3,367			
		Large (D)	50.0	9,362	8,940	8,824	8,302	8,587	9,384			
		X-large (D)	170.0	27,567	26,558	26,305	24,385	25,554	27,531			
5. Knit fabric finishing	Commission	Medium (S)	7.7	398	142	74	-333	-27	-21			
		Large (C)	18.6	830	548	482	181	384	401			
	Integrated	Small (C)	1.5	310	174	163	46	138	135			
		Medium (S)	7.7	1,313	1,116	1,080	874	1,027	1,033			
		Large (C)	18.6	4,667	4,373	4,276	4,024	4,208	4,225			
		X-large (S)	31.0	9,130	8,917	8,831	8,442	8,663	8,694			
5c. Hosiery products 3/	Own hosiery	Small	2.7	289	153	137	5	94	87			
		Large	13.6	3,358	3,227	3,217	3,147	3,193	3,189			
	Integrated	Small	2.7	1,055	915	905	834	880	877			
		Large	13.6	3,006	2,868	2,858	2,788	2,834	2,830			
6. Carpet finishing	Integrated	Small	8.9	1,011	852	832	600	801	800			
		Medium	49.0	5,189	4,916	4,886	4,575	4,736	4,740			
		Large	122.0	15,959	15,358	15,348	14,821	15,080	15,123			
7. Stock and yarn finishing	Commission	Small	4.2	112	-151	-192	-486	-250	-256			
		Medium	9.4	222	-16	-88	-491	-185	-175			
		Large	23.0	596	326	261	-158	161	178			
	Own yarn	Small	4.2	230	28	-12	-307	-71	-76			
		Medium	9.4	453	256	220	-156	151	161			
		Large	23.0	2,120	1,847	1,781	1,498	1,678	1,699			
	Integrated	Medium	9.4	628	436	400	123	350	355			
		Large	23.0	1,774	1,493	1,427	1,144	1,328	1,342			
8. Nonwoven manufacturing		Small	24.0	2,781	2,594	2,557	2,351	2,478	2,511			
		Medium	57.0	3,591	3,298	3,233	2,948	3,133	3,150			
9. Felt fabric processing		Small	0.9	682	554	543	532	518	NA			
		Medium	4.4	676	478	442	144	359	NA			
		Large	10.7	1,054	767	704	332	603	NA			

Source: Development, Planning and Research Associates, Inc. estimates based on the imposition of wastewater control expenditures described in Chapter VII on the model plants described in Chapter VI utilizing the methodology presented in Chapter II.

1/ Type processing (or subdivision) applicable to woven and knit fabric finishing is shown for each model in these subcategories. These include "S" for simple; "C" for complex; and "D" for complex-desizing.
2/ Alternative technologies M, N, and P apply to wool scouring only.
3/ Hosiery products is a subdivision of the knit fabric finishing subcateogry.

model in knit fabric finishing (5a) became negative under the more stringent controls while that of the medium commission stock and yarn (7) model became negative under treatment alternative F, the most stringent technology. Also, the direct discharging small own fabric hosiery (5c) model incurred negative cash flows for all technologies except alternative A and G. The cash flows of all other models remained positive under all treatment alternatives except the small and medium own yarn stock and yarn finishing (7) models in the indirect category. The small model in the indirect category had its cash flow become negative under most of the treatment alternatives; the cash flow of the medium model became negative under treatment alternative F.

b. New Source Models

The annual cash flows for the new source models are shown in Table VIII-15. The cash flows for both the direct and indirect models were positive both before and after the imposition of controls.

4. Net Present Values

The model plant net present values (NPV) reflected the net present values of the models as of year 21. The net present value concept indicates the size of the return to the equity holders in excess of the firm's 8.3 percent cost of capital; thus, if the NPV was positive, it was assumed the particular firm was earning a return during the 21 year period in excess of the minimum return necessary to attract investors (the cost of capital). If the NPV was negative, then the firm's return was less than the minimum cost of capital.

a. Existing Models

The existing models' NPV's are shown in Tables VIII-16 and VIII-17 for the direct and indirect dischargers, respectively. In the direct discharger category, four models had negative NPV's in the base case which would indicate that these models would be better off to close even before the imposition of wastewater control. These include: the small wool scouring (1), the small commission woven fabric (4a), the small own stock and yarn (7), and the felt fabric processing (9) models. With the imposition of wastewater control, eight additional models (primarily commission mills) had negative NPV's under treatment alternative B and three additional under treatment alternative F, the most stringent technology. Under treatment alternative F the following models had negative NPV's in addition to those indicated above as having negative NPV's in the base case.

- small commission wool finishing (2)
- medium commission woven fabric (4b)
- small woven fabric (own fabric) (4a)
- medium commission knit fabric (simple and complex) (5a and 5b)
- medium integrated knit fabric (5b)
- small hosiery (own hosiery) (5c)
- small integrated hosiery (5c)
- small commission yarn (7)
- medium own yarn (7)
- small integrated yarn (7)
- medium felt fabric processing (9)

Table VIII-15. The textile industry, representative new source model plant impacts, effects of wastewater control expenditures on annual cash flows (year 21)

Subcategory	Type mill	Size/type[1/]	Daily capacity	Alternative Treatment Technologies: Direct Dischargers (NSPS) Baseline	R	S	T	Indirect Dischargers (PSNS) Baseline	R	S	T
			(kkg)	($000)							
2. Wool finishing	Integrated	Medium	20.0	9,393	8,172	8,452	8,198	10,681	10,117	9,790	9,636
4. Woven fabric finishing	Own fabric	Medium (C)	26.0	NA	NA	NA	NA	7,906	7,519	7,298	7,276
		Large (C)	130.0	20,327	18,104	18,895	18,531	NA	NA	NA	NA
	Integrated	Large (D)	50.0	20,579	19,292	19,626	19,377	17,980	17,400	17,076	16,921
5. Knit fabric finishing	Integrated	Large (C)	18.6	8,819	8,234	8,203	8,037	10,624	10,237	10,016	9,994
5c. Hosiery products[2/]	Integrated	Medium	6.0	5,254	4,947	NA	4,769	NA	NA	NA	NA
		Large	13.6	NA	NA	NA	NA	7,149	6,885	6,691	6,652
6. Carpet finishing	Integrated	Small	20.0	5,737	5,337	5,224	5,082	NA	NA	NA	NA
		Medium	49.0	NA	NA	NA	NA	10,235	9,846	9,625	9,603
7. Stock & yarn finishing	Own Yarn	Medium	3/	3,023	2,442	2,412	2,247	1,127	836	676	639
8. Nonwoven manufacturing		Medium	3/	2,679	2,286	2,174	2,032	11,626	11,240	11,019	10,998
9. Felt fabric processing		Medium	3/	1,644	1,251	1,138	996	2,269	1,999	1,818	1,779

1/ Type processing applicable to woven and knit fabric finishing is shown for each model in these subcategories. These include "C" for complex and "D" for complex desizing.

2/ Hosiery products is a subdivision of the Knit Fabric Finishing subcategory.

3/ For these models, there is a size difference between direct and indirect. For Stock & Yarn models the sizes are 23.0 and 9.3 kkg for the direct and indirect models respectively; Nonwoven Manufacturing models are 10.4 and 57.0 kkg respectively; and Felt Fabric Processing models, 2.0 and 4.4 kkg respectively.

Source: Development Planning and Research Associates, Inc. estimates based on the impositon of wastewater control expenditures described in Chapter VII on the model plants described in Chapter VI utilizing the methodology presented in Chapter II.

Table VIII-16. The textile industry, representative existing model plant impacts, effects of wastewater control expenditure on net present values - direct dischargers

Subcategory	Type Mill	Size/ Type 1/	Daily Capacity	Base Case	Alternative treatment technologies (BATEA) 2/ A	B	C	D	E	F	G	H	J	K	M	N	P
			(kkg)	($1,000)													
1. Wool scouring	Commission	Small	16.2	-1,208											-2,445	-2,890	-2,637
		Medium	35.6	848											-93	-780	-231
		Large	80.9	2,704											1,374	1,028	1,151
2. Wool finishing	Commission	Small	8.0	151	NA	-785	NA	-915	NA	-1,484	-714	-1,228	NA	-1,345			
	Integrated	Small	8.0	1,876	NA	752	NA	622	NA	54	823	310	NA	193			
		Medium	20.0	6,128	NA	4,453	NA	4,201	NA	3,191	4,260	3,425	NA	3,259			
		Large	40.0	49,551	NA	46,551	NA	46,130	NA	43,819	45,907	44,602	NA	44,358			
4. Woven fabric finishing	Commission	Small (S)	5.3	-13	NA	-704	-351	-751	-434	-1,458	-498	-804	-588	-910			
		Medium (C)	26.0	1,361	NA	292	736	149	-63	-498	354	-173	108	-354			
		Large (C)	130.0	10,498	NA	7,721	8,839	7,281	5,737	4,642	7,094	5,769	6,391	5,230			
	Own fabric	Small (S)	5.3	897	NA	240	539	200	473	-416	415	143	277	59			
		Medium (C)	26.0	5,563	NA	4,238	4,681	4,094	3,883	3,448	4,299	3,773	4,053	3,591			
		Large (C)	130.0	9,957	NA	6,791	7,916	6,359	4,814	3,720	6,171	4,846	5,468	4,308			
	Integrated	Small (S)	5.3	1,513	NA	808	1,107	768	1,041	152	983	711	910	627			
		Medium (D)	20.0	5,832	NA	4,635	5,088	4,500	4,289	3,846	4,704	4,185	4,460	3,999			
		Large (D)	50.0	22,534	NA	20,258	20,950	19,983	18,767	18,553	20,058	19,238	19,622	18,891			
		X-Large (C)	220.0	29,239	NA	23,711	25,434	23,163	20,338	18,903	22,494	20,522	21,485	19,813			
5. Knit fabric finishing	Commission	Medium (S)	7.7	165	NA	-703	-301	-789	-814	-1,150	-531	-969	-649	-1,005			
		Medium (C)	7.7	634	NA	-72	252	-145	-136	-435	69	-309	-32	-335			
		Large (C)	18.6	4,565	NA	3,579	4,004	3,444	3,368	2,898	3,650	3,131	3,466	3,031			
	Integrated	Medium (S)	7.7	1,847	NA	1,029	1,361	956	965	666	1,171	801	1,075	766			
		Medium (C)	7.7	1,092	NA	268	593	196	204	-95	409	41	309	6			
		Large (C)	18.6	7,652	NA	6,257	6,682	6,122	6,045	5,575	6,328	5,809	6,143	5,708			
5c. Hosiery Products 4/	Own hosiery	Small	2.7	72	-546	-1,157	NA	-1,142	NA	-1,419	-925	-1,263	NA	-1,256			
		Medium	6.0	4,947	4,161	3,569	NA	3,542	NA	2,927	3,753	3,378	NA	3,394			
	Integrated	Small	2.7	889	267	-273	NA	-267	NA	-526	-70	-375	NA	-375			
		Medium	6.0	4,212	3,433	2,842	NA	2,815	NA	2,200	3,026	2,651	NA	2,667			
6. Carpet finishing	Integrated	Small	20.0	4,153	NA	3,225	3,547	3,151	3,153	2,854	3,368	2,995	3,264	2,960			
		Medium	49.0	8,270	NA	6,971	7,386	5,827	6,683	6,267	7,032	6,528	6,847	6,412			
		Large	120.0	15,772	NA	13,059	13,704	12,783	11,720	11,517	12,856	12,020	12,522	11.847			
7. Stock & yarn finishing	Commission	Small	9.4	267	NA	-500	-133	-575	-448	-880	-356	-743	-468	-747			
		Medium	23.0	1,637	NA	692	1,152	568	572	11	762	249	583	190			
		Large	57.0	4,520	NA	3,067	3,759	2,899	2,025	1,542	2,862	1,889	2,548	1,717			
	Own yarn	Small	9.4	-58	NA	-788	-452	-862	-751	-1,150	-654	-1,027	-759	-1,041			
		Medium	23.0	314	NA	-729	-268	-853	-849	-1,409	-658	-1,171	-838	-1.231			
		Large	38.0	8,584	NA	7,091	7,563	6,991	6,663	5,983	6,950	6,401	6,706	6,037			
		X-Large	57.0	10,304	NA	8,563	9,255	8,394	7,521	7,037	8,358	7,384	8,044	7,212			
	Integrated	Small	9.4	185	NA	-583	-248	-658	-546	-946	-450	-823	-555	-837			
		Large	38.0	6,234	NA	4,850	5,321	4,749	4,422	3,741	4,709	4,160	4,465	3,796			
8. Nonwoven manufacturing		Medium	10.4	2,567	1,845	1,254	1,545	1,227	1,497	483	1,438	1.141	1,387	1,126			
9. Felt fabric processing		Medium	2.0	-62	-762	-1,353	NA	-1,380	NA	-2,024	-1,170	-1,467	NA	-1,482			

1/ Type processing (or subdivision) applicable to woven and knit fabric finishing is shown for each model in these categories. These include "S" for simple; "C" for complex; and "D" for complex-desizing.

2/ For those models with treatment alternative A (BPT), impacts for alternatives B through K include the impacts associated with compliance of alternative A.

3/ Alternative technologies M, N, and P apply to wool scouring only.

4/ Hosiery Products is a subdivision of the Knit Fabric Finishing Subcategory.

Source: Development, Planning and Research Associates, Inc. estimates based on the imposition of wastewater control expenditures described in Chapter VII on the model plants described in Chapter VI utilizing the methodology presented in Chapter II.

Table VIII-17. The textile industry, representative existing model plant impacts, effects of wastewater control expenditures on net present values - indirect dischargers

Subcategory	Type mill	Size/ type 1/	Daily capacity	Base case	Alternative Treatment Technologies (PSES) B	D	F	H	J	M 2/	N 2/	P 2/
			(kkg)	($1,000)								
1. Wool scouring	Commission	Small	16.0	-1,840						-2,978	-3,736	-3,144
		Large	81.0	2,697						1,427	892	1,024
2. Wool finishing	Commission	Small	3.3	119	-699	-771	-1,403	-1,039	-1,006			
	Integrated	Small	3.3	564	-155	-214	-691	-430	-402			
		Medium	20.0	6,927	5,254	4,905	3,454	3,977	4,279			
		Large	40.0	45,341	42,095	41,596	38,814	39,308	40,546			
4. Woven fabric finishing	Commission	Small (S)	2.4	-2	-741	-752	-1,142	-899	-903			
		Medium (C)	26.0	-1,004	-77	-210	-813	-490	-880			
		Large (C)	130.0	12,653	9,620	9,224	6,794	7,824	11,930			
	Own fabric	Small (S)	2.4	579	76	70	-183	-25	-28			
		Medium (C)	26.0	4,876	3,572	3,439	2,836	3,158	4,529			
		Large (C)	130.0	15,760	12,289	11,893	9,463	10,492	14,599			
	Integrated	Small (S)	2.4	547	28	22	-231	-73	-76			
		Medium (D)	20.0	5,364	4,595	4,462	3,859	4,372	5,552			
		Large (D)	50.0	22,063	19,690	19,439	18,127	18,749	21,206			
		X-large (D)	170.0	25,130	19,502	18,959	14,945	16,609	22,872			
5. Knit fabric finishing	Commission	Medium (S)	7.7	44	-787	-855	-1,279	-1,015	-996			
		Large (C)	18.6	2,444	1,457	1,314	713	1,038	1,115			
	Integrated	Small (C)	1.5	41	-469	-476	-729	-537	-539			
		Medium (S)	7.7	1,346	569	507	162	352	382			
		Large (C)	18.6	2,625	1,324	1,044	580	905	982			
		X-large (S)	31.0	11,125	9,120	8,940	8,011	8,459	8,600			
5c. Hosiery products 3/	Own hosiery	Small	2.7	-32	-623	-617	-914	-738	-744			
		Large	13.6	8,458	7,757	7,758	7,497	7,655	7,651			
	Integrated	Small	2.7	711	116	117	-144	14	10			
		Large	13.6	5,689	4,993	4,994	4,734	4,891	4,887			
6. Carpet finishing	Integrated	Small	3.9	1,454	807	780	-145	665	668			
		Medium	49.0	4,040	2,736	2,747	2,004	2,230	2,271			
		Large	122.0	17,033	14,253	14,041	12,718	13,200	13,409			
7. Stock and yarn finishing	Commission	Small	4.2	236	-491	-526	-1,287	-670	-675			
		Medium	9.4	488	-254	-312	-688	-458	-422			
		Large	23.0	1,288	283	145	-457	-136	-59			
	Own yarn	Small	4.2	97	-675	-701	-1,298	-813	-816			
		Medium	9.4	621	-82	-144	-489	-288	-254			
		Large	23.0	4,130	2,944	2,806	2,204	2,517	2,602			
	Integrated	Medium	9.4	294	-449	-511	-856	-655	-621			
		Large	23.0	3,353	2,226	2,088	1,486	1,807	1,881			
8. Nonwoven manufacturing		Small	24.0	7,147	6,237	6,170	5,825	5,998	6,050			
		Medium	57.0	4,076	2,767	2,629	2,023	2,348	2,425			
9. Felt fabric processing		Small	0.9	727	180	174	171	73	NA			
		Medium	4.4	159	-590	-652	-996	-824	NA			
		Large	10.7	-440	-1,509	-1,636	-2,242	-1,922	NA			

Source: Development, Planning and Research Associates, Inc. estimates based on the imposition of wastewater control expenditures described in Chapter VII on the model plants described in Chapter VI utilizing the methodology presented in Chapter II.

1/ Type processing (or subdivision) applicable to woven and knit fabric finishing is shown for each model in these subcategories. *These include "S" for simple; "C" for complex; and "D" for complex-desizing.*

2/ Alternative technologies M, N, and P apply to wool scouring only.

3/ Hosiery products is a subdivision of the knit fabric finishing subcategory.

In the indirect category, the NPV's of five model plants were negative in the base case: the small wool scouring (1), the small commission woven fabric (4a), small own hosiery (5c), small own yarn (7), and the large felt models (9). With the imposition of controls, ten models had negative NPV's under treatment alternative B, the least stringent, while an additional four had negative NPV's under treatment alternative F, the most stringent. Under alternative F, the following models had negative NPV's which did not have negative NPV's in the base case:

- small commission wool finishing (2)
- small integrated wool finishing (2)
- medium commission woven fabric (4a)
- small own woven fabric (4b)
- small integrated woven fabric (4c)
- medium commission knit fabric (5a)
- small integrated knit fabric (5b)
- small integrated hosiery (5c)
- small carpet (6)
- small, medium, and large commission yarn (7)
- medium own yarn (7)
- medium integrated yarn (7)
- medium felt (9)

b. New Source Models

The NPV's for the new source models are shown in Table VIII-18. In the base case, four of the direct discharger models had negative NPV's while only one of the indirect models had a negative NPV. These include:

- wool finishing (2) - direct model
- woven fabric (own) (4b) - direct model
- nonwoven (8) - direct model
- felt (9) - direct model
- wool finishing (2) - indirect model

The primary reason for these negative NPV's is the relatively high investment requirements for the models. From a financial point of view, it would be anticipated it would be unfeasible to construct these type mills; however in actuality, other factors may enter into consideration.

The NPV's of the remaining new source models were positive in the base case and remained positive under all of the treatment alternatives, except for the indirect yarn (7) model. This model's NPV was positive in the base case but negative under all treatment alternatives.

