



ADVANCED MATERIALS:
INDUSTRY GROWTH AND CHANGE IN SOUTH
CAROLINA

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South Carolina Department of Commerce | Division of Research

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INTRODUCTION

Technology, like in many other industries, has dramatically redefined the textile industry. No longer is the textile industry's purview confined to simply making fabrics or apparel for clothing, as it has become a pivotal tenet of a larger, more technological industry—advanced materials. The creation of advanced materials has transformed (some might even argue transcended) traditional fabric, chemical and metal production and continues to push the boundaries of current conceptions of industry definitions. Advanced textiles are a subset of advanced materials and both represent more economical and advanced processes, such as new types of composite nonwovens and laminates, new types of nonwoven finishing techniques, and superior fiber and textile additives. Advanced textiles in particular represent a new generation of textiles manufactured primarily for their technical and functional properties. Materials are now being produced that can be manipulated, modified, and tailored to precisely meet the needs of any particular customer or industry. Driven by function, these new materials are being created for automotive, aerospace, medical, and military applications. Even more important, advanced textiles are becoming an even more integral part of traditional industries such as automobile manufacturing, construction, metal fabrication, and textiles, making advanced textiles and materials a key component of growth in these industries. Advanced textiles are one of the many new products and processes that will continue to drive advanced materials growth in both the United States and South Carolina.

METHODOLOGY

This paper will examine the current state of the textile industry in South Carolina and seek to distinguish between the traditional textile industry of the past and the modern components of the industry that encapsulate the future. There is little doubt that advanced textiles trace their roots to the traditional textile industry, and any exploration of future growth must take this inclusive view. Advanced textiles represent the technological and innovative segment of the larger traditional textile market. Thus, efforts aimed at fostering the growth of the textile industry in South Carolina must firstly distinguish and identify those particular advanced (versus traditional) textiles that are the true drivers of this growth. A distinction will be made to establish the decline of traditional textiles (apparel manufacturing and basic fabric and yarn production) versus the rise of advanced textiles (advanced materials, fabrics, and fibers), and establish the premise that advanced textiles

will be the primary driver of textile growth in South Carolina. Furthermore, as a key component of the overall advanced materials industry, they will also help to promote the growth of advanced materials. Advanced textiles are but one component of the overall advanced materials industry. Because there is no single North American Industry Classification System (NAICS) specifically for advanced materials, Table 1 seeks to establish a number of NAICS that encompass advanced materials. Within the advanced materials cluster, there are a number of direct textile-related NAICS that overlap with conventional textile-based NAICS. It is these NAICS which encapsulate advanced textiles (NAICS 3133, 3149, and 3252) and which will be used as a basis for distinguishing advanced textiles from traditional textiles (Table 2). Thus, after establishing the current state of the overall textile industry in South Carolina, this paper will make the case that it is advanced textiles that will be the primary driver of future textile as well as advanced materials growth, and how current market trends and global conditions support this premise.

Table 1. Interrelated NAICS Codes for Advanced Materials

NAICS Code	Description
3133	Textile and Fabric Finishing and Fabric Coating Mills
3149	Other Textile Product Mills
3222	Converted Paper Product Manufacturing
3251	Basic Chemical Manufacturing
3252	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing
3255	Paint, Coating, and Adhesive Manufacturing
3259	Other Chemical Product and Preparation Manufacturing
3261	Plastic Product Manufacturing
3262	Rubber Product Manufacturing
3312	Steel Product Manufacturing from Purchased Steel
3313	Alumina and Aluminum Production and Processing
3314	Nonferrous Metal (except Aluminum) Production and Processing

Source: North American Classification System, United States, 2007. Executive Office of the President, Office of Management and Budget.

Table 2. Related NAICS for Textiles and Advanced Materials

NAICS Code	Description
313	Textile Mills: Establishments that transform a basic fiber (natural or synthetic) into a product, such as yarn or fabric that is further manufactured into usable items. <i>Advanced Materials Component—NAICS 3133, Textile and Fabric Finishing and Coating Mills</i>

NAICS Code	Description
314	Textile Product Mills: Establishments that manufacture textile products (except apparel) from purchased fabric, generally through cut and sew processes to make nonapparel textile products, such as sheets and towels. <i>Advanced Materials Component—NAICS 3149, Other Product Mills</i>
315	Apparel Manufacturing: Establishments that make apparel from purchased fabric or that weave or knit fabric and make garments. Includes businesses that have two distinct manufacturing processes: (1) cut and sew and (2) the manufacture of garments in establishments that first knit fabric and then cut and sew the fabric into a garment, to create ready to wear and custom apparel. <i>Advanced Materials Component—None</i>
325	Establishments primarily engaged in (1) manufacturing cellulosic (i.e. rayon and acetate) and noncellulosic (i.e. nylon, polyolefin, and polyester) fibers and filaments in the form of monofilament, filament yarn, staple, or tow or (2) manufacturing and texturing cellulosic and noncellulosic fibers and filaments. <i>Advanced Materials Component—NAICS 3252 Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing</i>

Source: North American Classification System, United States, 2007. Executive Office of the President, Office of Management and Budget.

CURRENT STATE OF THE TEXTILE INDUSTRY IN SOUTH CAROLINA

The textile and apparel industry played a formidable and pivotal part of not only the economy of South Carolina, but also the nation as a whole. Early settlers from England brought textile manufacturing tools and techniques with them to the New World and literally began weaving the fabrics of this industry in the Northeast. For two centuries, the Northeastern United States would be the focus of the textile industry. However, starting in the 1880's the industry moved south. This shift was not simple, as by the 1900s, it was seismic, resulting in the Southeast having the largest concentration of textile companies in the nation, for better or worse.

