

**Analysis of World Nonwovens Market**

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ABSTRACT

During the past decade, significant changes have occurred in the worldwide nonwoven market. The predominant regions of the world for the nonwoven production have been restructured. The Asia-Pacific region, including China, shows a potential growth in nonwoven production while the United States and Western Europe continue to develop production technology. The global production of nonwovens reached 4.4 million tons, which is equivalent to \$15.9 billion (U.S. dollar). During 2004, 64% of nonwoven materials were produced in North America, Western Europe and Japan. A decade earlier, these regions accounted for slightly higher than 70% of worldwide nonwoven output. The impact on the nonwovens industry is obvious as raw material prices escalate. Major nonwoven producers have faced the challenge, with increasing pressure, to sustain profit margins although raw material prices are not stable. This price volatility continued to impact financial performance of nonwoven companies in 2005. Nevertheless, global nonwoven production is forecast to rise to 6.3 million tons by 2009, or an increase of two million tons from 2004 production levels.

Keywords: textiles, economic analysis, nonwoven market, predominant regions, raw materials, global nonwoven production, North America, Western Europe, China

Introduction

Although the world market of nonwoven products continuously grows, it faces the structural readjustment followed by the change of global economic condition, raw material capacity and consumers' needs and behavior. In addition, new expansionary manufacturers are emerging while the existing nonwoven producers are concerned by present consumers. This research focuses

on the prediction of the future global nonwoven production as shown in Figure 1, by analyzing information about the global economic condition, the current market of nonwoven production, and the production trends of polypropylene (PP) and polyester (PET) which are most widely used as raw materials in nonwoven industry.