C. Production Effects

Total U.S. mill fiber consumption, an indicator of production, has increased during the last 15 years, although the predominant types of fibers have

Table VIII-18. The textile industry, representative new source model plant impacts, effects of wastewater control expenditures on net present values

Subcategory	Type mill	Size/type 1/	Daily capacity	Alternative Treatment Technologies: Direct Dischargers (NSPS) Baseline	R	S	T	Indirect Dischargers (PSNS) Baseline	R	S	T
			(kkg)	($000)							
2. Wool finishing	Integrated	Medium	20.0	-30,809	-35,637	-35,096	-36,030	-42,725	-47,376	-48,185	-48,698
4. Woven fabric finishing	Own fabric	Medium (C)	26.0	NA	NA	NA	NA	3,969	2,071	1,644	1,685
		Large (C)	130.0	- 5,672	-12,768	-11,84[illegible]	-13,198	NA	NA	NA	NA
	Integrated	Large (D)	50.0	13,150	7,822	8,640	7,729	10,408	7,048	6,249	5,734
5. Knit fabric finishing	Integrated	Large (C)	18.0	20,247	17,886	18,108	17,506	19,740	17,887	17,461	17,501
5c. Hosiery products 2/	Integrated	Medium	6.0	4,712	3,271	NA	2,476	NA	NA	NA	NA
		Large	13.6	NA	NA	NA	NA	10,614	9,246	8,913	8,808
6. Carpet finishing	Integrated	Small	20.0	3,799	2,014	2,038	1,519	NA	NA	NA	NA
		Medium	49.0	NA	NA	NA	NA	7,049	5,100	4,674	4,715
7. Stock & yarn finishing	Own yarn	Medium	3/	5,122	2,964	3,194	2,592	373	- 761	- 930	- 1,027
8. Nonwoven manufacturing		Medium	3/	- 5,100	- 6,808	- 6,784	- 7,303	8,775	6,608	6,181	6,222
9. Felt fabric processing		Medium	3/	- 1,047	- 2,586	-2,562	- 3,081	1,547	427	160	46

1/ Type processing applicable to woven and knit fabric finishing is shown for each model in these subcategories. These include "C" for complex and "D" for complex desizing.

2/ Hosiery products is a subdivision of the Knit Fabric Finishing subcategory.

3/ For these models, there is a size difference between direct and indirect. For Stock & Yarn models the sizes are 23.0 kkg and 9.3 kkg for the direct and indirect models respectively; Nonwoven Manufacturing models are 10.4 and 57.0 kkg respectively; and Felt Fabric Processing models, 2.0 and 4.4 kkg respectively.

Source: Development Planning and Research Associates, Inc. estimates based on the imposition of wastewater control expenditures described in Chapter VII on the model plants described in Chapter VI utilizing the methodology presented in Chapter II.

changed from wool and cotton to man-made. While production of broad woven fabrics has declined, its loss has been offset by significant increases in the production of knit goods and carpet and rugs. Capacity has increased at about the same rate as production, a result of increased efficiency in looms and a significant increase in the number of double knit machines put into operation.

Production, capacity and utilization closely parallel the general economy. In order to profit from rises and protect against recessions, the textile industry has increasingly consolidated, integrated and diversified within plants and among operations within multi-unit firms.

As was discussed in Chapter III, Industry Structure, there are approximately 1,777 facilities in the textile industry which are believed to be wet production facilities. Of these facilities, 612 plants are classified as low water use processing operations leaving a total of 1,165 plants to be considered as generators of wastewaters. These 1,165 wet processors were further analyzed in Chapter VII with the final determination made that 324 facilities will be required to incur expenditures for wastewater control compliance. It also has been determined that 217 of these 324 facilities are direct dischargers (BATEA) and 107 are indirect dischargers (PSES).

In this section the production effects resulting from the imposition of wastewater controls on the textile industry will be discussed. First base case closures are estimated for those facilities requiring control expenditures (base case closures represent plant closures which would occur even without expenditures for controls). Next plant closures attributable to control expenditure requirements are projected. Finally the resulting effects on the industry's production is assessed.

1. Base Case Plant Closures (without control expenditures)

According to Census data for SIC 22, the Textile Mill Product Group, the number of establishments has remained relatively stable during the past fifteen years (as discussed in Chapter III). While the total number of establishments has remained stable during this period many establishments have actually ceased operations, only to be replaced by new facilities (not necessarily in the same subcategory or SIC classification). It is anticipated this trend will continue during the next few years.

In view of long-term profit uncertainties, somewhat stabilized demand, and increasing influence of foreign competition, the overall textile industry is not expected to expand significantly in the next five to ten years. While many existing operations are expected to continue their modernization efforts and a few new textile plants are expected to be built, some plants, particularly the older, less efficient, less profitable facilities, are expected to cease operations. These "base case" closures will occur, in all probability, even without expenditure requirements for wastewater controls. Reasons for these closures vary; however, some of the more common factors include:

- increased international competition
- inability to adopt to changing fabric demands
- higher per unit cost of production in some plants--especially the smaller size operations
- lower per unit profit
- difficulty in meeting (financially and physically) other regulatory requirements
- plant obsolescence
- inadequate owner income
- owner retirement

It is anticipated additional textile operations will close in the future for similar reasons. It is estimated that of the 324 facilities which will be required to make control expenditures approximately 17 will close within the next three to five years barring any atypical changes in the industry's operating environment. The majority of these closures will be smaller commission type operations. Eleven base case closures are projected for the direct dischargers and six are projected for the indirect dischargers.

2. Impacted Plant Closures (with control expenditures)

Predicated on the assumption of no price increases, the industry's production effects resulting from the imposition of wastewater controls are best measured in terms of the possibility of facilities closing due to the imposition of effluent control costs. As was discussed in Chapter II, Methodology, barring unusual circumstances, most operations would cease if they could not adequately absorb required control costs. The most obvious measurement of a firm's ability to absorb the costs is its ability to maintain a positive income or cash flow after incurring control expenditures.

If incomes are negative, some firms would remain in operation as long as they cover variable costs; however, the requirements for overhead expenses would eventually cause such firms to cease.

The remaining situation that could arise would be one in which firms maintain positive incomes and generate net present values (NPV of their cash flows at their cost of capital) which are positive. This indicates that these firms are earning a return on their operation which exceeds their cost of capital. If their NPV's are negative then the firms would liquidate, realize salvage value in cash, and reinvest in a more financially viable investment (one which would earn at least their cost of capital).

A review of the financial effects of the imposition of wastewater controls on the models results in some confusion in the determination of which plants would be forced to close due to an inability to absorb the control expenditures, a confusion which results from the large number of models and wastewater control treatment alternatives applicable to each model. Accordingly, for this analysis, formalized closure criteria were developed. In the development of these criteria, certain necessary assumptions were made to simplify the interpretation of the impact results.

The closure criteria utilized are depicted below. These criteria basically represent the models' abilities to continue operations after incurring expenditures for wastewater controls.

Model's Viability	Net Present Value	Annual Cash Flow
Viable	Positive	Positive
Marginal	Slightly Negative[1/]	Slightly Negative[1/]
Closure	Negative	Negative

Based on the above criteria, closure decisions were made for each model at each treatment level. These are discussed below.

a. Existing Models

The projected closures for the existing models are shown in Tables VIII-19 and VIII-20 for direct and indirect dischargers, respectively. In the direct category, only one model was considered as a base case closure -- the small wool scouring (1) model. However, three models were considered to be operating under marginal conditions in the base case. With the imposition of controls, two models were considered as closures and four as marginal under treatment alternative C, the least stringent control. Under treatment alternative F, the most stringent, twelve models were considered as closures and three as marginal. In the wool scouring subcategory (1), the medium model was considered as marginal under all treatment alternatives in addition to the closure of the small model which was a closure in the base case. The models identified as closures under treatment alternative F included the following:

- small wool finishing commission (2)
- small commission woven fabric (4a)
- medium commission woven fabric (4a)
- medium (simple) knit fabric (5a)
- medium (complex) knit fabric (5b)
- small own hosiery (5c)
- small commission yarn (7)
- medium commission yarn (7)
- small own yarn (7)
- medium own yarn (7)
- small integrated yarn (7)
- felt fabric processing (9)

Under treatment alternative K (a technology using ozonation), the impact was slightly less. The medium commission woven fabric (4) model which was considered a closure under treatment alternative F became marginal under treatment alternative K. Several models considered marginal under alternative F were determined to be viable under alternative K.

1/ The criterion utilized here was that the positive cash flow must be greater than the amount by which the NPV was negative or a positive NPV must be greater than the amount by which the cash flow was negative. If not, then the plant was projected to close.

Table VIII-19. The textile industry, representative existing model plant impacts, projected model plant closures attributable to expenditures for wastewater control - direct dischargers

Subcategory	Type Mill	Size/ Type1/	Daily Capacity	Base Case	Alternative treatment technologies (BATEA)2/ A	B	C	D	E	F	G	H	J	K	M3/	N3/	P3/
			(kkg)														
1. Wool scouring	Commission	Small	16.2	C											C	C	C
		Medium	35.6	V											M	M	M
		Large	80.9	V											V	V	V
2. Wool finishing	Commission	Small	8.0	V	NA	C	NA	C	NA	C	C	C	NA	C			
	Integrated	Small	8.0	V	NA	V	NA	V	NA	V	V	V	NA	V			
		Medium	20.0	V	NA	V	NA	V	NA	V	V	V	NA	V			
		Large	40.0	V	NA	V	NA	V	NA	V	V	V	NA	V			
4. Woven fabric finishing	Commission	Small (S)	5.3	M	NA	C	C	C	C	C	C	C	C	C			
		Medium (C)	26.0	V	NA	V	V	V	M	C	V	M	V	M			
		Large (C)	130.0	V	NA	V	V	V	V	V	V	V	V	V			
	Own fabric	Small (S)	5.3	V	NA	V	V	V	V	M	V	V	V	V			
		Medium (C)	26.0	V	NA	V	V	V	V	V	V	V	V	V			
		Large (C)	130.0	V	NA	V	V	V	V	V	V	V	V	V			
	Integrated	Small (S)	5.3	V	NA	V	V	V	V	V	V	V	V	V			
		Medium (D)	20.0	V	NA	V	V	V	V	V	V	V	V	V			
		Large (D)	50.0	V	NA	V	V	V	V	V	V	V	V	V			
		X-Large (C)	220.0	V	NA	V	V	V	V	V	V	V	V	V			
5. Knit fabric finishing	Commission	Medium (S)	7.7	V	NA	C	C	C	C	C	C	C	C	C			
		Medium (C)	7.7	V	NA	M	V	C	C	C	V	C	C	C			
		Large (C)	18.6	V	NA	V	V	V	V	V	V	V	V	V			
	Integrated	Medium (S)	7.7	V	NA	V	V	V	V	V	V	V	V	V			
		Medium (C)	7.7	V	NA	V	V	V	V	M	V	V	V	V			
		Large (C)	18.6	V	NA	V	V	V	V	V	V	V	V	V			
6c. Hosiery Products 4/	Own hosiery	Small	2.7	V	C	C	NA	C	NA	C	C	C	NA	C			
		Medium	6.0	V	V	V	NA	V	NA	V	V	V	NA	V			
	Integrated	Small	2.7	V	V	M	NA	M	NA	M	M	M	NA	M			
		Medium	6.0	V	V	V	NA	V	NA	V	V	V	NA	V			
6. Carpet finishing	Integrated	Small	20.0	V	NA	V	V	V	V	V	V	V	V	V			
		Medium	49.0	V	NA	V	V	V	V	V	V	V	V	V			
		Large	120.0	V	NA	V	V	V	V	V	V	V	V	V			
7. Stock & yarn finishing	Commission	Small	9.4	V	NA	C	M	C	C	C	C	C	C	C			
		Medium	23.0	V	NA	V	V	V	V	C	V	V	V	C			
		Large	57.0	V	NA	V	V	V	V	V	V	V	V	V			
	Own yarn	Small	9.4	M	NA	C	M	C	C	C	C	C	C	C			
		Medium	23.0	V	NA	M	M	C	C	C	M	C	C	C			
		Large	38.0	V	NA	V	V	V	V	V	V	V	V	V			
		X-Large	57.0	V	NA	V	V	V	V	V	V	V	V	V			
	Integrated	Small	9.4	V	NA	C	M	C	C	C	M	C	C	C			
		Large	38.0	V	NA	V	V	V	V	V	V	V	V	V			
8. Nonwoven manufacturing		Medium	10.4	V	V	V	V	V	V	V	V	V	V	V			
9. Felt fabric processing		Medium	2.0	M	C	C	NA	C	NA	C	C	C	NA	C			

1/ Type processing (or subdivision) applicable to woven and knit fabric finishing is shown for each model in these categories. These include "S" for simple; "C" for complex; and "D" for complex-desizing.

2/ For those models with treatment alternative A (BPT), impacts for alternatives B through K include the impacts associated with compliance of alternative A.

3/ Alternative technologies M, N, and P apply to wool scouring only.

4/ Hosiery Products is a subdivision of the Knit Fabric Finishing Subcategory.

Definitions: V = Viable, M = Marginal; C = Closure; NA = Not Applicable.

Source: Development, Planning and Research Associates, Inc. estimates basec on the imposition of wastewater control expenditures described in Chapter

Table VIII-20. The textile industry, representative existing model plant impacts, projected model plant closures attributable to expenditures for wastewater controls - indirect dischargers

Subcategory	Type mill	Size/ type 1/	Daily capacity (kkg)	Base case	Alternative Treatment Technologies (PSES) B	D	F	H	J	M 2/	N 2/	P 2/
1. Wool scouring	Commission	Small	16.0	C						C	C	C
		Large	31.0							V	V	V
2. Wool finishing	Commission	Small	3.3	V	C	C	C	C	C			
	Integrated	Small	3.3	V	M	M	C	C	C			
		Medium	20.0	V	V	V	V	V	V			
		Large	40.0	V	V	V	V	V	V			
4. Woven fabric finishing	Commission	Small (S)	2.4	M	C	C	C	C	C			
		Medium (C)	26.0	V	M	M	C	C	V			
		Large (C)	130.0	V	V	V	V	V	V			
	Own fabric	Small (S)	2.4	V	V	V	C	M	M			
		Medium (C)	26.0	V	V	V	V	V	V			
		Large (C)	130.0	V	V	V	V	V	V			
	Integrated	Small (S)	2.4	V	V	V	C	M	M			
		Medium (D)	20.0	V	V	V	V	V	V			
		Large (D)	50.0	V	V	V	V	V	V			
		X-large (D)	170.0	V	V	V	V	V	V			
5. Knit fabric finishing	Commission	Medium (S)	7.7	V	C	C	C	C	C			
		Large (C)	18.5	V	V	V	V	V	V			
	Integrated	Small (C)	1.5	V	C	C	C	C	C			
		Medium (S)	7.7	V	V	V	V	V	V			
		Large (C)	18.6	V	V	V	V	V	V			
		X-large (S)	31.0	V	V	V	V	V	V			
5c. Hosiery products 3/	Own hosiery	Small	2.7	M	C	C	C	C	C			
		Large	13.5	V	V	V	V	V	V			
	Integrated	Small	2.7	V	V	V	M	V	V			
		Large	13.6	V	V	V	V	V	V			
6. Carpet finishing	Integrated	Small	8.9	V	V	V	M	V	V			
		Medium	49.0	V	V	V	V	V	V			
		Large	122.0	V	V	V	V	V	V			
7. Stock and yarn finishing	Commission	Small	4.2	V	C	C	C	C	C			
		Medium	9.4	V	C	C	C	C	C			
		Large	23.0	V	V	V	C	M	M			
	Own yarn	Small	4.2	M	C	C	C	C	C			
		Medium	9.4	V	M	M	C	C	C			
		Large	23.0	V	V	V	V	V	V			
	Integrated	Medium	9.4	V	C	C	C	C	C			
		Large	23.0	V	V	V	V	V	V			
8. Nonwoven manufacturing		Small	24.0	V	V	V	V	V	V			
		Medium	57.0	V	V	V	V	V	V			
9. Felt fabric processing		Small	0.9	V	V	V	V	V	NA			
		Medium	4.4	V	C	C	C	C	NA			
		Large	10.7	M	C	C	C	C	NA			

Definitions: V = viable, M = marginal; C = closure; NA = not applicable.
Source: Development, Planning and Research Associates, Inc. estimates based on the imposition of wastewater control expenditures described in Chapter VII on the model plants described in Chapter VI utilizing the methodology presented in Chapter II.

1/ Type processing (or subdivision) applicable to woven and knit fabric finishing is shown for each model in these subcategories. These include "S" for simple; "C" for complex; and "D" for complex-desizing.
2/ Alternative technologies M, N, and P apply to wool scouring only.
3/ Hosiery products is a subdivision of the knit fabric finishing subcategory.

For the existing indirect discharger models, the small wool scouring (1) model was considered a closure in the base case while three models were marginal. With the imposition of controls, eleven models were closures and three models marginal under treatment alternative B. Under treatment alternative F, seventeen models were closures while three others were marginal. The closures included the following:

- small commission wool finishing (2)
- small integrated wool finishing (2)
- small commission woven fabric (4a)
- medium commission woven fabric (4a)
- small own woven fabric (4b)
- small integrated woven fabric (4c)
- medium commission knit fabric (5a)
- medium integrated knit fabric (5b)
- small own hosiery (5c)
- small commission yarn (7)
- medium commission yarn (7)
- large commission yarn (7)
- small own yarn (7)
- medium own yarn (7)
- medium integrated yarn (7)
- medium felt fabric processing (9)
- large felt fabric processing (9)

Under treatment alternative H (the technology using ozonation), three models considered as closures under alternative F were impacted slightly less under alternative H and were determined to be marginal. These included the small own woven fabric (4b), the small integrated woven fabric (4c), and the large commission yarn (7) models. Also, several other models considered marginal under treatment alternative F were viable under treatment alternative H.

The model plant closures discussed above provided the basis for estimating those actual mill closures with the model closures analyzed in light of the industry structure, expected variations in the profitabilities of the individual mills and assumptions concerning size distributions within size categories, and mill characteristics. It was assumed that the size distribution of the actual mills within each size category was uniform and that the financial profiles of these mills were basically a function of size (as was the case with model plants). Based on these assumptions and on a determination of where each model plant fits within the industry structure, the estimates of closures were made. It should be noted projections of the number of actual plant closures were only made for the treatment options considered for proposal (described in Chapter VII) instead of for every treatment alternative.

The projected plant closures for the direct discharging treatment options are presented in Table VIII-21. As shown, BATEA option 1 (treatment alternative A) results in only three projected plant closures. It should be

Table VIII-21. The textile industry, projected mill closures attributable to expenditures for wastewater control options--direct dischargers (BATEA)

Subcategory	Number of existing facilities requiring control expenditures 1/	Base case closures 2/	Option 1 (Treatment Alternative A)	Option 2 (Treatment Alternative C)	Option 3 (Treatment Alternative B	Option 4 (Treatment Alternative D) 3/
1. Wool scouring	7	1	0	NA	NA	3
2. Wool finishing	11	0	0	NA	1	1
4. Woven fabric finishing	86	2	0	3	4	4
5. Knit fabric finishing	45	4	0	2	3	3
5c. Hosiery products 4/	6	0	1	NA	2	2
6. Carpet finishing	13	0	0	0	0	0
7. Stock & yarn finishing	33	4	0	6	10	12
8. Nonwoven manufacturing	11	0	0	0	0	0
9. Felt fabric finishing	5	0	2	NA	4	4
Total Direct	217	11	3	11	24	29

1/ As was discussed in Chapter VII. Note for Option 2, only selected subcategories will require control expenditures. For each of these subcategories the number of plants requiring Option 1 expenditures are as follows: Hosiery Products, 4; Nonwoven Manufacturing, 3; Felt Processing, 2.

2/ Of those plants requiring control expenditures, it is projected that those plants would close even without control requirements.

3/ For wool scouring plants the treatment alternative is M.

4/ Hosiery Products is a subdivision of the Knit Fabric Finishing subcategory.

Source: Development Planning and Research Associates, Inc., estimates based on the impact methodology and material presented previously in this report.

noted that option 1 is considered equivalent to BPT and that only 9 of the 217 direct discharging facilities are expected to be required to make expenditures to achieve this treatment level. BATEA options 2, 3, and 4 are reflective of proposed BATEA technologies and 217 existing direct dischargers are expected to require expenditures to achieve these treatment levels. Projected closures for BATEA options 2 (treatment alternative C), 3 (treatment alternative B), and 4 (treatment alternative D) are estimated to be 11, 24, and 29, respectively. Table VIII-21 depicts these projected closures by subcategory for each BATEA option considered.