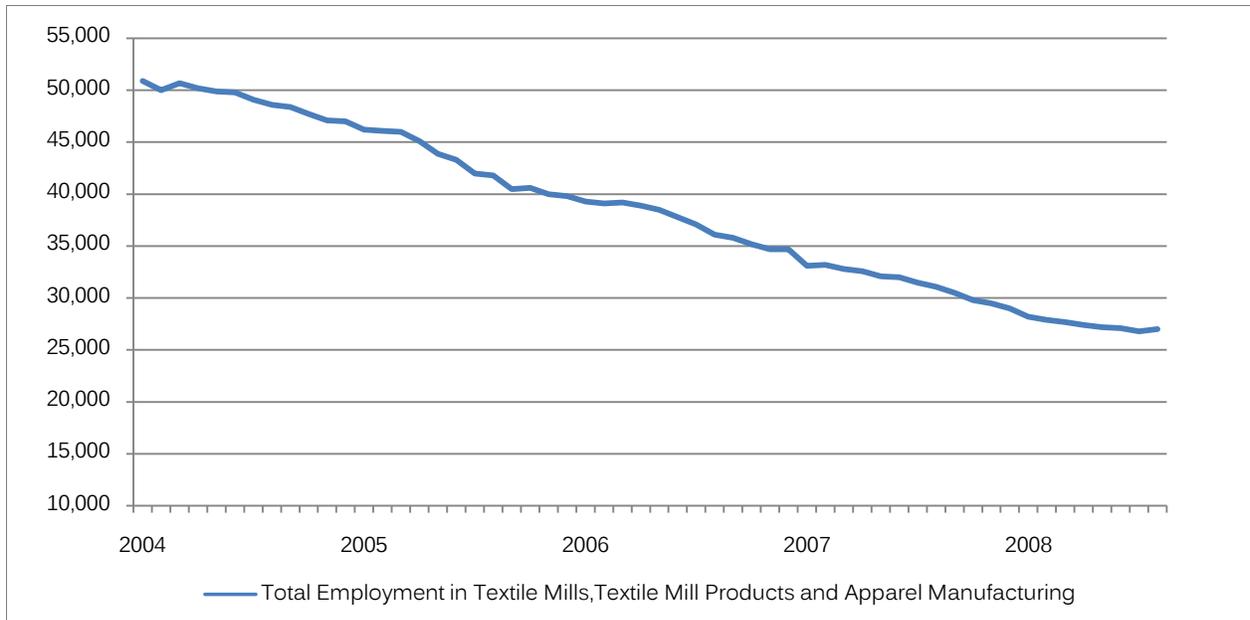
At its peak in the 1970s, the traditional textile industry in North and South Carolina accounted for almost half of the nation's textile jobs.¹ In 1973, South Carolina alone employed nearly 160,000 workers in the textile industry, and these workers accounted for just over 40% of all manufacturing jobs in the state.² Thirty-five years later, that number has dwindled to less than 30,000 employees, and 11% of all manufacturing jobs in the state (Figures 3 and 4). For an industry that, in its heyday,

¹ "Textiles: An Industry in Crisis." South Carolina Workforce Trends; Employment Security Commission, Labor Market Information, May, 2003 Special Edition.

² Ibid, pg. 3.

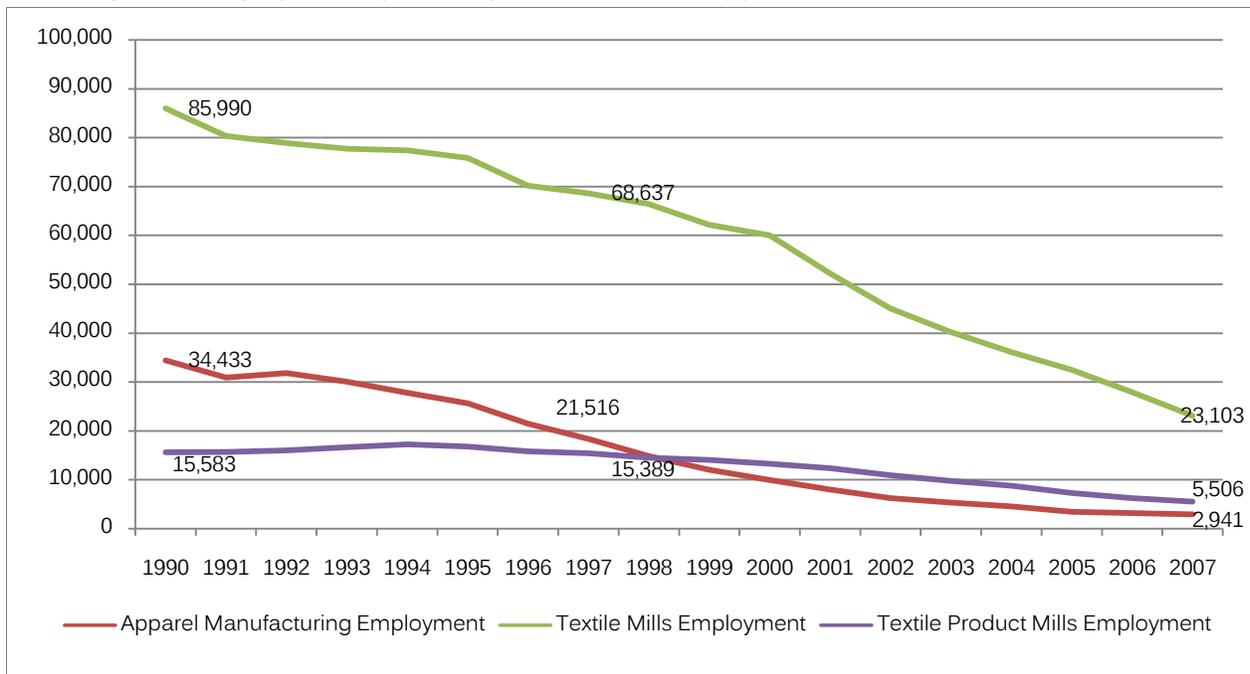
was the backbone of the state's economy, its current role has largely been reduced to a footnote, particularly for traditional textile mill products and apparel manufacturers.

Figure 3. Textile and Apparel Employment in South Carolina, 2004-present



Source: Current Employment Statistics, Bureau of Labor Statistics, US Department of Labor.

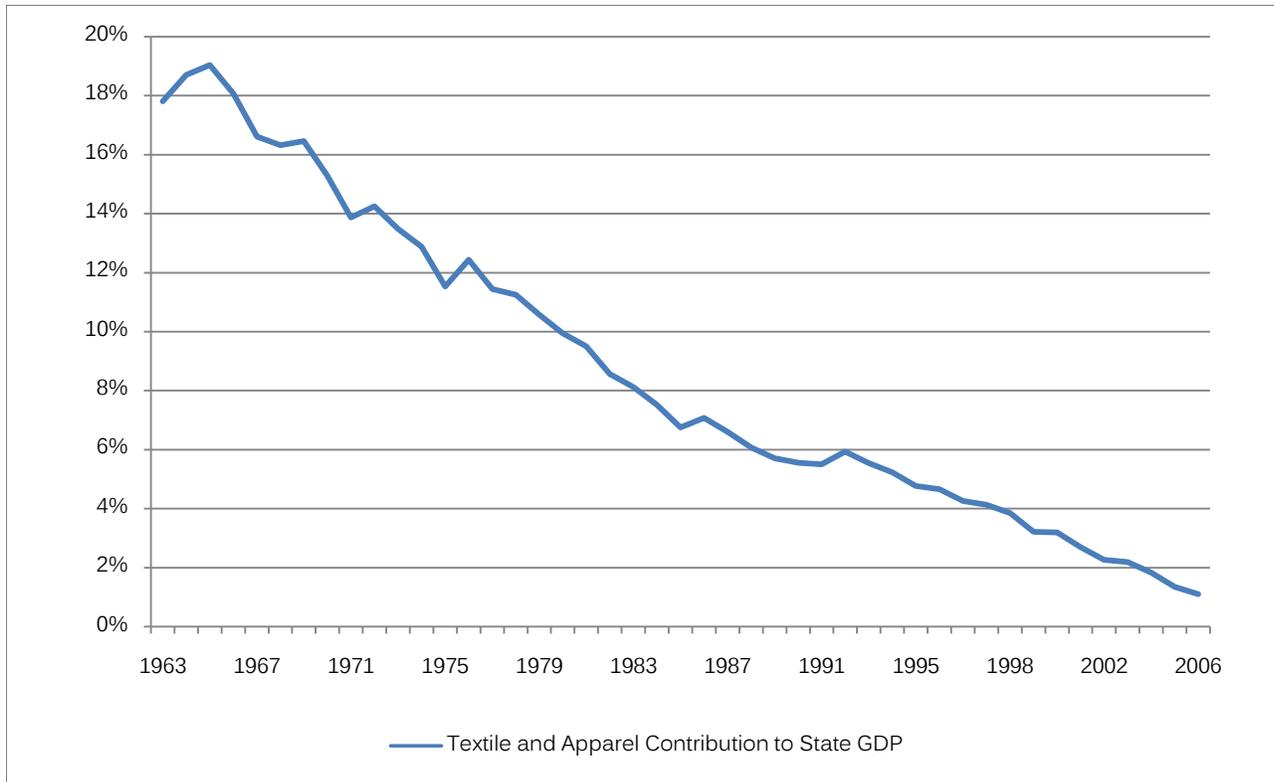
Figure 4. Employment by Industry for Textiles and Apparel in South Carolina, 1990-2007