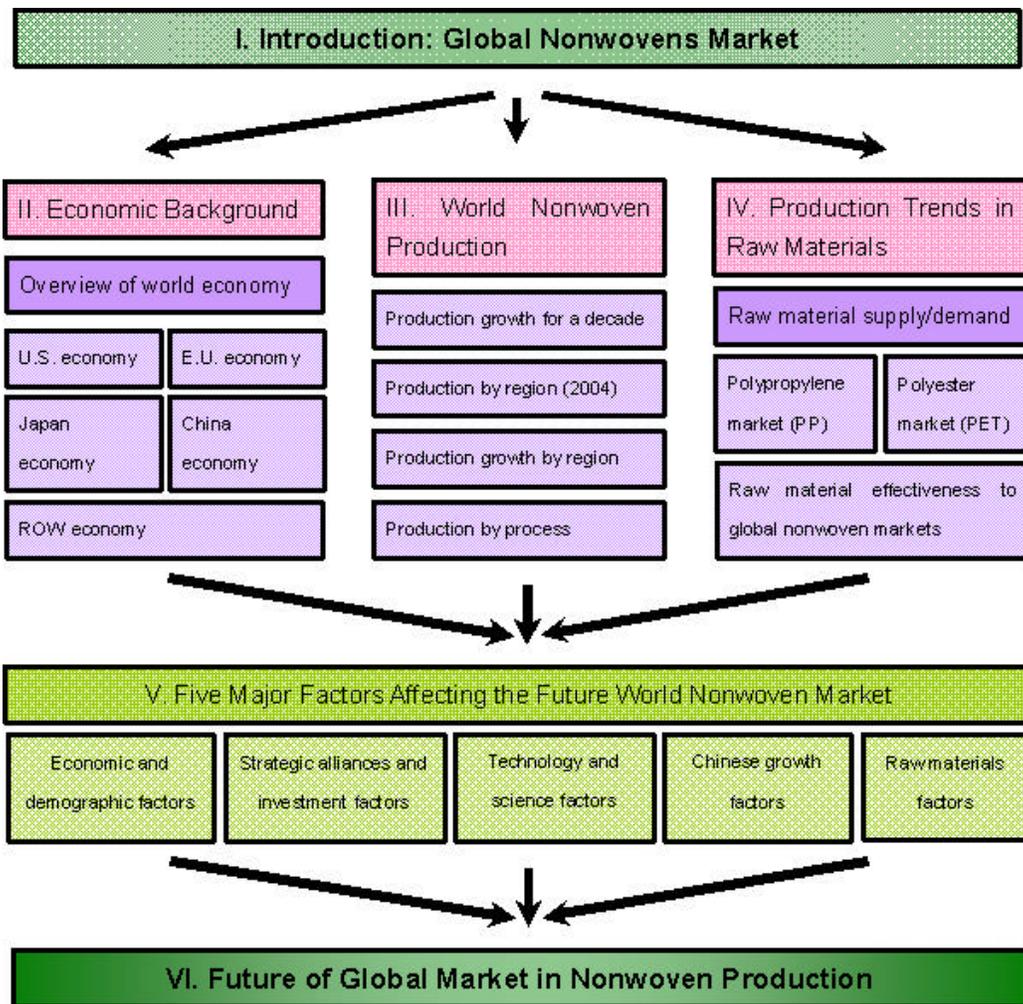


Figure 1. Forecast Process of Global Market in Nonwoven Production.

Note: Diagram developed by H. J. Lee & N. Cassill (2006)

According to Nikhil Meswani, the textile world in the twenty first century is composed of the United States (US), Europe, Japan and two giants, China and India (Meswani, 2004). Peter Driscoll indicated how China's role is important in the textile industry, including a forecast of the supply/demand change of polyester, a major raw material in nonwoven production (Driscoll, 2004).

Jean-Louis Juvet predicted more textile companies in the U.S. and Europe will consolidate to survive under the formidable international competition (Juvet, 2004). For example, the Freudenberg Group and its Japanese partner, Japan Vilene Co., recently have strengthened their

commitment in China for the apparel interlining and automotive filter production ("Freudenberg", 2005; "Freudenberg Expands", 2005). Juvet believes the developed countries will see a further reduction in fiber production for traditional textile end uses, but this will be offset by a rise in the output of technical textiles including nonwovens. Indeed, microencapsulated phase change materials, nanofibers, and various pharmaceutical solutions are used for the innovation of nonwoven end usage (Grady, 2005; Hanna & Engqvist, 2006; Ward, 2005).

Since the global dynamics in the nonwoven sector continue to restructure in production and marketing, forecasting the

future global market in nonwoven production requires i) reliable information about the global economic condition, ii) exact data on the raw material supply/demand, and iii) accurate market research on current global nonwoven production (INDA, 2004; Natrajan, 2005).

Despite the industry's restructuring, the U.S. industry leads the world in nonwoven technology and production (Bitz, 2003). The U.S. is the largest producer of nonwovens and this pattern is expected to continue in the near future. On the other hand, emerging economies such as China have the potential to grow in nonwovens at a significant rate ("World Textile", 2004).

During the past five years, more than 90% of nonwoven sales have been generated by the leading 40 producers and more than 30 companies of these 40 companies are based in North America and European countries (Bitz, 2003). These 30 leading companies of nonwovens remain as the most advanced of the industry in terms of technology innovation, global marketing and new production introductions, but the sales growth has slowed recently due to weak world economic conditions over the last few years.

Economic Background

Understanding the economic backgrounds of the United States, European Union, and Asia (China/ Japan) is critical to understanding the world nonwoven production market. These three predominant regions of the world combined account for more than 60% of the world's 2005 Gross Domestic Product (GDP), estimated at \$37.4 trillion as shown in Table 1 (Central Intelligence Agency (CIA), 2005). The Central Intelligence Agency recently indicated that the world's GDP grew by more than 9.2%, from 52.89 trillion dollars in 2004 to 60.63 trillion dollars in 2005. However, the European Union's annual growth in the same period was 4.55% which is a half of the world growth. In contrast, China's GDP grew almost three times in 2005 even though China has been taking administrative steps to "cool down" the overheated economy and its central bank increased interest rates in 2005 (CIA, 2006).

Table 1
Gross Domestic Product (GDP) by World Region

Region	2004 GDP	2005 GDP		Growth Rate 2004 - 2005
	(USD, trillion)	(USD, trillion)	(% share)	
U.S.	11.75	12.31	20.30%	4.77%
European Union	11.65	12.18	20.09%	4.55%
Japan	3.75	4.03	6.65%	7.47%
China	2.23	8.88	14.65%	298.21%
Rest of World	26.13	23.23	38.31%	-11.10%
World	55.51	60.63	100.00%	9.22%

Source: Central Intelligence Agency (CIA) estimates. (2005).