The projected indirect discharging plant closures resulting from the requirements of PSES options 1 (treatment alternative A), 2 (treatment alternative B), and 3 (treatment alternative D) are presented in Table VIII-22. As shown, there are no projected closures associated with PSES option 1 as this technology reflects the level of treatment currently in place for the indirect dischargers. Compliance with PSES options 2 and 3 are both projected to result in the closure of 20 facilities each. These projected closures, by subcategory, are shown for each PSES option considered in Table VIII-22.

b. New Source Models

The projected model closures for the new source models are shown in Table VIII-23. In the base case for the direct dischargers, two models were identified as closures (wool finishing (2) and nonwoven manufacturing (8)) and two as marginal (own woven fabric (4b) and felt (9)). In the indirect category only one, wool finishing (2), was considered as a closure in the base case. It is doubtful whether any mills represented by these models would be constructed even without the imposition of wastewater controls. With controls, their construction would be even more doubtful.

For the remaining models, the imposition of controls had a significant impact on the viability of only one model--the indirect discharging stock and yarn (7) model. This model was considered marginal under treatment alternative R but closure under treatment alternatives S and T.

While it is doubtful if facilities in certain subcategories will be built even with wastewater control requirements, it is probable a few new facilities in other subcategories could or will be built. Predicated on the impacts discussed previously, it is anticipated the imposition of wastewater control requirements may effect the future growth of only the direct discharging felt fabric processing subcategory (9) and the indirect discharging own fabric stock and yarn subcategory (7).

3. Production Loss

The production losses resulting from the imposition of wastewater control requirements will depend upon the number of actual plant closings and the capability of the remaining plants to absorb the lost production of those plants which actually do close. Based on the assumptions that all the

Table VIII-22. The textile industry, projected mill closures attributable to expenditures for wastewater constrol options--indirect dischargers (PSES)

Subcategory	Number of existing facilities requiring control expenditures 1/	Base case closures 2/	Option 1 (Treatment Alternative A)	Option 2 (Treatment Alternative B) 3/	Option 3 (Treatment Alternative D) 3/
1. Wool scouring	3	0	0	1	1
2. Wool finishing	22	3	0	4	4
4. Woven fabric finishing	31	0	0	2	2
5. Knit fabric finishing	27	2	0	5	5
5c. Hosiery products 4/	0	0	0	0	0
6. Carpet finishing	0	0	0	0	0
7. Stock & yarn finishing	24	1	0	8	8
8. Nonwoven manufacturing	0	0	0	0	0
9. Felt fabric finishing	0	0	0	0	0
Total Indirect	107	6	0	20	20

1/ As was discussed in Chapter III. Note Option 1, the technology is that which is currently in place; thus no facilities will require additional expenditures.

2/ Of those plants requiring control expenditures, it is projected that those plants would close even without control requirements.

3/ For wool scouring plants the treatment alternative is M.

4/ Hosiery Products is a subdivision of the Knit Fabric Finishing Subcatetory.

Source: Development Planning and Research Associates, Inc., estimates based on the impact methodology and material presented previously in this report.

Table VIII-23. The textile industry, representative new source model plant, projected closures

Subcategory	Type mill	Size/type[1/]	Daily capacity (kkg)	Direct Dischargers (NSPS) Baseline	R	S	T	Indirect Dischargers (PSNS) Baseline	R	S	T
2. Wool finishing	Integrated	Medium	20.0	C	C	C	C	C	C	C	C
4. Woven fabric finishing	Own fabric	Medium (C)	26.0	NA	NA	NA	NA	V	V	V	V
		Large (C)	130.0	M	M	M	M	NA	NA	NA	NA
	Integrated	Large (D)	50.0	V	V	V	V	V	V	V	V
5. Knit fabric finishing	Integrated	Large (C)	18.6	V	V	V	V	V	V	V	V
5c. Hosiery products[2/]	Integrated	Medium	6.0	V	V	NA	V	NA	NA	NA	NA
		Large	13.6	NA	NA	NA	NA	V	V	V	V
6. Carpet finishing	Integrated	Small	20.0	V	V	V	V	NA	NA	NA	NA
		Medium	49.0	NA	NA	NA	NA	V	V	V	V
7. Stock & yarn finishing	Own yarn	Medium	3/	V	V	V	V	V	M	C	C
8. Nonwoven manufacturing		Medium	3/	C	C	C	C	V	V	V	V
9. Felt fabric processing		Medium	3/	M	C	C	C	V	V	V	V

Alternative Treatment Technologies: Direct Dischargers (NSPS) and Indirect Dischargers (PSNS).

1/ Type processing applicable to woven and knit fabric finishing is shown for each model in these subcategories. These include "C" for complex and "D" for complex desizing.
2/ Hosiery products is a subdivision of the Knit Fabric Finishing subcategory.
3/ For these models, there is a size difference between direct and indirect. For Stock & Yarn models the sizes are 23.0 kkg and 9.3 kkg for the direct and indirect models respectively; Nonwoven Manufacturing models are 10.4 and 57.0 kkg respectively; and Felt Fabric Processing models, 2.0 and 4.4 kkg respectively.

Source: Development Planning and Research Associates, Inc. estimates based on the imposition of wastewater control expenditures described in Chapter VII on the model plants described in Chapter VI utilizing the methodology presented in Chapter II

Definitions: V=viable, M=marginal, C-closure, NA-not applicable projected plant closures depicted in Tables VIII-21 and VIII-22 occur and that no plants remaining in operation absorb the closing plants production, the total projected potential annual production losses associated with each of the proposed treatment options can be estimated. These estimates are presented in Table VIII-24 for both the direct and indirect dischargers. Aggregated potentially lost production associated with the wet processors' compliance with the proposed options are depicted below. Also depicted are the potentially lost production quantities expressed as a percent of the textile industry's wet processors-total production.

	Treatment Option	Potentially Lost Production	Lost Production as Percent of the Industry's Wet Processor Production
		(million pounds)	(percent)
BATEA	1	4.0	0.03
BATEA	2	51.2	0.44
BATEA	3	96.5	0.82
BATEA	4	146.0	1.24
PSES	1	0.0	0.00
PSES	2	74.7	0.64
PSES	3	74.7	0.64

These estimates are presented by subcategory in Table VIII-24.

It should be noted these projected potential losses reflect the lost production of those plant projected to close due to wastewater control requirements. If such closures and the resulting production losses occur, it would be anticipated much of the lost production would be absorbed either by existing plants with excess capacity or by increases in imports. While estimates of the actual proportion of the production losses which would be absorbed were not attempted, it would be expected the absorbed proportion would be high with very little actual production being lost.

D. Employment Effects

The number of employees in the textile industry was reported by the Department of Commerce to be 900,200 individuals in 1977, with historical employment rarely deviating below 900,000 or above 1 million individuals. Based on the industry structure discussed previously in this report, the estimated number of individuals employed by those operations which could potentially be impacted by wastewater control requirements is 422,500, or approximately 50 percent of the total number of employees in the industry as defined by the Department of Commerce.

Table VIII-25 presents the projected employment losses which could result due to the imposition of the proposed wastewater control options. These

Table VIII-24. The textile industry, projected annual production losses attributable to the requirements of the wastewater control options--direct dischargers (BATEA) and indirect dischargers (PSES)

Subcategory	DIRECT DISCHARGERS (BATEA) Option 1 (Treatment Alternative A)	Option 2 (Treatment Alternative C)	Option 3 (Treatment Alternative B)	Option 4 (Treatment Alternative)1/	INDIRECT DISCHARGERS (PSES) Option 1 (Treatment Alternative A)	Option 2 (Treatment Alternative B)1/	Option 3 (Treatment Alternative D)1/
	million pounds				million pounds		
1. Wool scouring	0	NA	NA	32.6	0	7.0	7.0
2. Wool finishing	0	NA	4.5	4.5	0	7.2	7.2
4. Woven fabric finishing	0	8.1	10.8	10.8	0	24.4	24.4
5. Knit fabric finishing	0	7.0	10.6	10.6	0	15.5	15.5
5c. Hosiery products 2/	1.4	NA	2.8	2.8	0	0	0
6. Carpet finishing	0	0	0	0	0	0	0
7. Stock & yarn finishing	0	36.1	62.6	79.5	0	20.6	20.6
8. Nonwoven manufacturing	0	0	0	0	0	0	0
9. Felt fabric finishing	2.6	NA	5.2	5.2	0	0	0
Total	4.0	51.2	96.5	146.0	0	74.7	74.7

1/ For wool scouring plants the treatment alternative is M.

2/ Hosiery Products is a subdivision of the Knit Fabric Finishing Subcategory.

Source: Development Planning and Research Associates, Inc., estimated based on the impact methodology and material presented previously in this report.

Table VIII-25. The textile industry, projected employment losses attributable to the requirements of the wastewater control options--direct dischargers (BATEA) and indirect dischargers (PSES)

Subcategory	DIRECT DISCHARGERS (BATEA) Option 1 (Treatment Alternative A	Option 2 (Treatment Alternative C)	Option 3 (Treatment Alternative B)	Option 4 (Treatment Alternative D)[1/]	INDIRECT DISCHARGERS (PSES) Option 1 (Treatment Alternative A)	Option 2 (Treatment Alternative B)[1/]	Option 3 (Treatment Alternative D)[1/]
	Number of Employees				Number of Employees		
1. Wool scouring	0	NA	NA	653	0	213	213
2. Wool finishing	0	NA	142	142	0	658	658
4. Woven fabric finishing	0	207	276	276	0	510	510
5. Knit fabric finishing	0	234	366	366	0	910	910
5c. Hosiery products[2/]	230	NA	687	687	0	0	0
6. Carpet finishing	0	0	0	0	0	0	0
7. Stock & yarn finishing	0	1152	1986	2471	0	618	618
8. Nonwoven manufacturing	0	0	0	0	0	0	0
9. Felt fabric finishing	326	NA	652	652	0	0	0
Total	556	1593	4109	5247	0	2909	2090

1/ For wool scouring plants the treatment alternative is M.

2/ Hosiery Products is a subdivision of the Knit Fabric Finishing Subcategory.

Source: Development Planning and Research Associates, Inc., estimates based on the impact methodology and material presented previously in this report.

estimates were based on the projected number of plant closures presented in Tables VIII-21 and VIII-22 and relevant information regarding the employment characteristics of the economic models discussed in Chapter VI.

The potential employment losses associated with each treatment option are summarized below.

Treatment Option		Potentially Lost Employment (number jobs)	Lost Employment as a Percent of the Industry's Wet Processor Employment (percent)
BATEA	1	556	0.13
BATEA	2	1,593	0.38
BATEA	3	4,109	0.97
BATEA	4	5,247	1.24
PSES	1	0	0.00
PSES	2	2,909	0.69
PSES	3	2,909	0.69

These estimates are presented by subcategory in Table VIII-25.

While for specific closing plants employment losses would occur, for those remaining in operation, the requirement for controls may actually have a slightly positive effect on the overall employment. This would be due to the fact that individuals would be employed to construct the wastewater treatment facility as well as additional individuals would be necessary to operate the facility once it was complete.

E. Community Effects

The closure of close to 50 mills under the most expensive direct and indirect options can be expected to have impacts of varying degrees on the communities involved. The greatest impacts can be anticipated in the southeast among the small communities built up around textile mills. Lesser impacts can be expected in the northeast.

Of the mills projected to close, approximately 50 percent will be commission mills which are predominantly located in the northeast. For the most part, these mills are small mills employing less than 200 individuals and are concentrated primarily in Pennsylvania, New York, New Jersey, and Massachusetts. These mills are dispersed among both the large metropolitan areas and smaller communities. These smaller communities in the northeast are believed to be relatively large (generally over 20,000) when compared to other small communities in the United States. While the closures of commission mills can be expected to have impacts on a few towns in the northeast, they will not have any widespread impact on the northeast as employees losing their jobs in the textile mills in this region are believed to be able to find employment in other industries. Even the smaller communities affected will not necessarily lose the entire payroll of the closing mills as many of the personnel can be expected to find employment in nearby communities precluding displacement.

While the impacts on communities in the northeast are not expected to be major, the impacts on communities in the southeast are expected to be relatively substantial, primarily due to the greater size of the mills and the smaller size of the communities involved. Mills projected to close in the southeast are anticipated to be the larger integrated mills and mills finishing their own textile goods (woven fabric, yarn, and hosiery). From data contained in Davison's Blue Book concerning dyers and finishers and mills with dyeing and finishing equipment, it was possible to estimate where these closures may occur. According to Davison's Blue Book about 50 percent of the yarn and hosiery finishers are located in communities of less than 10,000 people (based on 1970 census data) with about 70 percent of the hosiery mills located in these size communities. Although a textile community of 5,000 people typically hosts from 3 to 6 mills, usually it will have only a single finisher. Consequently, several small communities can be expected to be directly affected by mill closures. With payroll losses varying from about one half million to over 2 million dollars, severe impacts can be expected to fall on these communities. It is very unlikely that the employment losses from a mill closure could easily be absorbed in these small southeastern communities. The remaining closures can be expected to occur in the larger communities in which the ramifications of a mill closure would be considerably less.

F. Dislocational Effects

The availability of land for construction of additional wastewater treatment facilities varies widely within the textile industry. Among the commission mills in the Northeast, very little additional land is believed to be available particularly for those facilities within large urban areas. However, in the Southeast, with a few exceptions, additional land acquisition for the larger integrated type mills is not generally a problem. As the treatment technologies have small space requirements which can be met, in most cases, within existing land resources, no significant dislocational effects are expected to result with the imposition of controls. It should be noted that mills with relatively limited available space often can capitalize unutilized in-house space, reorganize operations, and utilize less space-intensive technologies in order to comply with wastewater control requirements. Those very few mills without the required space are not likely to relocate. For the integrated mills, curtailment of finishing operations may be a feasible alternative; in these cases, greige textiles would be shipped elsewhere to be finished. For the commission mills, relocation would be very unlikely as these mills generally exist to serve specific markets. Relocation would reduce their ability to compete in those markets.

G. Balance of Trade Impacts

The imposition of the various treatment options on the textile industry is expected to have very little effect on the United States' balance of trade. This is primarily due to the relatively small proportion of the industry requiring treatment expenditures and the even smaller proportion being impacted to the point of closure. The textile industry has historically competed with foreign producers and, since no general price increases are projected, it is not anticipated the overall competitiveness of the domestic mills will be affected.

H. Summary of Recommended Treatment Options Impacts

The following summarizes the impacts associated with each of the wastewater treatment options recommended for implementation by the EPA. The recommended options were summarized in Chapter VII.

1. BATEA (Existing Direct Dischargers)

For BATEA, the EPA has recommended the selection of BATEA Option 2 for Woven Fabric Finishing (4), Knit Fabric Finishing (5 but excluding 5c), Carpet Finishing (6), Stock and Yarn Finishing (7), and Nonwoven Manufacturing (8) and BATEA Option 4 for Wool Scouring (1), Wool Finishing (2), and Hosiery Products (5c) as the basis for proposal of BAT effluent limitations. BATEA Option 1 has been recommended for Felt Fabric Processing (9).

The imposition of these options will potentially affect 214 direct discharging facilities with three felt fabric processing (9) facilities currently achieving BATEA Option 1 and 22 facilities in the other subcategories presently achieving their respective BATEA Options 2 or 4. Compliance with these options is anticipated to require an initial investment amounting to $48 million with annualized costs of $21 million. The price increases required to offset such expenditures have been projected to be 2.2 percent or less. With respect to financial effects, assuming no price increases, the BATEA recommended options could reduce the models' returns on sales from a base case range of -0.9 to 5.9 percent to a range of -3.8 to 5.0 percent, cause reductions in cash flows, and cause reductions in the models' net present values. Prior to compliance with these options one model was a base case closure, three models were marginal with the remainder models all being viable. When the models were impacted with the recommended options nine models indicated closure, four models indicated marginal, with the remainder being viable. These financial impacts resulted in the projection that 19 existing direct dischargers may close due to compliance requirements resulting in potential production losses amounting to 126.5 million pounds and employment losses of 3,401 employees. Resultant community impacts associated with the closures will vary, but it is anticipated some communities, particularly in the southeast may incur impacts. Balance of payment impacts are anticipated to be nominal.

2. PSES (Existing Indirect Dischargers)

The EPA has recommended PSES Option 2 for all existing indirect dischargers. Compliance with this option will affect 107 indirect dischargers and will require an initial investment amounting to $38 million with annualized cost approximating $19 million. Required price increases needed to offset compliance expenditures for the model plants were 4.3 percent or less. If no price increases were assumed the models' financial impacts included declines in the models' returns on sales from a range of -1.6 to 4.1 percent for the base case to a range of -11.8 to 3.7 percent for the impacted case, reductions in the models' annual cash flows, and reductions in the models' net present values. Prior to control compliance (base case) one model was projected to be a closure, four models were considered to be marginal with the remainder being considered viable. In the impacted case twelve models indicated closure, three models were marginal, and the remainder were viable. These financial impacts resulted in the projection that 20 existing indirect discharging facilities may close due to compliance requirements. These closures could result in production losses totaling 74.7 million pounds and employment losses totaling 2,909 employees. The severity of the community affects will vary but it is anticipated some communities, particularly in the southeast, may incur impacts. Balance of payments impacts are expected to be nominal.

3. NSPS (New Source Direct Dischargers)

NSPS Option 2 has been recommended by EPA as the treatment requirement for new source direct dischargers. Impacts associated with new source models were difficult to assess as they represent facilities which have yet to be constructed. However, based on the new source models, the imposition of NSPS Option 2 expenditures resulted in the new source models requiring projected price increases to offset control expenditures ranging from 0.8 to 3.4 percent. Assuming no price increases, projected impacts reflected reductions in returns on sales from a base case range of 3.3 to 7.4 percent to an impacted range of 1.8 to 6.7 percent, reductions in the annual cash flows but none to negative levels, and reductions in the models' net present values with none becoming negative in the impacted case which were not negative in the base case. the financial impact analysis it was projected that only one model changed its viability status due to the imposition of control expenditures. This model was the medium felt fabric processing (9) model which was marginal in the base case and became a closure in the impacted case. This subcategory (felt) was the only projected subcategory which the imposition of control requirements may have significant effects on the likelihood of the entrance of new facilities.

4. PSNS (New Source Indirect Dischargers)

The EPA has recommended PSNS Option 2 apply to new source indirect dischargers. As mentioned above new source model plant impacts caused by the imposition of wastewater control requirements were difficult to assess as new source models represent facilities which have yet to be constructed. However, based on the new source models, the imposition of PSNS Option 2 resulted in individual model plant projected required price increases ranging from 0.4 to 2.3 percent. Assuming no price increases, projected financial impacts reflected reductions in the models' returns on sales from a base case range of 2.7 to 8.5 percent to an impacted case range of 1.9 to 7.1 percent, reductions in the models' annual cash flows (none to the point of being negative), and reductions in the models' net present values with only the medium own fabric stock and yarn (7) model reflecting a negative net present value which was not negative in the base case (prior to control expenditures). Based on the financial analysis it was determined it would be doubtful if new source integrated wool finishing (2) facilities would be constructed even without control expenditures and that medium own fabric stock and yarn (7) operations may prove to be only marginally viable if required to meet PSNS Option 2 requirements. It is unlikely future growth in the other subcategories will be significantly affected by PSNS requirements.

IX. LIMITS OF THE ANALYSIS

There was considerable published information available covering the structure and economic data of the textile industry at the major (or total) and the minor (or weaving and finishing, knitting, other textile products) industry levels and also by the SIC industries. However, there was very little published information available which addressed the industry under the functional classification system used in this study. This chapter discusses the general accuracy of the report and some of the key assumptions involved.

A. General Accuracy

The data and other information used in this study were drawn from published governmental reports, the industry data collection portfolio, and from extensive contacts with individual mills. Information on the status of effluent discharge and on recommended wastewater control systems and costs were furnished by EPA. Every effort was made to verify the data and other information used.

Detailed data on size distribution within each subcategory was provided by EPA. Size distributions by type mill were based primarily on the industry surveys.