Source: Quarterly Census of Employment and Wages, Bureau of Labor Statistics, US Department of Labor

Alongside this decline in employment has been a dramatic decline in both the textile and apparel industries' contribution to state gross domestic product (GDP). In 2006, the textile and apparel manufacturing industry contributed 1.1% to state gross domestic product (Figure 5).

Figure 5. Percent Contribution to State GDP of the Textile and Apparel Industries, 1963-2006



Source: Regional Economic Accounts, Bureau of Economic Analysis,

This contrasts with its former peak in the mid-1960s when these industries contributed nearly 20% to the state GDP.³ Even within this small contribution to state GDP, there is an interesting dichotomy. The lion's share of textile and apparel manufacturing's contribution to state GDP stems solely from textile mills and textile product, as apparel manufacturing's contribution to state GDP is 0.1%. It must also be noted that this decline has not been unique to these two particular manufacturing industries, as the entire non-durable manufacturing goods industry in South Carolina has declined in its overall contribution to state GDP. Non-durable goods contributed more than 13% to state GDP in 1997. By 2007, that same number had dwindled to 6.3%.⁴ State GDP has continued to increase at a steady rate during this same 10 year period, yet the contribution of textiles and apparel manufacturing has trended in the opposite direction (Table 6).

³ This is based upon available data from the Bureau of Economic Analysis, whose records are from 1963 onwards.

⁴ Regional Economic Accounts, Bureau of Labor Statistics, US Department of Commerce.

Table 6. Contribution to State GDP by Industry (millions of current dollars), 1997-2006

Year	Total State GDP	Textile Mill and Textile Product Mills (NAICS 313 and 314)	Apparel Manufacturing (NAICS 315)
1997	\$97,397	\$3,414	\$615
1998	\$102,945	\$3,450	\$518
1999	\$108,663	\$3,245	\$246
2000	\$112,514	\$3,257	\$330
2001	\$117,296	\$2,942	\$224
2002	\$121,582	\$2,578	\$181
2003	\$127,885	\$2,615	\$189
2004	\$131,851	\$2,190	\$231
2005	\$138,619	\$1,688	\$186
2006	\$146,211	\$1,444	\$165

Source: Regional Economic Accounts, Bureau of Economic Analysis, US Department of Commerce.

TRENDS IN ADVANCED MATERIALS: ADVANCED TEXTILES

In the early 1980s, Dan Luria and Jack Russell's study, *Rational Reindustrialization* posited a theory that the manufacturing of goods in developed economies is far from over; instead investment in development and innovation in particular sectors could be a prudent endeavor to bolster worker retention and business.⁵ Despite being written nearly 30 years ago, the authors' assessment of manufacturing in the US remains a salient and timely point. There is little doubt that the textile and apparel industries—alongside other manufacturing and good-producing industries—have suffered dramatic declines not only in South Carolina, but also the United States. Volatile, macro-economic conditions make for bleak reading and have often obscured some smaller, niche markets within these larger manufacturing sectors that have actually experienced significant growth. Some more specialized industries have shown better growth rates than their larger industry grouping. Even for those advanced textile industries that have experienced contractions, there are still success stories to be told, particularly for those companies and industries that have survived tough economic challenges by diversifying and offering innovative products in response to consumer demands. Success has also come to those companies that have invested heavily in promoting research and innovation and, within the context of textiles, have engendered an almost completely new industry, mainly that of advanced textiles.

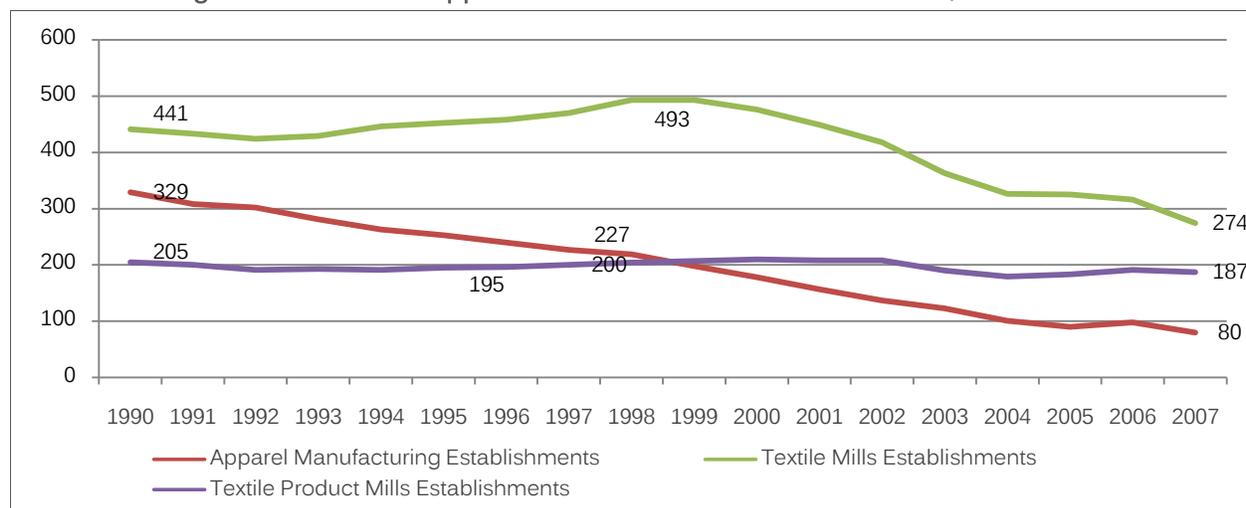
Advanced textiles are the culmination of years of research, growth, and innovation in the traditional textile, chemical, and plastics industries. Advanced textiles transcend these industries, yet at the same time, are highly steeped in all, and they embody the idea of technology blurring the

⁵ Dan Luria and Jack Russell, *Rational Reindustrialization*. Detroit: Widgetripper Press, 1981.

boundaries amongst industries. Arun Pal Aneja from DuPont best describes these materials, calling them “the third generation textiles” and “not simply alternatives to natural or synthetic fibers but provid[ing] superior functionality in broad emerging sectors of the economy from space to super conductivity and agriculture to geotextiles.”⁶ Advanced textiles, alongside advanced materials, represent the replacement of traditional textiles with more highly-engineered products, and it is only through encouraging the growth and development of these advanced textiles that the textile industry will continue to exist in South Carolina.