CIA. (2006). Retrieved November 9, 2006 from <https://www.cia.gov/cia/publications/factbook/rankorder/2004rank.html>

There are two major negative effects impacting nonwoven industry. However, the world economy seems to be strong enough to reduce those two impacts. First, the oil price hike is not an external shock to the world economy since the world oil demand

unexpectedly decreased over past three years (Energy Information Administration (EIA), 2006). The second serious risk is posed by a weakening of the U.S. dollar; with one dollar trading against 0.85 euro (3rd week of November, 2005). Exchange

rates may not be the central parameters to correct the structural imbalance of the U.S. and Euro currencies. European Forecasting Network (EFN) forecasts that one dollar will cost 0.89 euro on average in 2006, but assumes a further temporary weakening of the dollar will negatively affect the industries in the euro area (European Forecasting Network (EFN), 2005).

U.S. Economy

The U.S. economy started moving out of the recession in 2003, but the growth was slower in 2004 than expected due to the recent decline in the value of the U.S. dollar versus several other major world currencies. This slowed growth could reduce nonwoven imports and increase U.S. exports. Indeed, the decline in the value of the U.S. dollar against the Euro, British Pound, Yen and several other major world currencies

improved the competitiveness of U.S. exports and made nonwoven imports less attractive. This will be beneficial to domestic nonwoven producers involved in export. On the other hand, the country's deficit positions can increase interest rates continuously, slow economic growth and reduce government-sponsored entitlement programs (INDA, 2004).

Petroleum industry analysts forecast oil prices to remain high during 2005 and possibly rise further in 2006 (EIA, 2006). Energy Information Administration (EIA; 2005) estimated the increase of oil prices in the U.S. would surpass 5.6% in 2006 (Table 2) and total U.S. petroleum demand in 2006 would be projected to average 21 million barrel/day or 2.3% more than 2005 levels (Table 3).

Table 2
Annual U.S. Petroleum Price

	(U.S. dollar/gallon)			
	2004	2005	2006	Growth
All Grades	1.89	2.34	2.47	5.60%
Regular	1.85	2.29	2.43	6.01%
Retail Diesel	1.81	2.45	2.56	4.76%

Source: Energy Information Administration (EIA) estimates. (2005).
EIA. (2005). Retrieved November 11, 2005 from <http://www.eia.doe.gov/emeu/steo/pub/contents.html>

Table 3
Annual U.S. Petroleum Demand

	(mn barrels per day)			
	2004	2005	2006	Growth (2005-2006)
Motor Gasoline	9.11	9.12	9.26	1.57%
Jet Fuel	1.63	1.62	1.67	3.14%
Distillate Fuel Oil	4.06	4.08	4.21	3.02%
Residual Fuel Oil	0.86	0.90	0.85	-5.16%
Other Oils	5.07	4.85	5.04	3.94%
Total Demand	20.73	20.57	21.04	2.25%

Source: Energy Information Administration (EIA) estimates. (2005).
EIA. (2005). Retrieved November 11, 2005 from <http://www.eia.doe.gov/emeu/steo/pub/contents.html>

Hurricane-related disruptions combined with increased prices resulted in lower projected demand for petroleum products in 2005 (Weisman, 2005). The 2006 growth of oil price is supposed to be 4.5%, and 2006 petroleum demand is expected to be 21.04 million barrel per day

on average, or 2.3% over 2005. The effects of higher oil prices are already evident but it is expected that the global economic recovery is strong enough to weather the effects of rising oil prices. United States' nonwoven producers export over twice the volume imported. However, the imports of

nonwovens into the U.S. are rising faster than the exports since the U.S. nonwoven producers set up foreign operations (European Commission (EC), 2005).