Financial aspects of the impact analysis were based on synthesized costs and returns for "representative" types of model plants. These costs and returns were developed from a variety of sources including published research from universities and government agencies, information obtained from the data collection portfolio, and published financial performance data.

Throughout the study, an effort was made to evaluate the data and other information used and to update these materials wherever possible. Checks were made with informed sources in industry and government to help assure that the data and information used were as reliable and as representative as possible. For example, construction costs, working capital requirements, proportions of capital financed through debt and equity, and profitability ratios were checked with the appropriate persons in industry firms who are experienced and knowledgeable in these matters. Efforts were made to use the latest data available.

Specifications of the contract required the Contractor to use effluent control costs provided by EPA. The Effluent Guidelines Division, EPA, and the technical contractor provided recommended alternative effluent control systems, investment costs and annual operating costs adapted to the types and sizes of "representative" model plants used in this analysis.

Given the accuracy of the wastewater control costs, it is believed that this study's analysis represents a usefully accurate evaluation of the economic impact of the proposed guidelines. For informational purposes, a sensitivity analysis was conducted utilizing different assumptions about the wastewater control costs. The results of this sensitivity analysis are presented in Appendix D of this report.

B. Range of Error

Different data series and different sections of the analysis will have different possible ranges or error.

Estimated data error ranges expressed as an average for the industry were as follows. These were based on review of the variability in survey data received and estimates of possible error in interpretation and application of published and unpublished information.

		Error Range (Percent)
1.	Information regarding the organization and structure of the industry, number, location and size of plants, and other information descriptive of industry segments	± 10
2.	Price information for products and raw materials	± 20
3.	Cost information for plant investments and operating costs	± 20
4.	Financial information concerning the industry	± 15

C. Critical Assumptions

In an economic impact analysis of most any industry, it is inevitable that simplifying assumptions must be made to bring the problem into a framework of analysis consistent with the constraints of time, budget, and data availability. The major critical assumptions used in this analysis were as follows:

1. Types and sizes of the model plants were representative of plants actually existing in the industry and of plants expected to be built in the future.

2. It was assumed that the financial data were representative of costs and returns of existing plants or new plants to be constructed after promulgation of proposed guidelines. As stated earlier, the model plant financial data are based on 1977 dollars and were adjusted to reflect future economic activity.

3. Levels of profitability reflected in model plant profiles (based generally on 1977 economic conditions) would remain essentially the same but reflecting the general economic activity expected for the future 21 years.

4. It was assumed that the economic impacts of wastewater controls on those products not included in the detailed analysis of "representative" plants could be evaluated in general terms through associating them with those "representative" model plants for which detailed analyses were made. This association was based primarily on the fact that models were developed for a single product plant which represented a majority of industry segment's production. In most cases, there were actual plants producing products in similar combinations as those described in the model plants.

5. Wastewater control costs and control status estimates were supplied by the Effluent Guidelines Division, EPA. It was assumed these data were realistic in terms of:

   (a) applicability of effluent treatment systems recommended,

   (b) investment and annual operating costs for systems, and

   (c) percentage of total number of plants which have treatment in place for each industry segment and for the industry in general as reported in the Development Document.

APPENDIX A

SELECTED REFERENCES

SELECTED REFERENCES

1. Cline, W.R., N. Kawanabe, T.O.M. Kronsjo, and T. Williams, _Trade Negotiations in the Tokyo Round_, The Brookings Institutions, Wash.D.C.

2. _Daily News Record_, Fairchild Publications, N.Y.

3. _Davison's Textile Blue Book_, Davison Publishing Co., Ridgewood, N.J., 1979.

4. _Fairchilds' Textile and Apparel Financial Directory_, Fairchild Publications, N.Y., 1978.

5. _Federal Reserve Bulletin_.

6. Federal Trade Commission, Quarterly Financial, _Report for Manufacturing Corporations_.

7. Hudak, Stephen J. and Paul T. Bohnslav, _The Textile Industry_, Department of the Treasury, 1976.

8. Rand McNally, _Road Atlas_, Chicago, Ill., 1979.

9. Robert Morris Associates, _Annual Statement Studies_, 1973-1978.

10. Standard and Poor's, "Textiles Basic Analysis," _Industry Surveys_, 1979.

11. _Textile Hi-Lights_.

12. _Textile Organon_, Textile Economics Bureau, Inc., N.Y.

13. Troy, Leo, _Almanac of Business and Industrial Financial Ratios_, 1977.

14. U.S. Department of Agriculture, Economics, Statistics, and Cooperative Service, _Cotton and Wool Situation_.

15. ________________, ________, _Supplement for 1978 to Statistics on Cotton and Related Data 1920-73_, Statistical Bulletin No. 535.

16. ________________, Economic Research Service, _U.S. Textile Fiber Demand_, Technical Bulletin 1500, 1974.

17. U.S. Department of Commerce, Bureau of Economic Analysis, _Survey of Current Business_.

18. ________________, Bureau of the Census, _Census of Manufactures_, 1958-1977.

19. ____________________, ________________, Average Weight and Width of Broadwoven Fabrics (Gray), MC-22T (Supplement) 1977.

20. ____________________, ________________, Current Industrial Report Series MQ-C1(76)-2, Survey of Plant Capacity, 1976.

21. ____________________, ________________, Current Industrial Report Series M22A, Woven Fabrics-Production, Inventories, and Unbilled Orders.

22. ____________________, ________________, Current Industrial Report Series 1722D, Consumption on the Woolen and Worsted System.

23. ____________________, ________________, Current Industrial Report Series M22D, Cotton, Manmade Fiber Stable, and Linters-Consumption, Stocks, and Spindle Activity.

24. ____________________, ________________, Current Industrial Report Series MQ22K, Knit Fabric Production.

25. ____________________, ________________, Current Industrial Report Series MA-22F.1, Textured Yarn Production.

26. ____________________, ________________, Current Industrial Report Series MA-22F.2, Spun Yarn Production.

27. ____________________, ________________, Current Industrial Report Series MA-22S, Broadwoven Fabric Finished.

28. ____________________, ________________, Current Industrial Report Series MQ-22T, Broadwoven Gray Fabric.

29. ____________________, ________________, Current Industrial Report Series MQ-23X, Sheets, Pillowcases, and Towels.

30. ____________________, ________________, Current Industrial Report Series MC-22Z, Textile Machinery in Place (All Types).

31. ____________________, ________________, Current Industrial Report Series, MA-200(76)-1, Manufacturers' Pollution Abatement Capital Expenditures and Operating Costs.

32. ____________________, U.S. Imports: Ratios of Textiles/Apparel, 1977.

33. U.S. Environmental Protection Agency. Development Document for Effluent Limitations Guidelines and New Source Performance Standards for the Textile Mills, EPA-440/1-79-022-b, October, 1979.

34. ____________________, Technical Study Report BATEA-NSPS-PSES-PSNS Textile Mills Point Source Category, prepared by Sverdrup and Parcel and Associates, Inc. 1978.

35. ________________, Economic Analysis of Pretreatment Standards for the Textile Industry, EPA 440/1-77-009, 1977.

36. U.S. International Trade Commission, The History and Current Status of the Multifiber Arrangement, USITC Publication 880, 1978.

37. ________________, Operation of the Trade Agreements Program, USITC Publication 791.

38. U.S. Department of Labor, Bureau of Labor Statistics, Wholesale Price Indexes.

39. ________________, ________________, Industry Wage Survey: Textiles, May 1975, Bulletin 1945, 1977.

40. ________________, ________________, Industry Wage Survey: Textile Dyeing and Finishing, June 1976, Bulletin 1967, 1977.

41. ________________, ________________, Productivity Indexes for Selected Industries, Bulletin 1983, 1977.

42. ________________, ________________, Industry Wage Survey: Hosiery, July 1976, Bulletin 1987, 1977.

43. U.S. Treasury Department, Internal Revenue Service, Corporation Source Book of Statistics of Income, 1967-1974.

44. The Value Line Investment Survey, Arnold Bernhard & Co., N.Y., 1979.

45. Ward, Lionel Edward, Interfiber Competition with Emphasis on Cotton, University of California, Davis, Ph.D., Economics, Agriculture, University Microfilms, Inc., Ann Arbor, Michigan, 1969.

APPENDIX B

MODEL PLANT FINANCIAL PROFILES

APPENDIX B INDEX

Model Plant Financial Profiles

Existing/new source	Segment	Type of mill	Discharge	Appendix table number
Existing	Wool scouring	Commission	Direct	B-1
Existing	Wool finishing	Commission	Direct	B-2
Existing	Wool finishing	Integrated	Direct	B-3
Existing	Woven fabric finishing	Commission	Direct	B-4
Existing	Woven fabric finishing	Own fabric	Direct	B-5
Existing	Woven fabric finishing	Integrated	Direct	B-6
Existing	Knit fabric finishing	Commission	Direct	B-7
Existing	Knit fabric finishing	Integrated	Direct	B-8
Existing	Hosiery finishing	Own hosiery	Direct	B-9
Existing	Hosiery finishing	Integrated	Direct	B-10
Existing	Carpet finishing	Integrated	Direct	B-11
Existing	Stock and yarn finishing	Commission	Direct	B-12
Existing	Stock and yarn finishing	Own yarn	Direct	B-13
Existing	Stock and yarn finishing	Integrated	Direct	B-14
Existing	Nonwoven fabric finishing	Felt	Direct	B-15
Existing	Nonwoven fabric finishing	Nonwoven	Direct	B-16
Existing	Wool scouring	Commission	Indirect	B-17
Existing	Wool finishing	Commission	Indirect	B-18
Existing	Wool finishing	Integrated	Indirect	B-19
Existing	Woven fabric finishing	Commission	Indirect	B-20
Existing	Woven fabric finishing	Own	Indirect	B-21
Existing	Woven fabric finishing	Integrated	Indirect	B-22
Existing	Knit fabric finishing	Commission	Indirect	B-23
Existing	Knit fabric finishing	Integrated	Indirect	B-24
Existing	Hosiery manufacturing	Own	Indirect	B-25
Existing	Hosiery manufacturing	Integrated	Indirect	B-26
Existing	Carpet manufacturing	Integrated	Indirect	B-27
Existing	Stock and yarn finishing	Commission	Indirect	B-28
Existing	Stock and yarn finishing	Own	Indirect	B-29
Existing	Stock and yarn finishing	Integrated	Indirect	B-30
Existing	Nonwoven	Felt	Indirect	B-31
New source	Nonwoven	Non-woven	Indirect	B-32
New source	Wool finishing	Integrated	Direct	B-33
New source	Woven fabric finishing	Own	Direct	B-34
New source	Woven fabric finishing	Integrated	Direct	B-35
New Source	Knit fabric finishing	Integrated	Direct	B-36
New source	Hosiery manufacturing	Integrated	Direct	B-37
New source	Carpet manufacturing	Integrated	Direct	B-38
New source	Stock and yarn finishing	Own	Direct	B-39
New source	Nonwoven	Felt	Direct	B-40
New source	Nonwoven	Nonwoven	Direct	B-41
New source	Wool finishing	Integrated	Indirect	B-42
New source	Woven fabric finishing	Own	Indirect	B-43
New source	Woven fabric finishing	Integrated	Indirect	B-44
New source	Knit fabric finishing	Integrated	Indirect	B-45
New source	Hosiery manufacturing	Integrated	Indirect	B-46
New source	Carpet manufacturing	Integrated	Indirect	B-47
New Source	Stock and yarn finishing	Own	Indirect	B-48
New source	Nonwoven	Felt	Indirect	B-49
New source	Nonwoven	Nonwoven	Indirect	B-50

Appendix Table B-1. The Textile Mills Industry, representative existing model plants' cost characteristics

SEGMENT: Wool Scouring TYPE OF MILL: Commission TYPE OF DISCHARGER: Direct

	Small		Medium		Large	
	($000)	(Percent)	($000)	(Percent)	($000)	(Percent)
SALES	3,327.1	100.0	7,473.1	100.0	13,500.3	100.0
COSTS:						
Textile Materials	0.0	0.0	0.0	0.0	0.0	0.0
Direct Labor	954.9	28.7	1,830.9	24.5	5,035.7	37.3
Indirect Labor	479.1	14.4	956.6	12.8	1,039.5	7.7
Other	1,843.2	55.4	4,087.8	54.7	6,318.1	46.8
TOTAL	3,277.2	98.5	6,875.3	92.0	12,393.3	91.8
CASH EARNINGS	49.9	1.5	597.8	8.0	1,107.0	8.2
LESS:						
Depreciation	76.6	2.3	373.7	5.0	432.0	3.2
Interest	16.6	0.5	7.6	0.1	0.0	0.0
PRE-TAX INCOME	-43.3	-1.3	216.5	2.9	675.0	5.0
INCOME TAX	0.0		90.4	1.2	310.5	2.3
AFTER-TAX INCOME	-43.3	-1.3	126.1	1.7	364.5	2.7
CASH FLOW	33.3	1.0	499.8	6.7	796.5	5.9

Appendix Table B-2. The Textile Mills Industry, representative existing model plants' cost characteristics

SEGMENT: Wool Finishing TYPE OF MILL: Commission TYPE OF DISCHARGER: Direct

	Small	
	($000)	(Percent)
SALES	2,929.8	100.0
COSTS:		
Textile Materials	0.0	0.0
Direct Labor	583.0	19.9
Indirect Labor	193.4	6.6
Other	2,062.6	70.4
TOTAL	2,839.0	96.9
CASH EARNINGS	90.8	3.1
LESS:		
Depreciation	11.7	0.4
Interest	0.0	0.0
PRE-TAX INCOME	79.1	2.7
INCOME TAX	24.5	0.8
AFTER-TAX INCOME	54.6	1.9
CASH FLOW	66.3	2.3

Appendix Table B-3. The Textile Mills Industry, representative existing model plants' cost characteristics

SEGMENT: Wool Finishing TYPE OF MILL: Integrated TYPE OF DISCHARGER: Direct

	Small		Medium		Large	
	($000)	(Percent)	($000)	(Percent)	($000)	(Percent)
SALES	22,127.7	100.0	32,143.6	100.0	84,656.0	100.0
COSTS:						
Textile Materials	8,231.5	37.2	12,503.9	38.9	37,502.6	44.3
Direct Labor	5,332.8	24.1	6,493.0	20.2	17,354.5	20.5
Indirect Labor	1,814.5	8.2	2,507.2	7.8	4,910.0	5.8
Other	5,664.7	25.6	8,807.3	27.4	15,830.7	18.7
TOTAL	21,043.4	95.1	30,311.4	94.3	75,597.8	89.3
CASH EARNINGS	1,084.3	4.9	1,832.2	5.7	9,058.2	10.7
LESS:						
Depreciation	309.8	1.4	353.6	1.1	1,862.4	2.2
Interest	331.9	1.5	417.8	1.3	1,185.2	1.4
PRE-TAX INCOME	442.6	2.0	1,060.8	3.3	6,010.6	7.1
INCOME TAX	198.9	0.9	495.7	1.5	2,871.6	3.4
AFTER-TAX INCOME	243.7	1.1	565.1	1.8	3,139.0	3.7
CASH FLOW	553.5	2.5	918.7	2.9	5,001.4	5.9

Appendix Table B-4. The Textile Mills Industry, representative existing model plants' cost characteristics

SEGMENT: Woven Fabric Finishing TYPE OF MILL: Integrated TYPE OF DISCHARGER: Direct

	Small		Medium		Large		X-Large	
	($000)	(%)	($000)	(%)	($000)	(%)	($000)	(%)
SALES	9,355.8	100.0	23,629.4	100.0	57,408.2	100.0	235,290.0	100.0
COSTS:								
Textile Materials	4,509.5	48.2	10,137.0	42.9	23,652.1	41.2	110,586.3	47.0
Direct Labor	1,562.4	16.7	4,820.4	20.4	12,572.4	21.9	63,998.9	27.2
Indirect Labor	402.3	4.3	921.6	3.9	1,837.1	3.2	11,058.6	4.7
Other	2,273.5	24.3	6,072.8	25.7	14,065.0	24.5	33,646.5	14.3
TOTAL	8,747.7	93.5	21,951.8	92.9	52,126.6	90.8	219,290.3	93.2
CASH EARNINGS	608.1	6.5	1,677.6	7.1	5,281.6	9.2	15,999.7	6.8
LESS:								
Depreciation	233.9	2.5	401.7	1.7	1,607.5	2.8	3,999.9	1.7
Interest	149.7	1.6	448.9	1.9	1,205.6	2.1	1,411.7	0.6
PRE-TAX INCOME	224.5	2.4	827.0	3.5	2,468.5	4.3	10,588.1	4.5
INCOME TAX	94.3	1.0	383.5	1.6	1,171.4	2.0	5,068.8	2.2
AFTER-TAX INCOME	130.2	1.4	443.5	1.9	1,297.1	2.3	5,519.3	2.3
CASH FLOW	364.1	3.9	845.2	3.6	2,904.6	5.1	9,519.2	4.0

Appendix Table B-5. The Textile Mills Industry, representative existing model plants' cost characteristics

SEGMENT: Woven Fabric Finishing TYPE OF MILL: Own Fabric TYPE OF DISCHARGER: Direct

	Small		Medium		Large	
	($000)	(Percent)	($000)	(Percent)	($000)	(Percent)
SALES	8,766.1	100.0	44,168.7	100.0	113,607.2	100.0
COSTS:						
Textile Materials	4,225.3	48.2	28,003.0	63.4	72,367.8	63.7
Direct Labor	973.0	11.1	3,754.3	8.5	10,451.9	9.2
Indirect Labor	587.3	6.7	1,280.9	2.9	2,272.1	2.0
Other	2,586.0	29.5	9,142.8	20.7	23,630.3	20.8
TOTAL	8,371.6	95.5	42,181.0	95.5	108,722.1	95.7
CASH EARNINGS	394.5	4.5	1,987.7	4.5	4,885.1	4.3
LESS:						
Depreciation	140.3	1.6	618.4	1.4	1,476.9	1.3
Interest	52.6	0.6	265.0	0.6	0.0	0.0
PRE-TAX INCOME	202.2	2.3	1,104.3	2.5	3,408.2	3.0
INCOME TAX	83.6	1.0	516.6	1.2	1,622.4	1.4
AFTER-TAX INCOME	118.6	1.3	587.7	1.3	1,785.8	1.6
CASH FLOW	258.9	3.0	1,206.1	2.7	3,262.7	2.9

Appendix Table B-6. The Textile Mills Industry, representative existing model plants' cost characteristics

SEGMENT: Woven Fabric Finishing TYPE OF MILL: Commission TYPE OF DISCHARGER: Direct

	Small		Medium		Large	
	($000)	(Percent)	($000)	(Percent)	($000)	(Percent)
SALES	1,688.9	100.0	6,966.5	100.0	31,383.0	100.0
COSTS:						
Textile Materials	0.0	0.0	0.0	0.0	0.0	0.0
Direct Labor	493.2	29.2	1,964.6	28.2	9,571.8	30.5
Indirect Labor	140.2	8.3	501.6	7.2	2,039.9	6.5
Other	998.0	59.1	3,977.6	57.1	16,852.7	53.7
TOTAL	1,631.4	96.6	6,443.8	92.5	28,464.4	90.7
CASH EARNINGS	57.5	3.4	522.7	7.5	2,918.6	9.3
LESS:						
Depreciation	8.5	0.5	348.4	5.0	1,255.3	4.0
Interest	16.9	1.0	14.0	0.2	721.8	2.3
PRE-TAX INCOME	32.1	1.9	160.3	2.3	941.5	3.0
INCOME TAX	6.6	0.4	63.4	0.9	438.4	1.4
AFTER-TAX INCOME	25.5	1.5	96.9	1.4	503.1	1.6
CASH FLOW	34.0	2.0	445.3	6.4	1,758.4	5.6

Appendix Table B-7. The Textile Mills Industry, representative existing model plants' cost characteristics

SEGMENT: Knit Fabric Finishing TYPE OF MILL: Commission TYPE OF DISCHARGER: Direct