Successful textile companies have redefined their value and created unique selling points for their products, transforming themselves into advanced textile companies. Whether it is increasing product quality through technological innovations, or increasing the capacity to respond to highly-specific consumer demands, successful advanced textile companies today are a shadow of the typical image of the textile mills that dotted South Carolina's landscape 100 years ago. The number of textile companies has undoubtedly declined (Figure 7), yet at the same time, the surviving ones have greatly expanded their scope to focus on producing advanced textiles. This growth is demonstrated by advanced textile establishments being found in other advanced materials NAICS codes including, NAICS: 3261, Plastic Product Manufacturing; and NAICS 325 Chemical Manufacturing, furthering demonstrating how advanced textiles have blurred the lines among industry classifications.

Figure 7. Textile and Apparel Establishments in South Carolina, 1990-2007



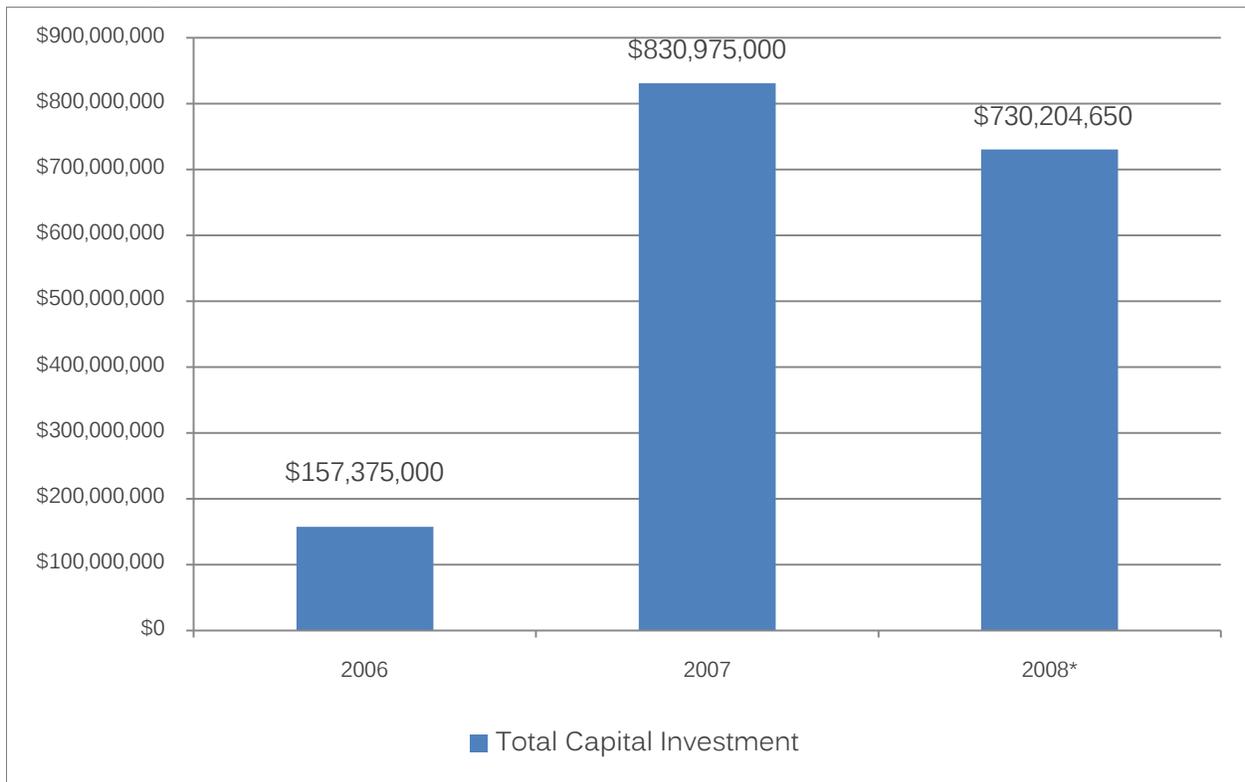
Source: Quarterly Census of Employment and Wages, Bureau of Labor Statistics.

If South Carolina envisions rebuilding and strengthening its textile industry, it will require a dramatic break with the past and a full embrace of the future, a future which steps the heart of textiles within that of advanced materials. Recent capital investment activity in South Carolina bears out this premise (Figure 8). South Carolina has experienced tremendous investment in advanced

⁶ Arun Pal Aneja, “Fiber Renaissance for the Next Millennium.” *International Nonwovens Journal*. Volume 8, No.2, Fall 1999.

materials over the past several years, reaching nearly \$1 billion in 2007. Early numbers from 2008 indicate this trend may continue. A closer examination of these numbers reveals that a large number of these new companies are 'textile companies'. However, these companies, many of which by traditional NAICS standards are classified as traditional textile companies, are by no means producing 'traditional' textile products. What these companies are producing are products such as high-performance fibers for ballistic protection, non-woven fiberglass, hybrid composite cloths, and the next generation of geotextiles for industrial applications, or in other words, advanced textiles.

Figure 8. Capital Investment in South Carolina in Advanced Materials, 2006-2008



*Correct as of 10/9/2008. Source: SC Department of Commerce.