Europe Economy

The European Union (EU) currently has 25 members and four candidate members (see Appendix A). European economic activity slowed with the global recession at the beginning of the decade (Johnsson, 2005). However, the European Union's economies are forecasted to grow faster in coming years than were expected due to increasing global activity, internal restructuring and the addition of member countries (Hanson, 2005). On the other side, according to INDA (2004), the strengthening European market is not expected to have a major impact on the nonwoven market of North America because many European nonwoven companies are globally oriented but not cost competitive due to high social taxation. The cost of doing business in Western Europe is high resulting in the shift of investment toward Eastern Europe, where environmental controls are less demanding. Since the Eastern European countries are integrated into the EU, this structural difficulty in European nonwoven companies will be minimized in the near future.

Japan Economy

Japan remains a significant economic power in the Asia-Pacific region. However, Japan's past decade malaise and China's potential economic growth predict Japan's economic power could be over soon (Palley, 2005). While Japan is a high cost producer of nonwoven materials, the Japanese nonwoven industries have a) successfully developed high value nonwoven products for niche markets, and b) begun investing heavily in nonwoven production facilities in neighboring Asia-Pacific countries (principally Korea, China and Thailand) (INDA, 2004). Japan will continue to move nonwoven production to lower cost Asian nations, due to high value of the yen relative to competing currencies, and lower production costs of China, Thailand and Korea.

China Economy

China continues to experience industrial development. China's entry into the World Trade Organization (WTO) in 2001 had a direct effect on imports and exports to the U.S. (Association of the Nonwoven Fabric Industry (INDA), 2005). In addition, the U.S. quota on Chinese goods was phased out in 2005. China's WTO status and quota elimination will continue to have a positive impact on nonwoven investment in China. On the other hand, it is expected that the level of imports from China will rise, which could further impact the U.S. nonwoven industry.

In 2004, China accounted for almost half of the nonwoven output within the Asia-Pacific region, and its production capacity increased more than five times in the past 10 years (INDA, 2005). According to INDA's Asia-Pacific report (2005), China's nonwoven industry will continue to expand its nonwoven market at a more moderate rate of 12% a year (International Monetary Fund (IMF), 2005). On the other hand, China has some main risks in the nonwoven production: a potential shortage of raw materials, comparably backward technology, and the lack of consistent supply of electrical power and oil (INDA, 2005).

Asia-Pacific Countries and Latin America

During the past several years, the Gross Domestic Products of major Asia-Pacific countries were affected by the global economic slowdown, but the economies of Korea, Thailand and Taiwan did expand in a 2003 turnaround (Kimberly-Clark, 2004). Asia-Pacific markets will be increasingly important to North American and European nonwoven companies as sites for manufacturing operations. Over the long term, investment by North American firms in Asia-Pacific nations will rise since the nonwoven industries in this region are well developed and growing rapidly as the various interdependent economies develop.

The Latin American nonwovens industry is growing, with the leading nonwovens producing nations being Mexico and Brazil (Thurston, 2005). There have been considerable investments by U.S.

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nonwovens manufacturers to supply the Latin American markets. Most of the production from this area is converted and consumed within the domestic Latin markets. It is expected that free trade agreements will not have a major impact on either imports or exports of nonwovens between North America and Latin America due to the North America's investments in local Latin nonwovens production.

World Nonwoven Production

The global production of nonwovens reached 4.4 million tons which is equivalent to \$15.9 billion (USD) and equals approximately 110 million square meters in 2004 (Table 4). Tonnage has increased at an average annual growth rate of 7.4% per year over the past decade.

Table 4.
Global Nonwoven Fabric Production

	1994	1999	2004	Growth Rate 1994-2004 (%/Year)
Tonnes (Million)	2.2	3.2	4.4	7.4%
Dollars (billion)	9.0	12.6	15.9	5.9%
Square meters (millions)	49.0	74.0	110.0	8.4%

Source: INDA & European Disposables and Nonwovens Association (EDANA) estimates (2004)
INDA. (2004). *Worldwide Outlook for the Nonwovens Industry: 2004-2009*. (INDA report), Cary, NC.

During 2004, approximately 64% of nonwoven materials were produced in North America, Western Europe and Japan. A decade earlier, these regions accounted for slightly higher than 70% of world nonwoven output (Figure 2). This nonwovens industry phenomenon has occurred due, in part, to

the industrialization of China. The Chinese government is encouraging private enterprise to expand the industries with efficient factories; China now accounts for nearly half of the nonwovens output in the Asia-Pacific region (INDA, 2005).