	Medium (Simple)		Medium (Complex)		Large	
	($000)	(Percent)	($000)	(Percent)	($000)	(Percent)
SALES	2,833.9	100.0	2,957.3	100.0	5,988.9	100.0
COSTS:						
Textile Materials	0.0	0.0	0.0	0.0	0.0	0.0
Direct Labor	926.7	32.7	875.4	29.6	1,832.6	30.6
Indirect Labor	277.7	9.8	239.5	8.1	574.9	9.6
Other	1,513.3	53.4	1,715.2	58.0	2,743.0	45.8
TOTAL	2,717.7	95.9	2,830.1	95.7	5,150.5	86.0
CASH EARNINGS	116.2	4.1	127.2	4.3	838.4	14.0
LESS:						
Depreciation	85.0	3.0	20.7	0.7	443.2	7.4
Interest	14.1	0.5	23.7	0.8	126.0	2.1
PRE-TAX INCOME	17.1	0.6	82.8	2.8	269.2	4.5
INCOME TAX	3.4	0.1	26.2	0.9	115.7	1.9
AFTER-TAX INCOME	13.7	0.5	56.6	1.9	153.5	2.6
CASH FLOW	98.7	3.5	77.3	2.6	596.7	10.0

Appendix Table B-8. The Textile Mills Industry, representative existing model plants' cost characteristics

SEGMENT: Knit Fabric Finishing TYPE OF MILL: Integrated TYPE OF DISCHARGER: Direct

	Medium (Simple)		Medium (Complex)		Large	
	($000)	(Percent)	($000)	(Percent)	($000)	(Percent)
SALES	15,044.7	100.0	13,946.8	100.0	30,134.7	100.0
COSTS:						
Textile Materials	8,801.1	58.5	6,680.5	47.9	17,297.3	57.4
Direct Labor	1,880.6	12.5	1,422.6	10.2	3,766.8	12.5
Indirect Labor	631.9	4.2	474.2	3.4	1,145.1	3.8
Other	3,024.0	20.1	4,476.9	32.1	4,791.4	15.9
TOTAL	14,337.6	95.3	13,054.2	93.6	27,000.6	89.6
CASH EARNINGS	707.1	4.7	892.6	6.4	3,134.1	10.4
LESS:						
Depreciation	210.7	1.4	195.3	1.4	1,265.6	4.2
Interest	15.0	0.1	153.4	1.1	210.9	0.7
PRE-TAX INCOME	481.4	3.2	543.9	3.9	1,657.6	5.5
INCOME TAX	217.6	1.4	247.6	1.8	782.1	2.6
AFTER-TAX INCOME	263.8	1.8	296.3	2.1	875.5	2.9
CASH FLOW	474.5	3.2	491.6	3.5	2,141.1	7.1

Appendix Table B-9. The Textile Mills Industry, representative existing model plants' cost characteristics

SEGMENT: Hosiery TYPE OF MILL: Own TYPE OF DISCHARGER: Direct

	Small		Medium	
	($000)	(Percent)	($000)	(Percent)
SALES	6,002.5	100.0	18,250.4	100.0
COSTS:				
Textile Materials	2,827.1	47.1	8,595.9	47.1
Direct Labor	1,374.5	22.9	4,069.8	22.3
Indirect Labor	270.1	4.5	930.8	5.1
Other	1,374.5	22.9	3,522.3	19.3
TOTAL	5,846.2	97.4	17,118.8	93.8
CASH EARNINGS	156.1	2.6	1,131.6	6.2
LESS:				
Depreciation	84.0	1.4	255.6	1.4
Interest	36.1	0.6	109.6	0.6
PRE-TAX INCOME	36.0	0.6	766.4	4.2
INCOME TAX	7.4	0.1	354.4	1.9
AFTER-TAX INCOME	28.6	0.5	412.0	2.3
CASH FLOW	112.6	1.9	667.6	3.7

Appendix Table B-10. The Textile Mills Industry, representative existing model plants' cost characteristics

SEGMENT: Hosiery Manufacturing TYPE OF MILL: Integrated TYPE OF DISCHARGER: Direct

	Small		Medium	
	($000)	(Percent)	($000)	(Percent)
SALES	10,837.1	100.0	18,250.4	100.0
COSTS:				
Textile Materials	3,868.8	35.7	8,157.9	44.7
Direct Labor	2,470.8	22.8	3,923.8	21.5
Indirect Labor	455.2	4.2	1,076.9	5.9
Other	3,489.5	32.2	3,887.4	21.3
TOTAL	10,284.4	94.9	17,045.9	93.4
CASH EARNINGS	522.7	5.1	1,204.5	6.6
LESS:				
Depreciation	184.2	1.7	273.7	1.5
Interest	130.0	1.2	164.3	0.9
PRE-TAX INCOME	208.5	1.9	766.5	4.2
INCOME TAX	86.6	0.8	354.4	1.9
AFTER-TAX INCOME	121.9	1.1	412.1	2.3
CASH FLOW	306.1	2.8	685.8	3.8

Appendix Table B-11. The Textile Mills Industry, representative existing model plants' cost characteristics

SEGMENT: Carpet Mills TYPE OF MILL: Integrated TYPE OF DISCHARGER: Direct

	Small		Medium		Large	
	($000)	(Percent)	($000)	(Percent)	($000)	(Percent)
SALES	25,238.9	100.0	50,158.7	100.0	135,430.4	100.0
COSTS:						
Textile Materials	12,064.2	47.8	26,734.6	53.3	74,351.3	54.9
Direct Labor	2,801.5	11.1	4,363.8	8.7	10,021.9	7.4
Indirect Labor	1,741.5	6.9	1,855.9	3.7	2,844.0	2.1
Other	7,319.3	29.0	14,044.4	28.0	38,733.1	28.6
TOTAL	23,926.5	94.8	46,998.7	93.7	125,950.3	93.0
CASH EARNINGS	1,312.4	5.2	3,160.0	6.3	9,480.1	7.0
LESS:						
Depreciation	403.8	1.6	601.9	1.2	1,896.0	1.4
Interest	252.4	1.0	1,103.5	2.2	3,114.9	2.3
PRE-TAX INCOME	656.2	2.6	1,454.6	2.9	4,469.2	3.3
INCOME TAX	301.5	1.2	684.7	1.4	2,131.7	1.6
AFTER-TAX INCOME	354.7	1.4	769.9	1.5	2,337.5	1.7
CASH FLOW	758.5	3.0	1,371.8	2.7	4,233.5	3.1

Appendix Table B-12. The Textile Mills Industry, representative existing model plants' cost characteristics

SEGMENT: Stock & Yarn Finishing TYPE OF MILL: Commission TYPE OF DISCHARGER: Direct

	Small		Medium		Large	
	($000)	(Percent)	($000)	(Percent)	($000)	(Percent)
SALES	1,758.0	100.0	4,493.5	100.0	12,192.7	100.0
COSTS:						
Textile Materials	0.0	0.0	0.0	0.0	0.0	0.0
Direct Labor	409.6	23.3	880.7	19.6	3,145.7	25.8
Indirect Labor	218.0	12.4	274.1	6.1	1,146.1	9.4
Other	998.5	56.8	2,979.3	66.3	6,876.7	56.4
TOTAL	1,626.1	92.5	4,134.1	92.0	11,168.5	91.6
CASH EARNINGS	131.9	7.5	359.4	8.0	1,024.2	8.4
LESS:						
Depreciation	61.6	3.5	157.2	3.5	426.7	3.5
Interest	30.0	1.7	76.4	1.7	207.3	1.7
PRE-TAX INCOME	40.3	2.3	125.8	2.8	390.2	3.2
INCOME TAX	8.4	0.5	46.9	1.0	173.8	1.4
AFTER-TAX INCOME	31.9	1.8	78.9	1.8	216.4	1.8
CASH FLOW	93.5	5.3	236.1	5.3	643.1	5.3

Appendix Table B-13. The Textile Mills Industry, representative existing model plants' cost characteristics

SEGMENT: Stock & Yarn Finishing TYPE OF MILL: Own TYPE OF DISCHARGER: Direct

	Small		Medium		Large		X-Large	
	($000)	(%)	($000)	(%)	($000)	(%)	($000)	(%)
SALES	9,078.9	100.0	16,151.0	100.0	28,169.9	100.0	33,459.9	100.0
COSTS:								
Textile Materials	4,339.7	47.8	8,656.9	53.6	15,831.5	56.2	19,975.6	59.7
Direct Labor	917.0	10.1	1,728.2	10.7	2,986.0	10.6	4,282.9	12.8
Indirect Labor	499.3	5.5	662.2	4.1	2,140.9	7.6	970.3	2.9
Other	3,041.5	33.5	4,586.8	28.4	5,014.3	17.8	5,888.9	17.6
TOTAL	8,797.5	96.9	15,634.1	96.8	25,972.7	92.2	31,117.7	93.0
CASH EARNINGS	281.4	3.1	516.9	3.2	2,197.2	7.8	2,342.2	7.0
LESS:								
Depreciation	72.7	0.8	177.7	1.1	817.0	2.9	501.9	1.5
Interest	90.8	1.0	0.0	0.0	450.7	1.6	133.8	0.4
PRE-TAX INCOME	117.9	1.3	339.2	2.1	929.5	3.3	1,706.5	5.1
INCOME TAX	43.1	0.5	149.3	0.9	432.7	1.5	805.6	2.4
AFTER-TAX INCOME	74.8	0.8	189.9	1.2	496.8	1.8	900.9	2.7
CASH FLOW	147.5	1.6	367.6	2.3	1,313.8	4.7	1,402.8	4.2

Appendix Table B-14. The Textile Mills Industry, representative existing model plants' cost characteristics

SEGMENT: Stock & Yarn Finishing TYPE OF MILL: Integrated TYPE OF DISCHARGER: Direct

	Small		Large	
	($000)	(Percent)	($000)	(Percent)
SALES	6,322.2	100.0	27,316.3	100.0
COSTS:				
Textile Materials	2,573.1	40.7	15,024.0	55.0
Direct Labor	1,669.1	26.4	5,791.1	21.2
Indirect Labor	493.1	7.8	901.4	3.3
Other	1,264.5	20.0	3,906.2	14.3
TOTAL	5,999.8	94.9	25,622.7	93.8
CASH EARNINGS	322.4	5.1	1,693.6	6.2
LESS:				
Depreciation	177.0	2.8	546.3	2.0
Interest	0.0	0.0	273.2	1.0
PRE-TAX INCOME	145.4	2.3	874.1	3.2
INCOME TAX	56.3	0.9	406.1	1.5
AFTER-TAX INCOME	89.1	1.4	468.0	1.7
CASH FLOW	266.1	4.2	1,014.3	3.7

Appendix Table B-15. The Textile Mills Industry, representative existing model plants' cost characteristics

SEGMENT: Nonwoven Fabric Finishing TYPE OF MILL: Felt TYPE OF DISCHARGER: Direct

	Medium	
	($000)	(Percent)
SALES	5,309.9	100.0
COSTS:		
Textile Materials	1,359.3	25.6
Direct Labor	1,593.0	30.0
Indirect Labor	154.0	2.9
Other	1,906.3	35.9
TOTAL	5,012.6	94.4
CASH EARNINGS	297.3	5.6
LESS:		
Depreciation	159.3	3.0
Interest	63.7	1.2
PRE-TAX INCOME	74.3	1.4
INCOME TAX	22.2	0.4
AFTER-TAX INCOME	52.1	1.0
CASH FLOW	211.4	4.0

Appendix Table B-16. The Textile Mills Industry, representative existing model plants' cost characteristics

SEGMENT: Nonwoven Fabric Finishing TYPE OF MILL: Nonwoven TYPE OF DISCHARGER: Direct

	Medium	
	($000)	(Percent)
SALES	7,249.8	100.0
COSTS:		
Textile Materials	2,225.7	30.7
Direct Labor	732.2	10.1
Indirect Labor	72.5	1.0
Other	3,530.7	48.7
TOTAL	6,561.1	90.5
CASH EARNINGS	688.7	9.5
LESS:		
Depreciation	188.5	2.6
Interest	94.2	1.3
PRE-TAX INCOME	406.0	5.6
INCOME TAX	181.4	2.5
AFTER-TAX INCOME	224.6	3.1
CASH FLOW	413.1	5.7

Appendix Table B-17. The Textile Mills Industry, representative existing model plants' cost characteristics

SEGMENT: Wool Scouring TYPE OF MILL: Commission TYPE OF DISCHARGER: Indirect

	Small		Large	
	($000)	(Percent)	($000)	(Percent)
SALES	3,892.0	100.0	14,074.2	100.0
COSTS:				
Textile Materials	0.0	0.0	0.0	0.0
Direct Labor	1,117.0	28.7	5,249.7	37.3
Indirect Labor	560.4	14.4	1,083.7	7.7
Other	2,183.0	56.1	6,600.9	46.9
TOTAL	3,860.5	99.2	12,934.3	91.9
CASH EARNINGS	31.5	0.8	1,139.9	8.1
LESS:				
Depreciation	89.9	2.3	450.4	3.2
Interest	19.5	0.5	0.0	0.0
PRE-TAX INCOME	-77.9	-2.0	689.5	4.9
INCOME TAX	0.0	0.0	317.5	2.3
AFTER-TAX INCOME	-77.9	-2.0	372.0	2.6
CASH FLOW	12.0	0.3	822.4	5.8

Appendix Table B-18. The Textile Mills Industry, representative existing model plants' cost characteristics

SEGMENT: Wool Finishing TYPE OF MILL: Commission TYPE OF DISCHARGER: Indirect

	Small	
	($000)	(Percent)
SALES	1,149.1	100.0
COSTS:		
Textile Materials	0.0	0.0
Direct Labor	228.7	19.9
Indirect Labor	75.8	6.6
Other	809.0	70.4
TOTAL	1,113.5	96.9
CASH EARNINGS	35.6	3.1
LESS:		
Depreciation	4.6	0.4
Interest	0.0	0.0
PRE-TAX INCOME	31.0	2.7
INCOME TAX	6.3	0.5
AFTER-TAX INCOME	24.7	2.1
CASH FLOW	29.3	2.5

Appendix Table B-19. The Textile Mills Industry, representative existing model plants' cost characteristics

SEGMENT: Wool Finishing TYPE OF MILL: Integrated TYPE OF DISCHARGER: Indirect

	Small		Medium		Large	
	($000)	(Percent)	($000)	(Percent)	($000)	(Percent)
SALES	6,913.7	100.0	36,428.9	100.0	80,423.7	100.0
COSTS:						
Textile Materials	2,571.9	37.2	14,170.8	38.9	35,627.7	44.3
Direct Labor	1,666.2	24.1	7,358.6	20.2	16,486.9	20.5
Indirect Labor	566.9	8.2	2,841.5	7.8	4,664.6	5.8
Other	1,783.7	25.8	9,981.7	27.4	15,280.5	19.0
TOTAL	6,588.7	95.3	34,352.6	94.3	72,059.6	89.6
CASH EARNINGS	325.0	4.7	2,076.3	5.7	8,364.1	10.4
LESS:						
Depreciation	96.8	1.4	400.7	1.1	1,769.3	2.2
Interest	103.8	1.5	473.5	1.3	1,125.9	1.4
PRE-TAX INCOME	124.4	1.8	1,202.1	3.3	5,468.9	6.8
INCOME TAX	46.2	0.7	563.5	1.5	2,611.6	3.2
AFTER-TAX INCOME	78.2	1.1	638.6	1.8	2,857.3	3.6
CASH FLOW	175.0	2.5	1,039.3	2.9	4,626.6	5.8

Appendix Table B-20. The Textile Mills Industry, representative existing model plants' cost characteristics

SEGMENT: Woven Fabric Finishing TYPE OF MILL: Commission TYPE OF DISCHARGER: Indirect

	Small		Medium		Large	
	($000)	(Percent)	($000)	(Percent)	($000)	(Percent)
SALES	569.5	100.0	6,095.7	100.0	36,111.4	100.0
COSTS:						
Textile Materials	0.0	0.0	0.0	0.0	0.0	0.0
Direct Labor	166.3	29.2	1,719.0	28.2	11,014.0	30.5
Indirect Labor	47.3	8.3	438.9	7.2	2,347.2	6.5
Other	338.2	59.4	3,468.4	56.9	19,319.6	53.5
TOTAL	551.8	96.9	5,626.3	92.3	32,680.8	90.5
CASH EARNINGS	17.7	3.1	469.4	7.7	3,430.6	9.5
LESS:						
Depreciation	2.9	0.5	304.8	5.0	1,444.5	4.0
Interest	6.3	1.1	12.2	0.2	830.6	2.3
PRE-TAX INCOME	8.5	1.5	152.4	2.5	1,155.5	3.2
INCOME TAX	1.7	0.3	59.6	1.0	541.1	1.5
AFTER-TAX INCOME	6.8	1.2	92.7	1.5	614.4	1.7
CASH FLOW	9.7	1.7	397.5	6.5	2,058.9	5.7

Appendix Table B-21. The Textile Mills Industry, representative existing model plants' cost characteristics

SEGMENT: Woven Fabric Finishing TYPE OF MILL: Own TYPE OF DISCHARGER: Indirect

	Small		Medium		Large	
	($000)	(Percent)	($000)	(Percent)	($000)	(Percent)
SALES	2,959.2	100.0	38,646.7	100.0	130,723.1	100.0
COSTS:						
Textile Materials	1,426.3	48.2	24,502.0	63.4	83,270.6	63.7
Direct Labor	328.5	11.1	3,285.0	8.5	12,026.5	9.2
Indirect Labor	198.3	6.7	1,120.8	2.9	2,614.5	2.0
Other	881.8	29.8	7,999.9	20.7	26,536.8	20.3
TOTAL	2,834.9	95.8	36,907.6	95.5	124,448.4	95.2
CASH EARNINGS	124.3	4.2	1,739.1	4.5	6,274.7	4.8
LESS:						
Depreciation	47.4	1.6	541.1	1.4	1,699.5	1.3
Interest	17.8	0.6	231.9	0.6	0.0	0.0
PRE-TAX INCOME	59.1	2.0	966.1	2.5	4,575.2	3.5
INCOME TAX	14.9	0.5	450.2	1.2	2,182.6	1.7
AFTER-TAX INCOME	44.2	1.5	515.9	1.3	2,392.6	1.8
CASH FLOW	91.6	3.1	1,057.0	2.7	4,092.1	3.1

Appendix Table B-22. The Textile Mills Industry, representative existing model plants' cost characteristics

SEGMENT: Woven Fabric Finishing TYPE OF MILL: Integrated TYPE OF DISCHARGER: Indirect

	Small		Medium		Large		X-Large	
	($000)	(%)	($000)	(%)	($000)	(%)	($000)	(%)
SALES	3,158.3	100.0	26,084.9	100.0	57,408.4	100.0	216,436.6	100.0
COSTS:								
Textile Materials	1,522.3	48.2	11,190.4	42.9	23,652.3	41.2	101,725.2	47.0
Direct Labor	527.4	16.7	5,321.3	20.4	12,572.4	21.9	58,870.8	27.2
Indirect Labor	135.8	4.3	1,017.3	3.9	1,837.1	3.2	10,172.5	4.7
Other	773.7	24.5	6,729.9	25.8	14,122.4	24.6	31,166.9	14.4
TOTAL	2,959.2	93.7	24,259.0	93.0	52,184.2	90.9	201,935.4	93.3
CASH EARNINGS	199.1	6.3	1,825.9	7.0	5,224.2	9.1	14,501.2	6.7
LESS:								
Depreciation	79.0	2.5	495.6	1.9	1,607.4	2.8	3,679.4	1.7
Interest	50.6	1.6	495.6	1.9	1,205.5	2.1	1,298.7	0.6
PRE-TAX INCOME	69.5	2.2	834.7	3.2	2,411.3	4.2	9,523.1	4.4
INCOME TAX	19.9	0.6	387.2	1.5	1,143.9	2.0	4,557.6	2.1
AFTER-TAX INCOME	49.6	1.6	447.5	1.7	1,267.4	2.2	4,965.5	2.3
CASH FLOW	128.6	4.1	943.1	3.6	2,874.8	5.0	8,644.9	4.0