Furthermore, the companies behind these numbers tell an even more revealing story. Of the nearly \$730 million that has been invested in the advanced materials industry in South Carolina this year alone, none of that investment has stemmed from traditional textile mills, and not a single company is an apparel manufacturer. Looking back over 2007 and 2008, with nearly \$2 billion invested in South Carolina, only one company was involved in apparel manufacturing, and even this apparel manufacturing was of a highly specialized nature (high-performance race wear suits). Additionally, the vast majority of companies investing in South Carolina during this time are involved in the production of purely *synthetic* textiles for largely commercial and industrial applications, producing advanced textiles for niche markets. Recent highlights include:

- In 2008, Shaw Industries invested over \$60 million to purchase a plant to invest in expanding its capacity to produce polymer chips used for manufacturing carpeting yarn.
- In 2007, Eastman Chemical invested twice in growing its facility in South Carolina, announcing a \$130 million in February, followed by further \$100 million investment in October. This investment was directed toward the conversion of its existing polymer line to also produce copolyesters and increase the capacity production of other advanced polymers.
- In 2007, DuPont selected its Cooper River plant in Berkeley, South Carolina for a \$500 million investment to expand the production of Kevlar® for both military and industrial use. Plans include the construction of a new Kevlar® fiber facility that will ultimately increase global Kevlar® production by more than 25%. This facility is part of a national plan that is the single largest investment in Kevlar® production since its introduction in 1965.
- In 2006, Milliken invested \$5 million and created 200 jobs to expand its facility in McCormick County. Widely recognized as a leader in the research and development for the textile and chemical industry, Milliken continues to be a cornerstone of the advanced materials industry here in South Carolina. It is one of the largest privately held textile and chemical manufacturers in the world, holding more than 2,000 patents, with more than 10,000 employees at 55 facilities around the world. Although the company's origin is in the Northeast, Milliken has been present in South Carolina for almost 125 years. During this time the company has built a portfolio of more than 19,000 different textile and chemical products, including some of the most cutting-edge advanced materials products in the world.
- In 2006, Cytec invested \$16 million and created 50 jobs in its Greenville location. Then again in 2007, the company invested \$150 million and created another 225 jobs to expand its carbon fiber production facilities. Cytec Carbon Fibers, LLC manufactures carbon fibers such as Thornel® T300, T650 and T40/800, which are used in a variety of applications from military and defense to commercial aerospace. These advanced composite fibers are lightweight, durable, and resistant to corrosion, which is why they represent the wave of the future in the push toward building more energy efficient machines.

These investments in advanced textiles, as a larger part of the advanced materials industry, demonstrate that South Carolina has a robust future in textiles. But it is one that is highly steeped in advanced materials, and relies upon products developed by consumer demand and driven by research and development. Economic development, growth and success are becoming more and more inextricably linked with these types of industries involving intensive research, development, knowledge, and innovation. As Robert Atkinson and Daniel Correa highlight in *The 2007 New Economy Index*, "new growth economics [is] driven by the recognition that the old economic

models created in the industrial era dominated by commodity goods production could no longer adequately explain growth, especially in an economy powered by knowledge and innovation.”⁷ A large part of this innovation will stem from further encouraging investment, both public and private, into research and development and cutting-edge industries such as advanced materials and advanced textiles.

FUTURE TRENDS FOR GLOBAL COMPETITIVENESS

The Globalization of Labor

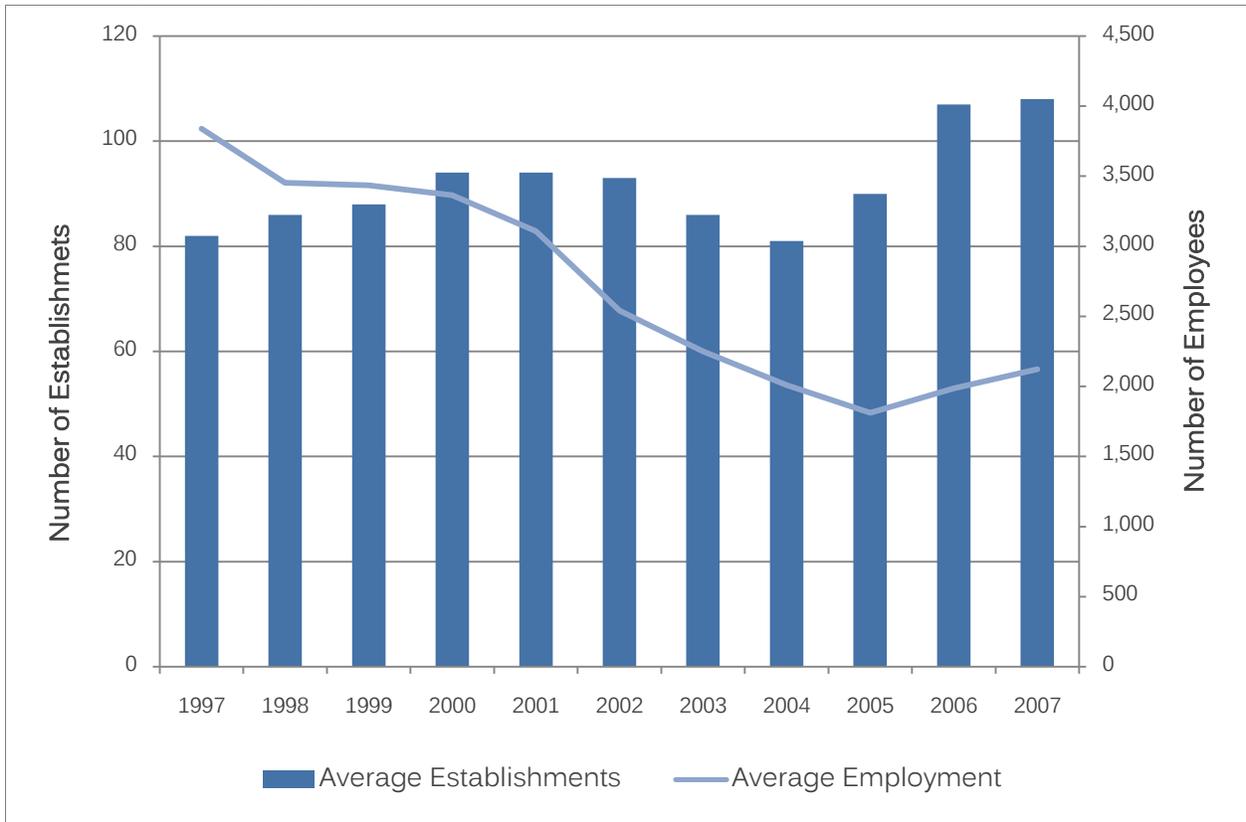
Cheap labor is described by Michael Porter in *The Competitive Advantages of Nations* as being a “lower-order advantage” meaning it is easy to imitate. Furthermore, this type of advantage means that “competitors can often readily duplicate such advantages by finding another low-cost location.”⁸ The textile industry became a stark example of this supposition, demonstrated by the steady outflow of textile jobs from the United States to cheaper, overseas labor markets. Just as lower labor costs drove the industry south in the early 1900s, the quest for cheaper labor remains a continuous theme in traditional textile production. China, Vietnam, and Bangladesh are just a few of the many countries in Asia that offer significantly lower labor costs than the US and are now leveraging their competitive advantage (even cheaper labor).