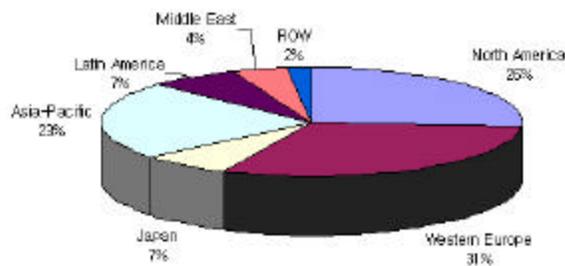


Figure 2. Nonwoven Production by Region (2004).

Source: Association of the Nonwoven Fabrics Industry (INDA) & European Disposables and Nonwovens Association (EDANA) estimates (2004)
INDA. (2004). *Worldwide Outlook for the Nonwovens Industry: 2004-2009*. (INDA report), Cary, NC.

The Asia-Pacific market, excluding Japan, rapidly expanded exceeding one million tons in 2004. The production in the Asia-Pacific market has grown 2.5 times over the past 10 years (Table 5). Much of the growth during the past several years is due

to China. In 2004, China accounted for almost half of the nonwoven output within the Asia-Pacific region, and its production capacity increased more than five times over the past decade.

Table 5
World Nonwoven Production Growth by Region (1994-2004)

	1994	1999	2004	Growth 1994-2004
North America	0.74	0.91	1.16	56.76%
Western Europe	0.61	0.92	1.36	122.95%
Japan	0.19	0.30	0.31	63.16%
Asian-Pacific	0.40	0.63	1.02	155.00%
Latin America	0.13	0.23	0.31	138.46%
Middle East	0.13	0.12	0.18	38.46%
ROW	0.03	0.06	0.09	200.00%
World	2.23	3.17	4.43	98.65%

Source: INDA & EDANA estimates (2004)

INDA. (2004). Worldwide Outlook for the Nonwovens Industry: 2004-2009. (INDA report), Cary, NC.

Latin American nonwoven production in 2004 totaled 0.31 million tons. The leading nonwoven producers (Argentina, Brazil, Chile, Colombia, Mexico and Venezuela) produced over 90% of all nonwovens in this region (Thurston, 2005).

The total nonwoven output from the Middle East was 0.18 tons in 2004. The nonwoven industry's growth during the past decade expanded 13% per year. A considerable amount of this growth was due to the industry in Israel which produced over 40% of the total Middle East nonwoven production.

The rest of world includes Africa, India, Pakistan and Russia. The nonwoven industry in the country of South Africa has a long history and is well developed with

several technologies, such as spun-bonded, carded thermal-bonded, resin-bonded and needle-punched technologies. Yet, there is little nonwoven activity in North Africa except Egypt. India's nonwoven output was about 0.04 tons in 2004. This country has appeared to be on the verge of major expansion for the past decade.

Nonwoven production by process has experienced changes. Table 6 presents the considerable growth of the four basic nonwoven technologies in tons for the past 10 years (1994-2004). While the carded technologies lost market share from 55% in 1994 to 46% in 2004, their combined volume has continued to be filled by the spunlaid technologies.

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Table 6
Global Nonwoven Production by Process

	1994	1999	2004	(mn tons) Growth 1994-2004
Carded	1.20	1.72	2.06	72.30%
Spunlaid	0.73	1.14	1.85	276.40%
Air Laid	0.13	0.19	0.33	62.00%
Wet Laid	0.12	0.14	0.20	25.30%

Source: INDA & EDANA estimates (2004)

INDA. (2004). Worldwide Outlook for the Nonwovens Industry: 2004-2009. (INDA report), Cary, NC.

Spunlaced technologies are rapidly growing and increasing their share. Table 7 shows the growth of spunlaced nonwovens and the increasing demise of thermal/resin bonded nonwoven technologies over the past 10 years. Thermal and resin bonded nonwovens which accounted for over 40% of the carded technologies in early 1990's represent only 35% of the total carded bonded share in 2004. As the processing technology of spunlacing develops, the

quality of spunlaced nonwovens is remarkably improved although the production needs simple equipment and comparably lower production cost than that of thermal/resin bonded nonwovens. In addition, spunlaced nonwovens have developed over the past 10 years for making wipes, and spunlaced nonwoven gauze have reached sales and production levels that challenge those of woven gauze (Pourdeyhimi, 2004).