Appendix Table B-23. The Textile Mills Industry, representative existing model plants' cost characteristics

SEGMENT: Knit Fabric Finishing TYPE OF MILL: Commission TYPE OF DISCHARGER: Indirect

	Medium		Large	
	($000)	(Percent)	($000)	(Percent)
SALES	3,741.8	100.0	7,900.1	100.0
COSTS:				
Textile Materials	0.0	0.0	0.0	0.0
Direct Labor	1,223.6	32.7	2,338.4	29.6
Indirect Labor	366.7	9.8	639.9	8.1
Other	1,983.2	53.0	4,463.6	56.5
TOTAL	3,573.5	95.5	7,441.9	94.2
CASH EARNINGS	168.3	4.5	458.2	5.8
LESS:				
Depreciation	112.2	3.0	55.3	0.7
Interest	18.7	0.5	63.2	0.8
PRE-TAX INCOME	37.4	1.0	339.7	4.3
INCOME TAX	7.7	0.2	149.6	1.9
AFTER-TAX INCOME	29.7	0.8	190.1	2.4
CASH FLOW	141.9	3.8	245.4	3.1

Appendix Table B-24. The Textile Mills Industry, representative existing model plants' cost characteristics

SEGMENT: Knit Fabric Finishing TYPE OF MILL: Integrated TYPE OF DISCHARGER: Indirect

	Small		Medium		Large		X-Large	
	($000)	(%)	($000)	(%)	($000)	(%)	($000)	(%)
SALES	3,820.0	100.0	13,518.3	100.0	37,257.2	100.0	52,645.1	100.0
COSTS:								
Textile Materials	2,139.2	56.0	7,543.2	55.8	17,846.2	47.9	30,218.3	57.4
Direct Labor	649.4	17.0	1,689.8	12.5	3,800.3	10.2	6,580.6	12.5
Indirect Labor	267.4	7.0	567.8	4.2	1,266.7	3.4	2,000.5	3.8
Other	615.0	16.1	3,055.1	22.6	11,847.8	31.8	8,423.2	16.0
TOTAL	3,671.0	96.1	12,855.9	95.1	34,761.0	93.3	47,222.6	89.7
CASH EARNINGS	149.0	3.9	662.4	4.9	2,496.2	6.7	5,422.5	10.3
LESS:								
Depreciation	61.1	1.6	189.3	1.4	521.6	1.4	2,211.1	4.2
Interest	11.5	0.3	13.6	0.1	409.8	1.1	368.6	0.7
PRE-TAX INCOME	76.4	2.0	459.5	3.4	1,564.8	4.2	2,842.8	5.4
INCOME TAX	23.2	0.6	207.1	1.5	737.6	2.0	1,351.0	2.6
AFTER-TAX INCOME	53.2	1.4	252.4	1.9	827.2	2.2	1,491.8	2.8
CASH FLOW	114.3	3.0	441.7	3.3	1,348.8	3.6	3,702.9	7.0

Appendix Table B-25. The Textile Mills Industry, representative existing model plants' cost characteristics

SEGMENT: Hosiery Manufacturing | TYPE OF MILL: Own | TYPE OF DISCHARGER: Indirect

	Small		Large	
	($000)	(Percent)	($000)	(Percent)
SALES	6,003.9	100.0	30,022.8	100.0
COSTS:				
Textile Materials	2,827.8	47.1	14,140.7	47.1
Direct Labor	1,374.9	22.9	6,695.1	22.3
Indirect Labor	270.2	4.5	1,531.2	5.1
Other	1,387.1	23.1	5,794.4	19.3
TOTAL	5,860.0	97.6	28,161.4	93.8
CASH EARNINGS	143.9	2.4	1,861.4	6.2
LESS:				
Depreciation	84.1	1.4	420.4	1.4
Interest	36.0	0.6	180.1	0.6
PRE-TAX INCOME	23.8	0.4	1,260.9	4.2
INCOME TAX	4.8	0.1	591.7	2.0
AFTER-TAX INCOME	19.0	0.3	669.2	2.2
CASH FLOW	103.1	1.7	1,089.6	3.6

Appendix Table B-26. The Textile Mills Industry, representative existing model plants' cost characteristics

SEGMENT: Hosiery Manufacturing   TYPE OF MILL: Integrated   TYPE OF DISCHARGER: Indirect

	Small		Large	
	($000)	(Percent)	($000)	(Percent)
SALES	10,840.1	100.0	24,853.4	100.0
COSTS:				
Textile Materials	3,869.9	35.7	11,109.5	44.7
Direct Labor	2,471.5	22.8	5,343.5	21.5
Indirect Labor	455.3	4.2	1,466.4	5.9
Other	3,512.2	32.4	5,293.7	21.3
TOTAL	10,308.9	95.1	23,213.0	93.4
CASH EARNINGS	531.2	4.9	1,640.4	6.6
LESS:				
Depreciation	184.4	1.7	372.8	1.5
Interest	130.0	1.2	223.7	0.9
PRE-TAX INCOME	216.8	2.0	1,043.9	4.2
INCOME TAX	90.6	0.8	487.6	2.0
AFTER-TAX INCOME	126.2	1.2	556.3	2.2
CASH FLOW	310.6	2.9	929.1	3.7

Appendix Table B-27. The Textile Mills Industry, representative existing model plants' cost characteristics

SEGMENT: Carpet Manufacturing TYPE OF MILL: Integrated TYPE OF DISCHARGER: Indirect

	Small		Medium		Large	
	($000)	(Percent)	($000)	(Percent)	($000)	(Percent)
SALES	11,171.6	100.0	56,450.1	100.0	128,572.3	100.0
COSTS:						
Textile Materials	5,340.0	47.8	30,087.9	53.3	70,586.2	54.9
Direct Labor	1,240.0	11.1	4,911.2	8.7	9,514.4	7.4
Indirect Labor	770.8	6.9	2,088.7	3.7	2,700.0	2.1
Other	3,295.5	29.5	16,324.1	28.9	36,771.6	28.6
TOTAL	10,646.4	95.3	53,411.8	94.6	119,572.2	93.0
CASH EARNINGS	525.2	4.7	3,038.3	5.4	9,000.1	7.0
LESS:						
Depreciation	178.8	1.6	677.4	1.2	1,800.0	1.4
Interest	111.8	1.0	1,241.9	2.2	2,957.2	2.3
PRE-TAX INCOME	234.6	2.1	1,119.0	2.0	4,242.9	3.3
INCOME TAX	99.1	0.9	523.6	0.9	2,023.1	1.6
AFTER-TAX INCOME	135.5	1.2	595.4	1.1	2,219.8	1.7
CASH FLOW	314.3	2.8	1,272.8	2.3	4,019.8	3.1

Appendix Table B-28. The Textile Mills Industry, representative existing model plants' cost characteristics

SEGMENT: Stock & Yarn Finishing TYPE OF MILL: Commission TYPE OF DISCHARGER: Indirect

	Small		Medium		Large	
	($000)	(Percent)	($000)	(Percent)	($000)	(Percent)
SALES	724.3	100.0	1,599.0	100.0	4,326.5	100.0
COSTS:						
Textile Materials	0.0	0.0	0.0	0.0	0.0	0.0
Direct Labor	168.8	23.3	313.4	19.6	1,116.2	25.8
Indirect Labor	89.8	12.4	97.5	6.1	406.7	9.4
Other	413.5	57.1	1,066.6	66.7	2,448.9	56.6
TOTAL	672.1	92.8	1,477.5	92.4	3,971.8	91.8
CASH EARNINGS	52.2	7.2	121.5	7.6	354.7	8.2
LESS:						
Depreciation	25.3	3.5	56.0	3.5	151.5	3.5
Interest	12.4	1.7	27.2	1.7	73.5	1.7
PRE-TAX INCOME	14.5	2.0	38.3	2.4	129.7	3.0
INCOME TAX	2.9	0.4	7.9	0.5	48.8	1.1
AFTER-TAX INCOME	11.6	1.6	30.4	1.9	80.9	1.9
CASH FLOW	36.9	5.1	86.4	5.4	232.4	5.4

Appendix Table B-29. The Textile Mills Industry, representative existing model plants' cost characteristics

SEGMENT: Stock & Yarn Finishing TYPE OF MILL: Own TYPE OF DISCHARGER: Indirect

	Small		Medium		Large	
	($000)	(Percent)	($000)	(Percent)	($000)	(Percent)
SALES	3,736.8	100.0	5,747.2	100.0	15,435.0	100.0
COSTS:						
Textile Materials	1,786.2	47.8	3,080.5	53.6	8,674.5	56.2
Direct Labor	377.4	10.1	615.0	10.7	1,636.1	10.6
Indirect Labor	205.5	5.5	235.6	4.1	1,173.1	7.6
Other	1,251.8	33.5	1,580.5	27.5	2,824.7	18.3
TOTAL	3,620.9	96.9	5,511.6	95.9	14,308.3	92.7
CASH EARNINGS	115.9	3.1	235.6	4.1	1,126.7	7.3
LESS:						
Depreciation	29.9	0.8	63.2	1.1	447.6	2.9
Interest	37.4	1.0	57.4	1.0	247.0	1.6
PRE-TAX INCOME	48.6	1.3	115.0	2.0	432.1	2.8
INCOME TAX	10.2	0.3	41.7	0.7	193.9	1.3
AFTER-TAX INCOME	38.4	1.0	73.3	1.3	238.2	1.5
CASH FLOW	68.3	1.8	136.5	2.4	685.8	4.4

Appendix Table B-30. The Textile Mills Industry, representative existing model plants' cost characteristics

SEGMENT: Stock & Yarn Finishing TYPE OF MILL: Integrated TYPE OF DISCHARGER: Indirect

	Small		Medium	
	($000)	(Percent)	($000)	(Percent)
SALES	5,747.2	100.0	14,967.3	100.0
COSTS:				
Textile Materials	2,339.1	40.7	8,232.0	55.0
Direct Labor	1,517.3	26.4	3,173.1	21.2
Indirect Labor	448.3	7.8	493.9	3.3
Other	1,138.0	19.8	2,155.3	14.4
TOTAL	5,442.7	94.7	14,054.3	93.9
CASH EARNINGS	304.5	5.3	913.0	6.1
LESS:				
Depreciation	160.9	2.8	299.3	2.0
Interest	0.0	0.0	149.7	1.0
PRE-TAX INCOME	143.6	2.5	464.0	3.1
INCOME TAX	55.4	1.0	209.2	1.4
AFTER-TAX INCOME	88.2	1.5	254.8	1.7
CASH FLOW	249.1	4.3	554.1	3.7

Appendix Table B-31. The Textile Mills Industry, representative existing model plants' cost characteristics

SEGMENT: Non-Woven Fabric | TYPE OF MILL: Felt | TYPE OF DISCHARGER: Indirect

	Small		Medium		Large	
	($000)	(Percent)	($000)	(Percent)	($000)	(Percent)
SALES	3,744.4	100.0	5,588.7	100.0	13,121.7	100.0
COSTS:						
Textile Materials	958.6	25.6	1,430.7	25.6	3,359.2	25.6
Direct Labor	1,123.3	30.0	1,676.6	30.0	3,936.5	30.0
Indirect Labor	295.8	7.9	162.1	2.9	380.5	2.9
Other	977.3	26.1	1,995.2	35.7	4,960.1	37.8
TOTAL	3,355.0	89.6	5,264.6	94.2	12,636.3	96.3
CASH EARNINGS	389.4	10.4	324.1	5.8	485.4	3.7
LESS:						
Depreciation	172.3	4.6	134.1	2.4	157.5	1.2
Interest	67.4	1.8	39.2	0.7	0.0	0.0
PRE-TAX INCOME	149.7	4.0	150.8	2.7	327.9	2.5
INCOME TAX	58.4	1.6	58.9	1.1	143.9	1.1
AFTER-TAX INCOME	91.3	2.4	91.9	1.6	184.0	1.4
CASH FLOW	263.6	7.0	226.0	4.0	341.5	2.6

Appendix Table B-32. The Textile Mills Industry, representative existing model plants' cost characteristics

SEGMENT: Non-woven Fabric TYPE OF MILL: Nonwoven TYPE OF DISCHARGER: Indirect

	Small		Medium	
	($000)	(Percent)	($000)	(Percent)
SALES	13,780.6	100.0	31,901.4	100.0
COSTS:				
Textile Materials	4,230.6	30.7	9,793.7	30.7
Direct Labor	1,391.8	10.1	3,222.0	10.1
Indirect Labor	137.8	1.0	319.0	1.0
Other	6,476.8	47.0	16,748.3	52.5
TOTAL	12,237.1	88.8	30,083.1	94.3
CASH EARNINGS	1,543.5	11.2	1,818.3	5.7
LESS:				
Depreciation	482.3	3.5	542.3	1.7
Interest	289.4	2.1	319.0	1.0
PRE-TAX INCOME	771.8	5.6	957.0	3.0
INCOME TAX	357.0	2.6	445.9	1.4
AFTER-TAX INCOME	414.8	3.0	511.1	1.6
CASH FLOW	897.1	6.5	1,053.4	3.3

Appendix Table B-33. The Textile Mills Industry, representative new source model plants' cost characteristics

SEGMENT: Wool Finishing TYPE OF MILL: Integrated TYPE OF DISCHARGER: Direct

	Medium	
	($000)	(Percent)
SALES	32,143.6	100.0
COSTS:		
Textile Materials	12,503.9	38.9
Direct Labor	5,519.0	17.2
Indirect Labor	2,131.1	6.6
Other	7,486.2	23.3
TOTAL	27,640.4	86.0
CASH EARNINGS	4,503.2	14.0
LESS:		
Depreciation	2,277.1	7.1
Interest	1,049.5	3.3
PRE-TAX INCOME	1,176.6	3.7
INCOME TAX	551.3	1.7
AFTER-TAX INCOME	625.3	2.0
CASH FLOW	2,902.4	9.0

Appendix Table B-34. The Textile Mills Industry, representative new source model plants' cost characteristics

SEGMENT: Woven Fabric Finishing TYPE OF MILL: Own TYPE OF DISCHARGER: Direct

	Large	
	($000)	(Percent)
SALES	113,607.2	100.0
COSTS:		
Textile Materials	72,367.8	63.7
Direct Labor	8,361.5	7.4
Indirect Labor	1,817.7	1.6
Other	20,528.8	18.1
TOTAL	103,075.8	90.7
CASH EARNINGS	10,531.4	9.3
LESS:		
Depreciation	2,775.3	2.4
Interest	1,485.7	1.3
PRE-TAX INCOME	6,270.4	5.5
INCOME TAX	2,996.3	2.6
AFTER-TAX INCOME	3,274.1	2.9
CASH FLOW	6,049.4	5.3

Appendix Table B-35. The Textile Mills Industry, representative new source model plants' cost characteristics

SEGMENT: Woven Fabric Finishing   TYPE OF MILL: Integrated   TYPE OF DISCHARGER: Direct

	Large	
	($000)	(Percent)
SALES	57,408.2	100.0
COSTS:		
Textile Materials	23,652.2	41.2
Direct Labor	10,686.5	18.6
Indirect Labor	1,561.5	2.7
Other	10,531.6	18.4
TOTAL	46,431.8	80.9
CASH EARNINGS	10,976.4	19.1
LESS:		
Depreciation	2,594.4	4.5
Interest	1,181.8	2.1
PRE-TAX INCOME	7,200.2	12.5
INCOME TAX	3,442.6	6.0
AFTER-TAX INCOME	3,757.6	6.5
CASH FLOW	6,352.0	11.1

Appendix Table B-36. The Textile Mills Industry, representative new source model plants' cost characteristics

SEGMENT: Knit Fabric Finishing   TYPE OF MILL: Integrated   TYPE OF DISCHARGER: Direct

	Large	
	($000)	(Percent)
SALES	30,134.7	100.0
COSTS:		
Textile Materials	17,297.3	57.4
Direct Labor	3,201.8	10.6
Indirect Labor	973.3	3.2
Other	3,688.5	12.2
TOTAL	25,160.9	83.5
CASH EARNINGS	4,973.8	16.5
LESS:		
Depreciation	556.4	1.8
Interest	353.4	1.2
PRE-TAX INCOME	4,064.0	13.5
INCOME TAX	1,527.0	5.0
AFTER-TAX INCOME	1,682.3	5.6
CASH FLOW	2,838.8	9.4

Appendix Table B-37. The Textile Mills Industry, representative new source model plants' cost characteristics

SEGMENT: Hosiery Manufacturing TYPE OF MILL: Integrated TYPE OF DISCHARGER: Direct

	Medium	
	($000)	(Percent)
SALES	18,250.4	100.0
COSTS:		
Textile Materials	8,157.9	44.7
Direct Labor	3,335.2	18.3
Indirect Labor	915.4	5.0
Other	2,993.9	16.4
TOTAL	15,402.4	84.4
CASH EARNINGS	2,848.0	15.6
LESS:		
Depreciation	569.4	3.1
Interest	305.3	1.7
PRE-TAX INCOME	1,973.3	10.8
INCOME TAX	933.7	5.1
AFTER-TAX INCOME	1,039.6	5.7
CASH FLOW	1,609.0	8.8

Appendix Table B-38. The Textile Mills Industry, representative new source model plants' cost characteristics

SEGMENT: Carpet Manufacturing TYPE OF MILL: Integrated TYPE OF DISCHARGER: Direct

	Small	
	($000)	(Percent)
SALES	25,238.9	100.0
COSTS:		
Textile Materials	12,064.2	47.8
Direct Labor	2,521.4	10.0
Indirect Labor	1,567.4	6.2
Other	5,993.9	23.8
TOTAL	22,146.9	87.8
CASH EARNINGS	3,092.0	12.3
LESS:		
Depreciation	645.6	2.6
Interest	355.3	1.4
PRE-TAX INCOME	2,091.1	8.3
INCOME TAX	990.2	3.9
AFTER-TAX INCOME	1,100.9	4.4
CASH FLOW	1,746.5	6.9

Appendix Table B-39. The Textile Mills Industry, representative new source model plants' cost characteristics

SEGMENT: Stock & Yarn Finishing TYPE OF MILL: Own TYPE OF DISCHARGER: Direct

	Medium	
	($000)	(Percent)
SALES	16,151.0	100.0
COSTS:		
Textile Materials	8,656.9	53.6
Direct Labor	1,469.0	9.1
Indirect Labor	562.9	3.5
Other	3,788.9	23.5
TOTAL	14,477.7	89.6
CASH EARNINGS	1,673.3	10.4
LESS:		
Depreciation	226.8	1.4
Interest	150.9	0.9
PRE-TAX INCOME	1,295.6	8.0
INCOME TAX	608.4	3.8
AFTER-TAX INCOME	687.2	4.3
CASH FLOW	914.0	5.7

Appendix Table B-40. The Textile Mills Industry, representative new source model plants' cost characteristics

SEGMENT: Nonwoven Fabric Finishing TYPE OF MILL: Felt TYPE OF DISCHARGER: Direct

	Medium	
	($000)	(Percent)
SALES	5,309.9	100.0
COSTS:		
Textile Materials	1,359.3	25.6
Direct Labor	1,354.1	25.5
Indirect Labor	130.9	2.5
Other	1,620.4	30.5
TOTAL	4,464.6	84.1
CASH EARNINGS	845.3	15.9
LESS:		
Depreciation	265.5	5.0
Interest	127.0	2.4
PRE-TAX INCOME	452.8	8.5
INCOME TAX	203.8	3.8
AFTER-TAX INCOME	249.0	4.7
CASH FLOW	514.5	9.7

Appendix Table B-41. The Textile Mills Industry, representative new source model plants cost characteristics

SEGMENT: Nonwoven Fabric Finishing TYPE OF MILL: Nonwoven TYPE OF DISCHARGER: Direct

	Medium	
	($000)	(Percent)
SALES	7,249.8	100.0
COSTS:		
Textile Materials	2,225.7	30.7
Direct Labor	622.4	8.6
Indirect Labor	61.6	0.8
Other	3,001.1	41.4
TOTAL	5,910.8	81.5
CASH EARNINGS	1,339.0	18.5
LESS:		
Depreciation	560.0	7.7
Interest	247.9	3.4
PRE-TAX INCOME	531.1	7.3
INCOME TAX	241.4	3.3
AFTER-TAX INCOME	289.7	4.0
CASH FLOW	849.7	11.7