This globalization of labor in the textile industry is likely to intensify in the future, as demand for better goods at cheaper prices continues to force producers to seek cheaper inputs. One of the biggest inputs affecting prices is labor, and producers will continue to seek lower labor costs to drive down overall costs. So how can South Carolina compete? By reestablishing its comparative advantage based upon research and development and innovation in the area of advanced textiles. This point is highlighted by growth in NAICS 3149, Other Textile Product Mills, which include companies that make products such as sails, awnings, and cable products, and not the traditional mill products such as curtains and linens. While this industry has experienced a decline in employment, the number of establishment in NAICS 3149 has actually increased by 32% (Figure 9). The increasing use of technology to raise productivity has led to declining employment, but not necessarily declining businesses. Thus with the decreasing need for large and extensive labor pools, cheap labor as a factor in locating a business becomes far less of a critical factor and refocuses the need for technological innovation and product development to drive business.

⁷ Ibid, p. 51

⁸ Michael Porter, *The Competitive Advantage of Nations*, The Free Press, New York, 1990, p.41.

Figure 9. Employees and Establishment for NAICS 3149, Other Textile Product Mills



Source: Quarterly Census of Employment and Wages, Bureau of Labor Statistics

Those textiles companies that have survived and thrived through the years of challenges brought on by globalization, federal and international trade regulations, technological advances and constantly changing consumer demand have been characterized by two important aspects: flexibility and innovation. The economist Joseph Schumpeter characterized this “Darwinian” progression best with his assertion that the weak and less creative would be destroyed while the strong and creative would rise in a process of “creative destruction.”⁹ This assertion does not appear to be changing anytime soon, and it is not unique to the textile industry. It is the ability and the absolute need to adapt to rapidly changing market conditions and consumer demand that is becoming a recurring theme throughout various industries, and textiles are no exception. This flexibility involves creating new products which respond to consumer and industry demands and continuing to develop innovative and efficient technologies for delivering these products. All of these tenets are embodied by the rise and success of advanced textiles.

The role of technology and rising productivity in shaping the traditional textile industry is best surmised by Pietra Rivoli in *The Travels of a T-Shirt*: “while production, revenues, and exports are soaring, employment is shrinking because of the rapid advances in technology and labor

⁹ Joseph Schumpeter, *Capitalism, Socialism and Democracy*. Peter Smith Publisher, 1942.

production.”¹⁰ Technology, alongside new and emerging sciences, such as nanotechnology and biotechnology, are enabling companies to produce new realms of advanced textile products. A report by EmergingTextiles.com supports this premise, citing that “the average price of garments produced in the USA rose by 25% as output was geared increasingly to high-end niche markets.”¹¹ Advanced textiles are rapidly changing how we define textiles, and it is through focusing on these technologically advanced products that future growth will be predicated.

The International Marketplace

Continuing to produce products that have faced severe global competition has been a losing battle for most American businesses; in particular, businesses engaged in the production of commodity apparel products have faced the harshest of competition on the world stage. Apparel production and exports in the US and South Carolina have plummeted in recent years, due to a variety of reasons, including overproduction, multilateral and regional trade agreements, and rapidly changing consumer demands. Agreements such as the North American Free Trade Agreement, Central American Free Trade Agreement, and the on-going Doha Round of trade negotiations leave a very uncertain future for traditional textiles in the US. Even if federal and international trade regulations, from NAFTA to the Multi-Fiber Agreement are to blame for a decline in US textile production, these types of agreements will continue to be part of the rules of engagement for competing in this industry, and further rules and restrictions may increase.

This stands in contrast to those companies that have continued to specialize and create unique products have been the most insulated from this competition. US textile manufacturers have some of the most advanced technologies for producing yarns and fabrics, as demonstrated by the vast success of advanced materials and advanced textiles. From Kevlar to carbon fibers, these involve textile production processes that are immersed in research, development, and innovation, which stands in contrast to the labor-intensive processes of apparel manufacturing. South Carolina can rediscover its comparative advantage in textiles, but it will have to be one that is steeped in further developing advanced textiles. Comparing export data from South Carolina bears out this premise. Exports from NAICS 315, Apparel Manufacturing have plummeted in South Carolina, going from \$150 million to \$38 million for apparel manufacturing from 2002 to 2007 (Figure 10). Meanwhile, exports from NAICS 314, 313, and 325 industries have declined, but not to the precipitous degree of apparel manufacturing (Figures 10 and 11).

¹⁰ Pietra Rivoli, *The Travels of a T-Shirt in the Global Economy*, Hoboken, NJ: John Wiley and Sons, Inc., 2005.

¹¹ “World Textile and Apparel Trade and Production Trends”, EmergingTextiles.com, March 2008.

<http://www.emergingtextiles.com/?q=stu&s=TI-apparel-trade-production-trends&c=stu080624-&peu=eu785&pus=us1217>.

Figure 10. Textile Product Mill and Apparel Exports in South Carolina

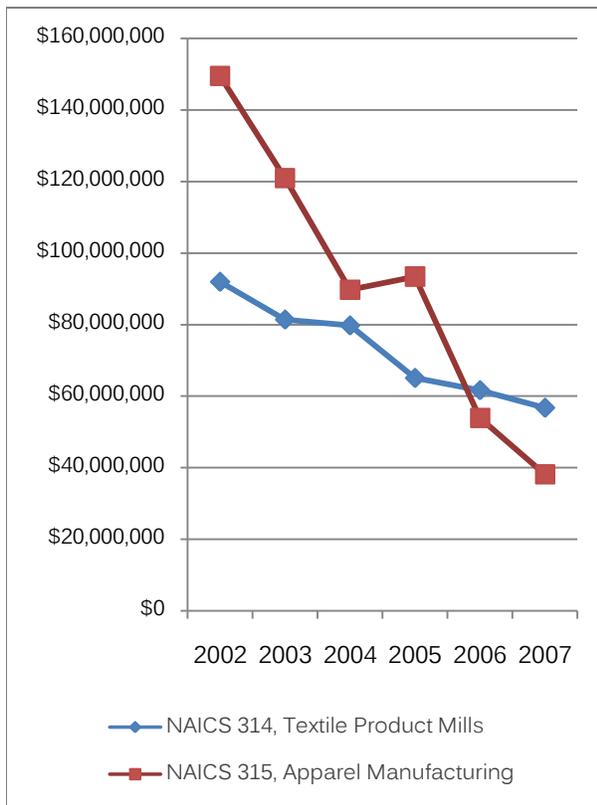
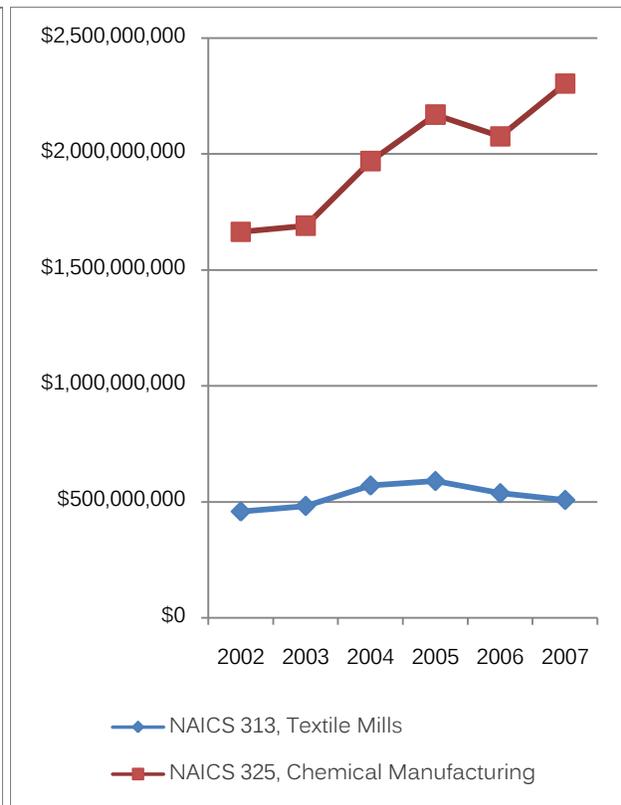


Figure 11. Textile Mill and Chemical Manufacturing Exports in South Carolina

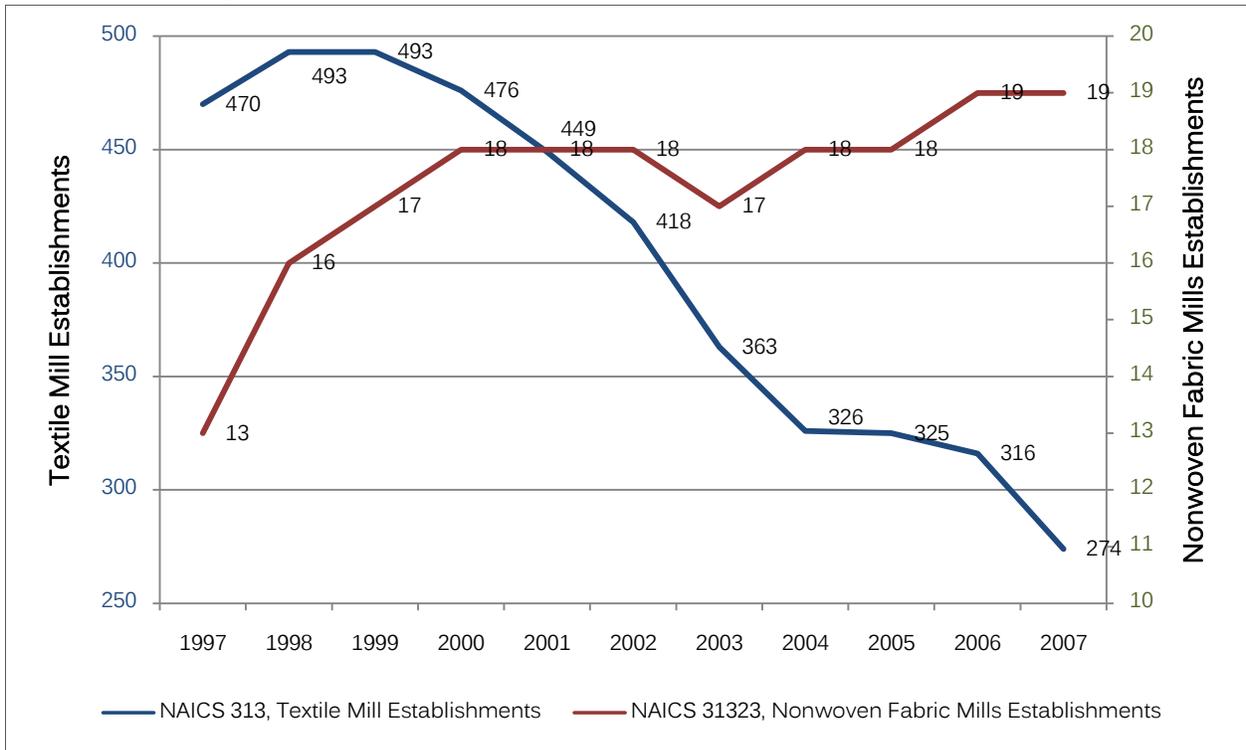


Source: TradeStats Express™

This difference can in part be attributed to these latter industries encompassing components of the advanced textiles and advanced materials industries. As noted earlier, traditional textile NAICS include more specific, advanced textile NAICS which are key components of the advanced materials industries. NAICS 3133, Textile and Fabric Finishing; NAICS 3149, Other Textile Product Mills; and NAICS 3252, Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing, are all niche, advanced textile establishments found within the larger, traditional textile manufacturing NAICS. As noted earlier, these advanced textiles companies have generally outperformed the traditional textile sectors in terms of growth rates for numbers of establishments. An even closer look at the even more specific, six-digit NAICS reveals an interesting dichotomy when compared to their larger, traditional grouping.

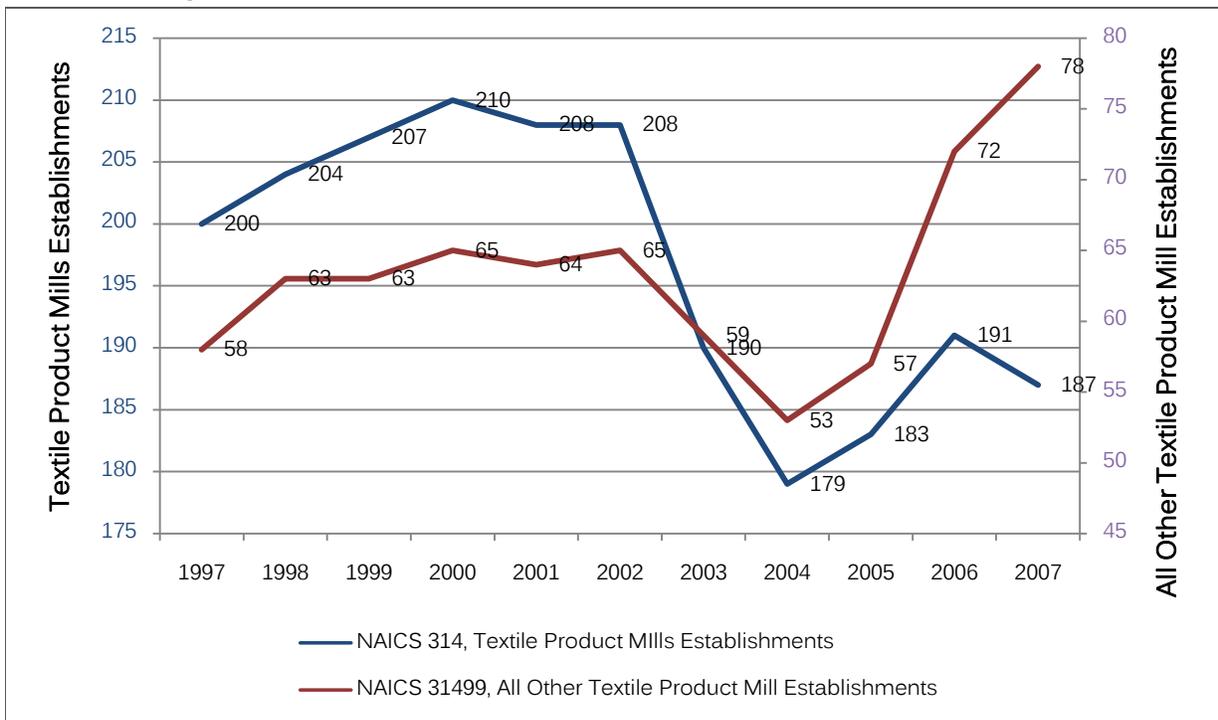
The more specialized, niche industries (all of which are producing advanced textiles), have generally experienced more steady, overall growth than their larger more general industry classifications. Nonwoven Fabric Mill Establishments have experienced an increase over the past ten years, while general textile mill establishments have almost halved (Figure 12). Companies involved in this industry are involved in the bonding or interlocking of fibers by mechanical, chemical, or thermal means and represent the heart of advanced textiles.