Appendix Table B-42. The Textile Mills Industry, representative new source model plants' cost characteristics

SEGMENT: Wool Finishing TYPE OF MILL: Integrated TYPE OF DISCHARGER: Indirect

	Medium	
	($000)	(Percent)
SALES	36,428.9	100.0
COSTS:		
Textile Materials	14,170.8	38.9
Direct Labor	6,254.8	17.2
Indirect Labor	2,415.3	6.6
Other	8,576.5	23.5
TOTAL	31,417.4	86.2
CASH EARNINGS	5,011.5	13.8
LESS:		
Depreciation	2,867.4	7.9
Interest	1,311.3	3.6
PRE-TAX INCOME	832.8	2.3
INCOME TAX	386.2	1.1
AFTER-TAX INCOME	446.6	1.2
CASH FLOW	3,314.0	9.1

Appendix Table B-43. The Textile Mills Industry, representative new source model plants' cost characteristics

SEGMENT: Woven Fabric Finishing TYPE OF MILL: Own TYPE OF DISCHARGER: Indirect

	Medium	
	($000)	(Percent)
SALES	38,646.7	100.0
COSTS:		
Textile Materials	24,502.0	63.4
Direct Labor	2,628.0	6.8
Indirect Labor	896.6	2.3
Other	6,423.1	16.6
TOTAL	34,449.7	89.1
CASH EARNINGS	4,197.0	10.9
LESS:		
Depreciation	927.5	2.4
Interest	492.5	1.3
PRE-TAX INCOME	2,777.0	7.2
INCOME TAX	1,319.5	3.4
AFTER-TAX INCOME	1,457.5	3.8
CASH FLOW	2,385.0	6.2

Appendix Table B-44. The Textile Mills Industry, representative new source model plants' cost characteristics

SEGMENT: Woven Fabric Finishing　　TYPE OF MILL: Integrated　　TYPE OF DISCHARGER: Indirect

	Large	
	($000)	(Percent)
SALES	57,408.4	100.0
COSTS:		
Textile Materials	23,642.0	41.2
Direct Labor	10,686.5	18.6
Indirect Labor	1,561.5	2.7
Other	11,967.0	20.9
TOTAL	47,857.0	83.4
CASH EARNINGS	9,551.4	16.6
LESS:		
Depreciation	2,275.0	4.0
Interest	1,046.3	1.8
PRE-TAX INCOME	6,230.1	10.8
INCOME TAX	2,976.9	5.2
AFTER-TAX INCOME	3,253.2	5.7
CASH FLOW	5,528.2	9.6

Appendix Table B-45. The Textile Mills Industry, representative new source model plants' cost characteristics

SEGMENT: Knit Fabric Finishing TYPE OF MILL: Integrated TYPE OF DISCHARGER: Indirect

	Large	
	($000)	(Percent)
SALES	37,257.2	100.0
COSTS:		
Textile Materials	17,846.2	47.9
Direct Labor	3,230.3	8.7
Indirect Labor	1,076.7	2.9
Other	8.954.7	24.0
TOTAL	31,107.9	83.5
CASH EARNINGS	6,149.3	16.5
LESS:		
Depreciation	854.4	2.3
Interest	1,373.7	3.7
PRE-TAX INCOME	3,921.2	10.5
INCOME TAX	1,868.7	5.0
AFTER-TAX INCOME	2,052.5	5.5
CASH FLOW	2,906.9	7.8

Appendix Table B-46. The Textile Mills Industry, representative new source model plants' cost characteristics

SEGMENT: Hosiery Manufacturing TYPE OF MILL: Integrated TYPE OF DISCHARGER: Indirect

	Large	
	($000)	(Percent)
SALES	24,853.4	100.0
COSTS:		
Textile Materials	11,109.5	44.7
Direct Labor	4,542.0	18.3
Indirect Labor	1,246.4	5.0
Other	4,077.2	16.4
TOTAL	20,975.1	84.4
CASH EARNINGS	3,878.3	15.6
LESS:		
Depreciation	775.4	3.1
Interest	415.7	1.7
PRE-TAX INCOME	2,687.2	10.8
INCOME TAX	1,276.4	5.1
AFTER-TAX INCOME	1,410.8	5.7
CASH FLOW	2,186.2	8.8

Appendix Table B-47. The Textile Mills Industry, representative new source model plants' cost characteristics

SEGMENT: Carpet Manufacturing TYPE OF MILL: Integrated TYPE OF DISCHARGER: Indirect

	Medium	
	($000)	(Percent)
SALES	56,450.1	100.0
COSTS:		
Textile Materials	30,087.9	53.3
Direct Labor	4,420.1	7.8
Indirect Labor	1,879.8	3.3
Other	14,472.3	25.7
TOTAL	50,860.1	90.1
CASH EARNINGS	5,590.0	9.9
LESS:		
Depreciation	1,006.1	1.8
Interest	667.8	1.2
PRE-TAX INCOME	3,916.1	6.9
INCOME TAX	1,866.2	3.3
AFTER-TAX INCOME	2,049.9	3.6
CASH FLOW	3,056.0	5.4

Appendix Table B-48. The Textile Mills Industry, representative new source model plants' cost characteristics

SEGMENT: Stock & Yarn Finishing TYPE OF MILL: Own TYPE OF DISCHARGER: Indirect

	Medium	
	($000)	(Percent)
SALES	5,747.2	100.0
COSTS:		
Textile Materials	3,080.5	53.6
Direct Labor	522.8	9.1
Indirect Labor	200.3	3.5
Other	1,348.2	23.5
TOTAL	5,151.8	89.6
CASH EARNINGS	595.4	10.4
LESS:		
Depreciation	135.0	2.4
Interest	76.8	1.3
PRE-TAX INCOME	383.6	6.7
INCOME TAX	170.6	3.0
AFTER-TAX INCOME	213.0	3.7
CASH FLOW	348.0	6.1

Appendix Table B-49. The Textile Mills Industry, representative new source model plants' cost characteristics

SEGMENT: Nonwoven Fabric Finishing TYPE OF MILL: Felt TYPE OF DISCHARGER: Indirect

	Medium	
	($000)	(Percent)
SALES	5,588.7	100.0
COSTS:		
Textile Materials	1,430.7	25.6
Direct Labor	1,425.1	25.5
Indirect Labor	137.8	2.5
Other	1,381.8	24.7
TOTAL	4,375.4	78.3
CASH EARNINGS	1,213.3	21.7
LESS:		
Depreciation	279.4	5.0
Interest	133.7	2.4
PRE-TAX INCOME	800.2	14.3
INCOME TAX	370.6	6.6
AFTER-TAX INCOME	429.6	7.7
CASH FLOW	709.0	12.7

Appendix Table B-50. The Textile Mills Industry, representative new source model plants' cost characteristics

SEGMENT: Nonwoven Fabric Finishing TYPE OF MILL: Nonwoven TYPE OF DISCHARGER: Indirect

	Medium	
	($000)	(Percent)
SALES	31,901.4	100.0
COSTS:		
Textile Materials	9,793.7	30.7
Direct Labor	2,738.7	8.6
Indirect Labor	271.2	0.8
Other	12,880.9	40.4
TOTAL	25,684.5	80.5
CASH EARNINGS	6,216.9	19.5
LESS:		
Depreciation	1,401.4	4.4
Interest	655.4	2.1
PRE-TAX INCOME	4,160.1	13.0
INCOME TAX	1,983.3	6.2
AFTER-TAX INCOME	2,176.8	6.8
CASH FLOW	3,578.2	11.2

APPENDIX C

Data Collection Portfolio
(and transmittal letter)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

Dear Sir:

The U.S. Environmental Protection Agency (EPA) is reviewing regulations for the textile industry pursuant to the Clean Water Act. You and other members of the industry can provide the best information possible so that potential economic problems can be carefully considered by the Agency.

To ensure that the information needed to develop these regulations is both thorough and timely, EPA is engaged in a wide range of information gathering, monitoring, sampling, and inspection activities authorized by Section 308 of the Act. For your information, Section 308 permits EPA and its authorized representatives to enter the premises on which an effluent source is located and to have access and to copy any records, to inspect any monitoring equipment, and to sample effluents. This phase of EPA's review is to gather information under Section 308 concerning your plant's production, and general financial and economic condition. This will be done through the attached financial questionnaire.

EPA is aware that the data requested in this questionnaire may be of a sensitive nature to your business. Therefore, you will note that on the cover sheet preceding the questionnaire itself, there are check-off blocks after the number of each question. This list is available so that you may specifically assert a claim of confidentiality for each item of information you are submitting which you consider to be of a proprietary nature.

EPA has regulations which set forth general guidelines on how EPA handles business information which is or may be entitled to confidential treatment (40 C.F.R. §2.201 et seq., 41 Fed. Reg. 36902 et seq., Sept. 1, 1976). The following paragraph from these regulations explains the basis for the confidential treatment of business information.

> "Reasons of business confidentiality" include the concept of trade secrecy and other related legal concepts which give (or may give) a business the right to preserve the confidentiality of business information and to limit its use or disclosure by others in order that the business may obtain or retain business advantages it derives from its right in the information. (40 C.F.R. §2.201(e))

You may assert any confidentiality claims at the time you submit the information using the check-off on the cover sheet. Failure to make your confidentiality claims on the cover sheet at the time of submission could result in the disclosure of the information without prior notice to you.

Once you have asserted your claim for confidentiality as to each item of information, EPA will treat the material as confidential unless a third party requests access to the data under the Freedom of Information Act. However, the information marked confidential will not be released until you have been given notice of the need for a determination of confidentiality. This notice will give you an opportunity to substantiate your claims. EPA will consider your comments before making its determination of whether the material in fact is entitled to confidential treatment. Our regulations, of course, provide that even if EPA makes a judgment that the material should be released you will receive advance notice in order that you may petition the courts to stop release of the information.

There are several reasons that EPA cannot automatically make all this data confidential. First, Section 308 requires that information obtained under this section be made available to the public unless a satisfactory showing has been made to the Administrator that release of the information would divulge methods or processes entitled to protection as trade secrets. The Act specifically states that effluent data is not entitled to confidential treatment. Second, the Freedom of Information Act requires EPA to find that the trade secrets, or commercial or financial information are entitled to confidential treatment before EPA can deny release.

We operate a sound system for receipt and handling of the requested information to maintain its confidentiality. The questionnaires will be received by EPA's Office of Analysis and Evaluation where they will be kept in locked files and will be handled only by authorized EPA employees. Next, the information will be coded, i.e., the sheet providing the name and address of the submitting company will be removed and the remaining data will be given a code number. The coded information will then be forwarded to our contractor, Development Planning and Research Associates, Inc. (DPRA), where an analysis of the data will be performed. DPRA by contract is specifically bound to maintain the confidentiality of information so designated. EPA alone will have the coded list by which companies and information may be matched up. When DPRA has completed its work with the data, the questionnaires will be returned to EPA where they will be stored in EPA's record center, which is a secured facility with limited access.

In addition to the study being done by EPA, the American Textile Manufacturers Institute (ATMI), the Carpet and Rug Institute (CRI) and the Northern Textile Association (NTA) are jointly working to develop an industry position regarding the economic impact of these regulations. In order to facilitate this work, these three trade associations are requesting you to provide them with a copy of your response to EPA's questionnaire. This will allow EPA and the industry to work from the same data base. As the enclosed letter explains, once the completed letters are received by the trade associations, all identifying information will be removed and the questionnaire will be sent to their independent contractor with an assigned code number.

All information sent to EPA and marked confidential will be protected in accordance with our regulations. Since it is the Agency's position that a company loses its right to confidential treatment of business information once that information is disclosed without protection, to a third party, any information sent to EPA as confidential cannot be protected unless the information is treated as confidential by the trade associations and their contractor. You will note however, that ATMI, CRI and NTA by their letter agree to keep confidential all information for which you desire such treatment and have signed an agreement with their contractor not to disclose the information to any other source. Please indicate on the space provided on the cover page, if you are sending a duplicate copy of the completed questionnaire to one of the three trade associations.

Please answer all questions contained in the attached survey and return it no later than 30 days from the date of receipt, in the pre-addressed envelope enclosed. Failure to respond to the enclosed survey withing the 30-day period may subject your company and its representatives to the enforcement provisions of Section 309 of the Act.

If you have any questions regarding this letter or tne attached survey, please contact the economic project officer, Anthony M. Montrone (202) 755-6906. Your cooperation in this survey is important to us, to the industry, and most of all to you. With your help, we are confident that final regulations will best balance the needs of all concerned.

Sincerely yours,

Albert J. Erickson,
Associate Deputy Assistant Administrator,
Office of Water Planning and Standards

Enclosures

AMERICAN TEXTILE MANUFACTURERS INSTITUTE, INC

400 S TRYON ST WACHOVIA CENTER
CHARLOTTE, N C 28285

April 6, 1978

TO TEXTILE PLANTS PARTICIPATING IN
EPA ECONOMIC WASTEWATER SURVEY

The American Textile Manufacturers Institute, the Carpet and Rug Institute and the Northern Textile Association are participating with EPA in a long range research project to determine the textile industry's technical and economic capability for meeting the Best Available Technology Economically Achievable (BATEA) water pollution guidelines. This effort is separate from the overall review of regulations referred to in the accompanying EPA letter but is intended to complement the agency's program.

One phase of the project will be an evaluation of several advanced wastewater treatment technologies which might be used to meet the guidelines. The second phase will be an economic analysis of the probable costs and related impact on the industry from the use of these technologies. Approximately 24 textile plants are participating in the technical studies and the three trade associations are soliciting wide input from their members in the economic studies.

Because the guidelines are to be based on the "Best Available Technology Economically Achievable", it is especially important that the economic evaluations be on a wide data base which accurately represents the industry. You can assist in this work by sending us a copy of each completed questionnaire which you provide to EPA.

All plant identification information will be deleted upon receipt and coded before being submitted to our economics contractor, Dynamics Associates. We will maintain strict confidentiality of plant identification and have a signed agreement with Dynamics prohibiting their disclosure of this information to any other source.

If you consider it essential, you may delete the plant name and the address and insert your own code before sending the questionnaires to us. It will be important, however, that we have the company name, the name of the state where the plant is located and the name of a corporate contact.

Please send the questionnaires to one of the three trade associations at one of the following addresses:

American Textile Manufacturers Institute, Inc.
Attn: O'Jay Niles
2124 Wachovia Center, 400 South Tryon Street
Charlotte, North Carolina 28285
Telephone: (704) 334-4734

Carpet and Rug Institute
Attn: Barry Torrence
P.O. Box 2048
Dalton, Georgia 30720
Telephone: (404) 278-3176

Northern Textile Association
Attn: Karl Spilhaus
211 Congress Street
Boston, Massachusetts 02110
Telephone: (617) 542-8220

Your cooperation in providing us with this information would be extremely helpful in conducting an industry-wide assessment of the economic impact of the BATEA requirements..

American Textile Manufacturers Institute, Inc.

Carpet and Rug Institute

Northern Textile Association

DATA COLLECTION PORTFOLIO
- TEXTILES -

FACILITY IDENTIFICATION

(1) Plant Name ______________________________

Address of Plant ______________________________

____

(2) Name of Parent Company ______________________________

Address of Parent Company ______________________________

____

(3) Name of individual we may contact concerning this Data Collection Portfolio

____

Telephone Number Area Code (______) Telephone No. ______________________________

(4) The attached survey is applicable to those plants which generate process wastewater. Process wastewater can be defined as liquid wastes resulting from processes utilized in your plant which are discharged to your own treatment facility, to a municipal treatment facility, or to some other receiving source. If your plant does **not** generate wastewater, please check the following box ☐, complete questions (1) through (5) on this page, and return this page to EPA in the enclosed envelope. If your plant **does** generate wastewater, please complete the attached questionnaire and return it to EPA.

(5) If you are also sending a copy of your questionnaire responses to one of the industry associations, please check the following box ☐.

(6) To assert your claim of confidentiality, please check off the box corresponding to the questions, which, in the company's opinion, requires confidential treatment.

1 ☐	3 ☐	5 ☐	7 ☐	9 ☐*	11 ☐
2 ☐	4 ☐	6 ☐	8 ☐	10 ☐	

NOTE: Upon receipt by EPA, this page will be separated from the remainder of the questionnaire so that data processing and use of the data is conducted on a coded basis.

Form Approved
O.M.B.
No. 158–R0160

For Use by EPA

Code Number__________

*The Clean Water Act specifically states effluent data are not subject to confidential treatment.

Form Approved O.M.B. No. 158—R0160	For Use by EPA Code Number ________

Data Collection Portfolio
- Textiles -

To accurately assess the economic consequences of requiring the Textile Industry to meet certain water pollution limitations, it is essential to obtain current economic and financial data. As the discharge limitations will vary according to each plant's production process employed and discharge method, it is necessary to obtain data on an individual plant basis. For purposes of filling out this Data Collection Portfolio, a plant shall relate to one technically coherent economic unit at one location for which financial data are most readily available. A company is a business unit producing goods and services with one or more capital facilities combined under some form of entrepreneurial control. All other data shall be provided on a best estimated basis. Data should reflect 1976 or your most recently completed fiscal year for which data are available.

1. PRODUCTION INFORMATION: Below please indicate the amount of raw materials used in this mill in 1976 or the most recent fiscal year as well as the amount of products processed in this mill during that time.

PURCHASED RAW MATERIALS (include interplant transfers)	(pounds)
Wool	
• Grease wool	________
• Clean wool	________
• Wool top	________
• Yarn	________
• Fabric (Greige)	________
• Other ________	________
Cotton	
• Raw cotton	________
• Yarn	________
• Fabric (Greige)	________
• Other ________	________
Man Made Fibers	
• Fiber	________
• Yarn (include filaments)	________
• Fabric (Greige)	________
• Other ________	________
Blends	
• Yarn	________
• Fabric (Greige)	________
• Other ________	________
Other (please specify)	
• ________	________
• ________	________
• ________	________

PROCESSED PRODUCTS (include interplant transfers)	(dollars)
Broadwoven Fabrics	
• Chiefly cotton	
Greige	________
Finished	________
• Chiefly Manmade	
Greige	________
Finished	________
• Chiefly Blends	
Greige	________
Finished	________
• Chiefly Woolen	
Greige	________
Finished	________
Women's Hosiery, except Socks	________
Other Hosiery	________
Knit Outerwear	________
Knit Underwear	________
Circular Knit Fabric	________
Warp Knit Fabric	________
Woven Carpets & Rugs	________
Tufted Carpets & Rugs	________
Yarn	________
Thread	________
Felt Goods	________
Lace Goods	________
Padding & Upholstery Filling	________
Coated Fabrics	________
Nonwoven Fabrics	________
Other (please specify)	
• ________	________
• ________	________

2. PROCESS DESCRIPTION: Please check the appropriate processes which apply to your operation.

________	Wool Scouring	________	Carbonizing
________	Combing	________	Dyeing
________	Carding	________	Bonding and Laminating
________	Spinning	________	Printing
________	Slashing	________	Functional Finishes
________	Weaving	________	Nonwoven Processes (Please Specify)
________	Knitting	________	____________________
________	Carpet Backing	________	____________________
________	Desizing	________	Other Processes (Please Specify)
________	Scouring	________	____________________
________	Bleaching	________	____________________
________	Mercerizing	________	____________________

3. PLANT DESCRIPTION: Information provided should be for calendar year 1976 or latest fiscal year (year ended __________).

(1) How representative was this plant's production data during the year represented in this questionnaire as compared to the averages for 1971-1975?

- About the same ☐
- Better than average ☐
- Worse than average ☐

(2) Approximate age of production equipment:

Age in Years	Percent of Total Production Equipment
(a) 0-5	________
(b) 6-10	________
(c) 11-15	________
(d) 16-20	________
(e) 21-50	________
(f) 50 or older	________

(3) Employment: Average number of

- Production Employees ________
- Non Production Employees ________

with production employees defined as hourly paid employees directly associated with production and non production employees defined as all other personnel at this plant (including supervisory and administrative).

(4) Organization:

(a) Is this company a
- ☐ proprietorship, partnership, or closely-held corporation
- ☐ public corporation

(b) Is this company a
- ☐ single-plant operation
- ☐ multi-plant operation

(c) For multi-plant operations:

Total sales of company from all textile products	Total sales of company from all products (including textiles)
☐ $100,000 or less	☐ $100,000 or less
☐ $100,001 to $500,000	☐ $100,001 to $500,000
☐ $500,001 to $1,000,000	☐ $500,001 to $1,000,000
☐ $1,000,001 to $5,000,000	☐ $1,000,001 to $5,000,000
☐ $5,000,001 to $50,000,000	☐ $5,000,001 to $50,000,000
☐ Greater than $50,000,000	☐ Greater than $50,000,000

(5) Plant capacity and utilization:

(a) Please indicate the number of hours __________ and days __________ in your "normal" work week.

(b) Days of operation in 1976 __________ days; in 1977 __________ days.

(c) Maximum rated plant capacity under normal work week:

__________ pounds textile and fiber material input per day

__________ square yards finished product per day

__________ other (i.e. pounds) __________ per day

(d) Percent of plants maximum rated capacity **utilized** in 1976 __________ in 1977 __________.

(e) Inventory turnover __________ times per year.

(f) What percent of your latest fiscal year's production was represented by commission work? __________ %

4. PRODUCTION AND INCOME DATA FOR LATEST FISCAL YEAR FOR THIS PLANT:

Data for latest fiscal year ending ____ / ____ / ____

(1) Poundage

Textile and Fiber Materials Input __________ lbs.

Production Output __________ lbs.

(2) Proportion of the above products which are goods which are transferred from this facility to another company-owned operating-facility __________ %

(3) Sales (or market Value of Production) $__________

(4) Costs (combine categories if necessary):

Textile and Fiber Materials	$ __________
Other Production Materials	$ __________
Direct Labor	$ __________
Indirect and General Labor	$ __________
Electricity	$ __________
Other Energy (oil, gas, coal, etc.)	$ __________
Depreciation	$ __________
Interest	$ __________
Taxes (except federal income taxes)	$ __________
Other Costs	$ __________

(5) Please indicate the annual cost of wastewater treatment.

Labor	$ __________
Materials (chemicals, etc.)	$ __________
Energy	$ __________
Depreciation	$ __________
Interest	$ __________
Other (please specify)	$
____________________	$ __________
____________________	$ __________

5. PLANT ASSETS: End of latest fiscal year (/ /)

(1) Cash and Receivables $ ________

(2) Inventories $ ________

(3) Fixed Assets (other than land): $ ________

	Gross	Net	Liquidation Value	Replacement
Building	________	________	________	________
Equipment	________	________	________	________

(4) Land (Availability and Value)

(a) Availability: How much land is available for construction of additional wastewater treatment facilities (Please Check):

	Now Own	Could Acquire
None	☐	☐
Less than ½ acre	☐	☐
½ - 1 acre	☐	☐
1-3 acres	☐	☐
More than 3 acres	☐	☐

(b) Value:

What is the book value of the land presently associated with this operation? $________

What is the approximate current value per acre of land in the vicinity of your plant? $ ________ per acre

(5) Capital Investment — total for last three (3) years—

Replacement of Equipment $ ________

Major Plant Expansions $ ________

Pollution Control and Safety $ ________

6. PLANT LIABILITIES AND EQUITY: End of latest fiscal year (/ /)

(1) Current Liabilities and Short Term Debt $________

(2) Long Term Debt

	Rate	Date Due	Amount
(a)	______ %	/ /	$ ________
(b)	______ %	/ /	$ ________
(c)	______ %	/ /	$ ________
(d)	______ %	/ /	$ ________
(e)	______ %	/ /	$ ________

(3) Owner's Equity (Book Value) $________

7. PLANT HISTORICAL DATA: Please give data for last five (5) fiscal years:

Year End	Pretax Profits ($000)	Total Assets ($000)	Total Sales ($000)
/ /	________	________	________
/ /	________	________	________
/ /	________	________	________
/ /	________	________	________
/ /	________	________	________

8. OTHER REGULATORY IMPACTS AND ASSOCIATED COSTS:

Describe briefly any Federal, State, or Local regulations and your planned response or progress already made.	Indicate Costs Incurred Over Last 3 Years		Estimate Anticipated Costs Over Next 3 Years	
	Investment Total	Operation & Maintenance	Investment Total	Operation & Maintenance
1.	$ ______	$ ______	$ ______	$ ______
2.	$ ______	$ ______	$ ______	$ ______
3.	$ ______	$ ______	$ ______	$ ______
4.	$ ______	$ ______	$ ______	$ ______

9. PLANT EFFLUENT CHARACTERISTICS AND DISCHARGE INFORMATION – 1976:

(1) During 1976 or your most recently completed fiscal year, what was your approximate average daily wastewater discharge? ____________ gallons/day

(2) Please indicate the approximate percentage of the total flow from each source:

_________ % Process-Related Wastewater

_________ % Boiler Blowdown

_________ % Non Contact Cooling Water

_________ % Sanitary Sewage

_________ % Cafeteria

_________ % Air Pollution Control Equipment

_________ % Other (Describe) ________________________________

(3) Please indicate method used to dispose of process-related wastewaters.

_________ Direct Discharge – Discharge of treated or untreated process-related wastewaters directly to a receiving body of water.

_________ Indirect Discharge – Discharge of partially treated or untreated process-related wastewaters directly to a Publicly Owned Treatment Works (POTW) via municipal sewer system.

_________ Other Discharge such as septic tank, evaporation lagoon, irrigation system, etc. Please explain briefly below.

____

____

(4) If your plant is a Direct Discharger, please indicate the following:

	Average presence (lbs. per 1,000 gallons)
BOD_5	__________________
COD	__________________
TSS	__________________

10. PLANT WASTEWATER TREATMENT COSTS: If your plant discharges wastewaters to a POTW, what were your wastewater treatment user charges?

	Total Cost	Cost per 1,000 Gallons
1975	___________	___________
1976	___________	___________
1977	___________	___________

11. COMMENTS: Please supply any other data or comments you feel may be helpful in evaluating the economic impact of effluent limitation guidelines on the Textile Industry (e.g. describe characteristics which result in an atypical expenditure for effluent controls).

Thank you for your cooperation. Please enclose this form in the accompanying envelope and mail directly to:

Mr. Anthony M. Montrone
U.S. Environmental Protection Agency
Office of Analysis & Evaluation (WH 586)
401 M Street, S.W.
Washington, D.C. 20460

APPENDIX D

Effects of Sensitivity on Model Plant Impacts

Effects of Sensitivity on Model Plant Impacts

To ascertain the effects higher wastewater control investments and annual operating and maintenance (O&M) costs had on the model plant impacts described in Chapter VIII of this report, a sensitivity analysis of the control costs was conducted. The sensitivity analysis was conducted at two levels. First the original wastewater control costs were doubled (200 percent of the original costs) and then secondly they were increased by a factor of 3.5 (350 percent of the original costs). Aside from the changes in the control costs, all assumptions utilized in the sensitivity analyses were the same as those used in the original impact analysis.

While the impact analyses described in Chapter VIII include numerous impact indicators (i.e. effects on prices, incomes, cash flows, and net present values), the sensitivity analyses concentrated only on the changes in the model plant viabilities. These are presented in Tables D-1 through D-4.

Table D-1. The textile industry, effects of varying wastewater control costs assumptions on projected model plant closures for existing direct discharging models (BATEA)

Subcategory	Type Mill	Size/ Type1/	Daily Capacity	Base Case	Option 1 (Treatment Alternative A) Percent of Control Costs 100	250	350	Option 2 (Treatment Alternative C) Percent of Control Costs 100	250	350	Option 3 (Treatment Alternative B) Percent of Control Costs 100	250	350	Option 4 (Treatment Alternative D)2/ Percent of Control Costs 100	200	350
			(kkg)													
1. Wool Scouring	Comm.	S	16.2	C	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		M	35.6	V	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		L	80.9	V	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2. Wool Finishing	Comm.	S	8.0	V	NA	NA	NA	NA	NA	NA	C	C	C	C	C	C
	Int.	S	8.0	V	NA	NA	NA	NA	NA	NA	V	M	C	V	M	C
		M	20.0	V	NA	NA	NA	NA	NA	NA	V	V	V	V	V	V
		L	40.0	V	NA	NA	NA	NA	NA	NA	V	V	V	V	V	V
4. Woven Fabric Finishing	Comm.	S (S)	5.3	M	NA	NA	NA	C	C	C	C	C	C	C	C	C
		M (C)	26.0	V	NA	NA	NA	V	V	M	V	C	C	V	C	C
		L (C)	130.0	V	NA	NA	NA	V	V	V	V	V	V	V	V	V
	Own	S (S)	5.3	V	NA	NA	NA	V	V	M	V	M	C	V	C	C
		M (C)	26.0	V	NA	NA	NA	V	V	V	V	V	V	V	V	V
		L (C)	130.0	V	NA	NA	NA	V	V	V	V	V	V	V	V	M
	Int.	S (S)	5.3	V	NA	NA	NA	V	V	V	V	V	C	V	V	C
		M (D)	20.0	V	NA	NA	NA	V	V	V	V	V	V	V	V	V
		L (D)	50.0	V	NA	NA	NA	V	V	V	V	V	V	V	V	V
		X-L (C)	220.0	V	NA	NA	NA	V	V	V	V	V	V	V	V	V
5. Knit Fabric Finishing	Comm.	M (S)	7.7	V	NA	NA	NA	C	C	C	C	C	C	C	C	C
		M (C)	7.7	V	NA	NA	NA	V	C	C	C	C	C	C	C	C
		L (C)	18.6	V	NA	NA	NA	V	C	C	C	C	C	C	C	C
	Int.	M (S)	7.7	V	NA	NA	NA	V	V	V	V	V	M	V	V	C
		M (C)	7.7	V	NA	NA	NA	V	V	M	V	M	C	V	M	C
		L (C)	18.6	V	NA	NA	NA	V	V	V	V	V	V	V	V	V
5c. Hosiery Products3/	Own	S	2.7	V	C	C	C	NA	NA	NA	C	C	C	C	C	C
		M	6.0	V	V	V	V	NA	NA	NA	V	V	V	V	V	V
	Int.	S	2.7	V	V	M	C	NA	NA	NA	V	M	C	V	M	C
		M	6.0	V	V	V	V	NA	NA	NA	V	V	V	V	V	V
6. Carpet Finishing	Int.	S	20.0	V	NA	NA	NA	V	V	V	V	V	V	V	V	V
		M	49.0	V	NA	NA	NA	V	V	V	V	V	V	V	V	V
		L	120.0	V	NA	NA	NA	V	V	V	V	V	V	V	V	V
7. Stock & Yarn Finishing	Comm.	S	9.4	V	NA	NA	NA	M	C	C	C	C	C	C	C	C
		M	23.0	V	NA	NA	NA	V	V	C	V	C	C	V	C	C
		L	57.0	V	NA	NA	NA	V	V	V	V	V	C	V	V	C
	Own	S	9.4	M	NA	NA	NA	M	C	C	C	C	C	C	C	C
		M	23.0	V	NA	NA	NA	M	M	C	M	C	C	C	C	C
		L	38.0	V	NA	NA	NA	V	V	V	V	V	V	V	V	V
		X-L	57.0	V	NA	NA	NA	V	V	V	V	V	V	V	V	V
	Int.	S	9.4	V	NA	NA	NA	M	C	C	C	C	C	C	C	C
		L	38.0	V	NA	NA	NA	V	V	V	V	V	V	V	V	V
8. Nonwoven Manufacturing	-	M	10.4	V	V	V	V	V	V	V	V	V	V	V	V	V
9. Felt Fabric Processing	-	M	2.0	M	C	C	C	NA	NA	NA	C	C	C	C	C	C

1/ Type processing applicable to woven and knit fabric finishing is shown for each model in these subcategories. These include "S" for simple, "C" for complex, and "D" for complex-desizing.
2/ *For wool scouring plants the treatment alternative is M.*
3/ Hosiery products is a subdivision of the knit fabric finishing subcategory.
Definitions: V = Viable; M = Marginal; C = Closure; and NA = Not Applicable
Source: Development, Planning and Research Associates, Inc. estimate based on the NPV methodology described in Capter II, the closure criteria presented in Chapter VIII, and the original wastewater control cost presented in Chapter VII.

Table D-2. The textile industry, effects of varying wastewater control costs assumptions on projected model plant closures for existing indirect dischargers (PSES)

Subcategory	Type Mill	Size/ Type1/	Daily Capacity	Base Case	Option 1 2/ (Treatment Alternative A) Percent of Control Costs			Option 2 (Treatment Alternative B) 3/ Percent of Control Costs			Option 3 (Treatment Alternative D) 3/ Percent of Control Costs		
			(kkg)		100	250	350	100	250	350	100	250	350
1. Wool Scouring	Comm.	S	16.0	C				NA	NA	NA	NA	NA	NA
		L	81.0	V				NA	NA	NA	NA	NA	NA
2. Wool Finishing	Comm.	S	3.3	V				C	C	C	C	C	C
	Int.	S	3.3	V				M	C	C	M	C	C
		M	20.0	V				V	V	V	V	V	V
		L	40.0	V				V	V	V	V	V	V
4. Woven Fabric Finishing	Comm.	S (S)	2.4	M				C	C	C	C	C	C
		M (C)	26.0	V				M	C	C	M	C	C
		L (C)	130.0	V				V	V	V	V	V	V
	Own	S (S)	2.4	V				V	C	C	V	C	C
		M (C)	26.0	V				V	V	V	V	V	V
		L (C)	130.0	V				V	V	V	V	V	V
	Int.	S (S)	2.4	V				V	C	C	V	C	C
		M (D)	20.0	V				V	V	V	V	V	V
		L (D)	50.0	V				V	V	V	V	V	V
		X-L (D)	170.0	V				V	V	V	V	V	V
5. Knit Fabric Finishing	Comm.	M (S)	7.7	V				C	C	C	C	C	C
		L (C)	18.6	V				V	V	C	V	V	C
	Int.	S (C)	1.5	V				C	C	C	C	C	C
		M (S)	7.7	V				V	M	C	V	M	C
		L (C)	18.6	V				V	V	C	V	M	M
		X-L (S)	31.0	V				V	V	V	V	V	V
5c. Hosiery Products 4/	Own	S	2.7	M				C	C	C	C	C	C
		L	13.6	V				V	V	V	V	V	V
	Int.	S	2.7	V				V	M	C	V	M	C
		L	13.6	V				V	V	V	V	V	V
6. Carpet Finishing	Int.	S	8.9	V				V	V	C	V	V	C
		M	49.0	V				V	V	V	V	V	V
		L	122.0	V				V	V	V	V	V	V
7. Stock & Yarn Finishing	Comm.	S	4.2	V				C	C	C	C	C	C
		M	9.4	V				C	C	C	C	C	C
		L	23.0	V				V	C	C	V	C	C
	Own	S	4.2	M				C	C	C	C	C	C
		M	9.4	V				M	C	C	M	C	C
		L	23.0	V				V	V	V	V	V	V
	Int.	M	9.4	V				C	C	C	C	C	C
		L	23.0	V				V	V	M	V	V	C
8. Nonwoven Manufacturing	-	S	24.0	V				V	V	V	V	V	V
		M	57.0	V				V	V	V	V	V	M
9. Felt Fabric Processing	-	S	0.9	V				V	M	C	V	M	C
		M	4.4	V				C	C	C	C	C	C
		L	10.7	M				C	C	C	C	C	C

1/ Type Processing applicable to woven and knit fabric finishing is shown for each model in these subcategories. These include "S" for simple; "C" for complex; and "D" for complex desizing.
2/ Option 1, Treatment Alternative A, is the current pretreatment practice; thus there are no additional treatment costs for compliance of Option 1.
3/ For the wool scouring models, the treatment alternative is M.
4/ Hosiery products is a subdivision of the knit fabric finishing subcategory.
Definitions: V = Viable; M = Marginal; C = Closure; and NA = Not Available.
Source: Development, Planning and Research Associates, Inc. estimate based on the NPV methodology described in Chapter II, the closure criteria presented in Chapter VIII, and the original wastewater control cost presented in Chapter VII.

Table D-3. The textile industry, effects of varying wastewater control costs assumptions on projected model plant closures for new source direct dischargers (NSPS)

Subcategory	Type Mill	Size Type1/	Daily Capacity	Base Case	Option 1[2/] (Treatment Alternative A) Percent of Control Costs 100	250	350	Option 2 (Treatment Alternative R) Percent of Control Costs 100	250	350	Option 3 (Treatment Alternative T) Percent of Control Costs 100	250	350
			(kkg)										
2. Wool Scouring	Int.	M	20.0	C				C	C	C	C	C	C
4. Woven Fabric Finishing	Own	L (C)	130.0	M				M	M	C	M	M	C
	Int.	L (D)	50.0	V				V	V	V	V	V	V
5. Knit Fabric Finishing	Int.	L (C)	13.6	M				M	M	C	M	M	C
5c. Hosiery Products3/	Int.	M	6.0	V				V	V	V	V	V	V
6. Capret Finishing	Int.	S	20.0	V				V	V	V	V	V	M
7. Stock & Yarn Finishing	Own	M	23.0	V				V	V	M	V	V	C
8. Nonwoven Manufacturing	-	M	10.4	V				V	V	M	V	V	M
9. Felt Fabric Processing	-	M	2.0	V				V	M	C	M	C	C

1/ Type processing applicable to woven and knit fabric finishing is shown for each model in these subcategories. These include "C" for complex and "D" for complex desizing.
2/ There are no additional costs associated with Option 1, Alternative A.
3/ Hosiery Products is a subdivision of the knit fabric finishing subcategory.
Definitions: V = Viable; M = Marginal; and C = Closure.
Source: Development Planning and Research Associates, Inc. estimate based on the NPV methodology described in Chapter II, the closure criteria presented in Chapter VIII, and the original wastewater control cost presented in Chapter VII.

Table D-4. The textile industry, effects of varying wastewater control costs assumptions on projected model plant closures for new source indirect dischargers (PSNS)

Subcategory	Type Mill	Size/ Type1/	Daily Capacity	Base Case	Option 1[2/] (Treatment Alternative A) Percent of Control Costs 100	250	350	Option 2 (Treatment Alternative R) Percent of Control Costs 100	250	350	Option 3 (Treatment Alternative T) Percent of Control Costs 100	250	350
			(kkg)										
2. Wool Finishing	Int.	M	20.0	C				C	C	C	C	C	C
4. Woven Fabric Finishing	Own	M (C)	26.0	V				V	V	M	V	V	M
	Int.	L (D)	50.0	V				V	V	V	V	V	M
5. Knit Fabric Finishing	Int.	L (C)	18.6	V				V	V	V	V	V	V
5c. Hosiery Products[3/]	Int.	L	13.6	V				V	V	V	V	V	V
6. Carpet Finishing	Int.	M	49.0	V				V	V	V	V	V	V
7. Stock & Yarn Finishing	Own	M	9.3	V				M	C	C	C	C	C
8. Nonwoven Manufacturing	-	M	57.0	V				V	V	V	V	V	V
9. Felt Fabric Processing	-	M	4.4	V				V	M	M	V	M	C

1/ Type processing applicable to woven and knit fabric finishing is shown for each model in these subcategories. These include "C" for complex and "D" for complex desizing.
2/ There are no additional costs associated with Option 1, Alternative A.
3/ Hosiery Products is a subdivision of the knit fabric finishing subcategory.
Definitions: V = Viable; M = Marginal; and C = Closure
Source: Development Planning and Research Associations, Inc. estimate based on the NPV methodology described in Chapter II, the closure criteria presented in Chapter VIII, and the original wastewater control cost presented in Chapter VII.

☆U.S. GOVERNMENT PRINTING OFFICE: 1979 O— 305-150/6596