Figure 12. Textile Mills versus Nonwoven Fabric Mills Establishments



Source: Quarterly Census of Employment and Wages, Bureau of Labor Statistics

Figure 13. Textile Mill versus All Other Textile Product Mill Establishments

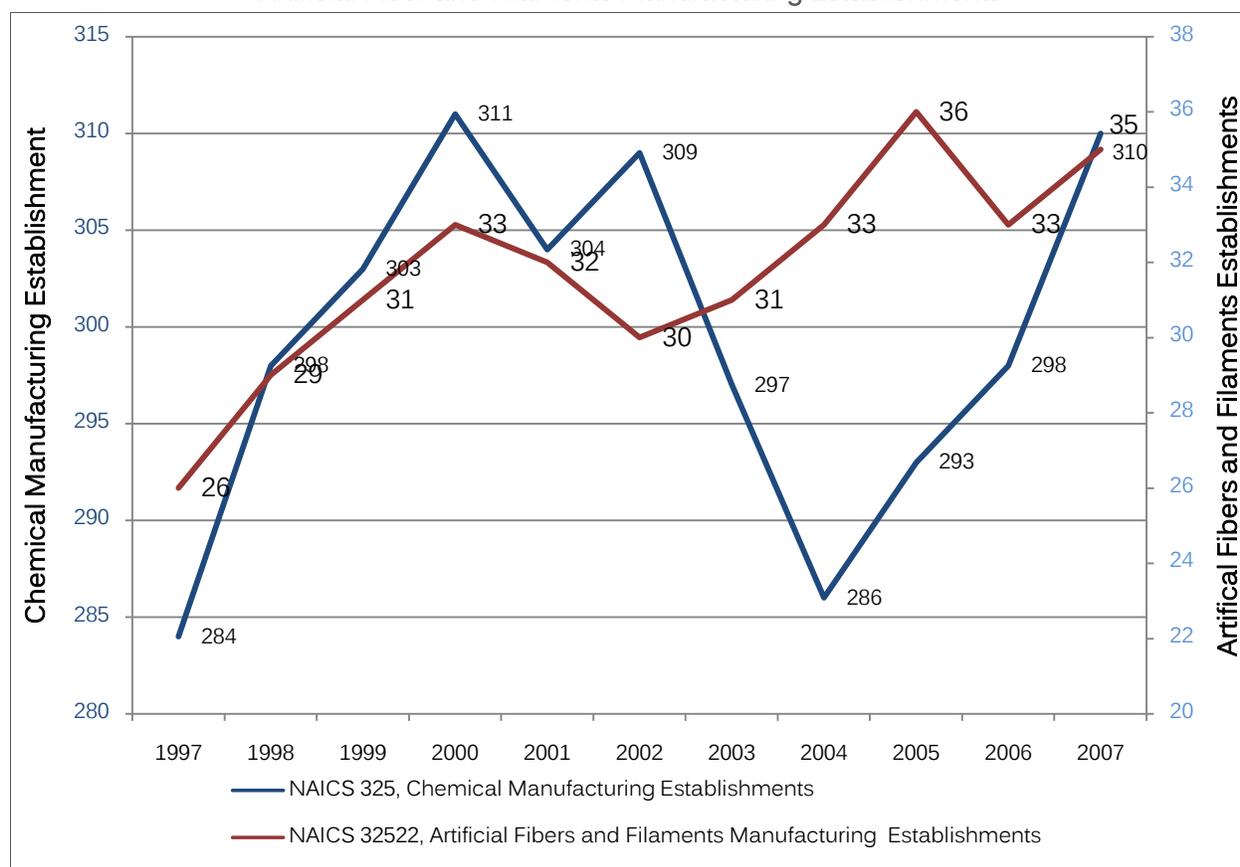


Source: Quarterly Census of Employment and Wages, Bureau of Labor Statistics

Growth and decline within NAICS 314, Textile Product Mills have not been as precipitous as NAICS 313. Within Textile Product Mills Establishments, its more specialized classification, NAICS 31499, All Other Textile Product Mill Establishments has also reflected a more stable count in establishment numbers and has actually experienced overall growth (Figure 13). Businesses involved in this latter classification are involved in the production of items such as textile fire hoses, sleeping bags, and carpet cutting and binding.

A look at NAICS 325 makes for similar reading. Chemical manufacturing establishments have not radically declined in the state, and the more specific, advanced textile component within this larger industry, NAICS 32522, Artificial Fibers and Filaments Manufacturing, has experienced overall growth (Figure 14). Overall, the growth in these niche, advanced textile industries is often obscured by declines in the larger industry grouping. Thus, future strategies for growing the textile industry in South Carolina must focus upon these technologically advanced industry grouping, or in other words, advanced textiles.

Figure 14. Chemical Manufacturing versus Artificial Fiber and Filaments Manufacturing Establishments



Source: Quarterly Census of Employment and Wages, Bureau of Labor Statistics

CONCLUSION

Just as the new economy has brought with it phenomenal structural changes in the way states and nations succeed in their development efforts, the evolution of traditional textiles to advanced textiles has completely changed the requirements for achieving economic growth and success in this industry. Furthermore, key tenets for economic success in the advanced textile industry are highly divergent from those that made textiles a powerhouse of the Southeast in the 1900s. The comparative advantage is no longer cheap labor; the advantage now lies with those areas that can provide highly-skilled and highly educated workers to keep businesses and industries at the forefront of innovation.

Advanced materials and advanced textiles are no exception to this adage. Both have been driven by developments in nanotechnology, polymer science, and biological science amongst others and these multi-disciplinary advances will continue to act as a catalyst for future growth. The lines between these industries will continue to soften, and advanced materials and textiles will continue to do just that: advance, producing materials that are responding to our very specific needs. What is crucial in all of this is the need for an educated workforce, as cheap labor is no longer a criterion for growth; instead a highly-educated labor force supported by strong investment in research and development is the driver for growth.