Table 7.
Carded and Bonded Nonwovens Shares by Technology

	1994	1999	2004	Growth 1994-2004
Needle-punched	43%	42%	44%	2%
Spunlaced	11%	14%	21%	91%
Thermal/Resin Bonded	46%	44%	35%	-24%

Source: INDA & EDANA estimates (2004)

INDA. (2004). Worldwide Outlook for the Nonwovens Industry: 2004-2009. (INDA report), Cary, NC.

Trends in Raw Materials

The global nonwoven industry is on the threshold of raw material supply and demand influenced by shifts in consumers' needs, high oil prices and global trade patterns. Indeed, major nonwoven producers have been faced with challenges to deliver sustained profit margins amid price volatility in these polymers. In this section, we review the production trends of polypropylene (PP) and polyester (PET) since they are major raw materials used in nonwoven industry.

Polypropylene(PP) Markets

The United States and West European market-driven nonwoven companies have pursued growth strategies targeting emerging economies in Asia as a sourcing base. Hence, the polypropylene markets for

nonwovens are fairly balanced on feedstock for short-term demand levels. Figure 3 illustrates polypropylene pricing trends for these regions (United States, Western Europe, and Asia Pacific) from 2001 to 2004. The price of polypropylene in North America has increased since 2001 because the polypropylene capacity has been greater than the production during the same period (Figure 4; Engelhardt, 2003; Natrajan, 2005). In the European Union, polypropylene is one of the leading polymers used for textiles including nonwovens, with more than 38% market share of the total fiber industry (Figure 5; "Polyolefins leads", 2005). Polypropylene consumption looks likely to have increased over the recent four years, and the consumption in the Western Europe reached around nine million tons ("Polypropylene

uncertainties”, 2005). The gap between Western European polypropylene production and capacity has tightened up during the past five years (Figure 6; Natrajan, 2005).

Therefore, the price of polypropylene in Western Europe is expected to be stable over 2006~2010 if the oil price does not fluctuate.

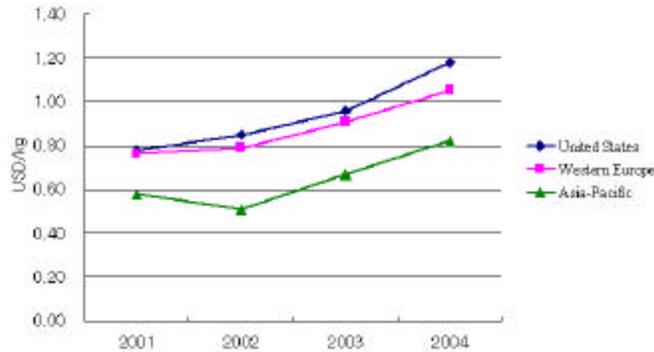


Figure 3. Global Polypropylene Pricing Trends.

Source: EDANA estimates (2005)

Natrajan, V. (2005, February). The Global Outlook for Nonwoven Raw Materials. *Nonwoven World*, pp. 63-68.

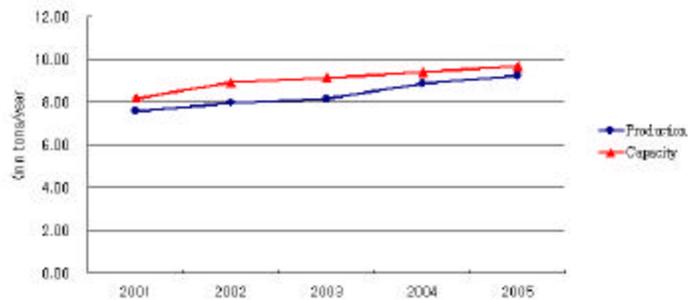


Figure 4. North America Polypropylene Market.

Source: EDANA estimates (2005)

Natrajan, V. (2005, February). The Global Outlook for Nonwoven Raw Materials. *Nonwoven World*, pp. 63-68.

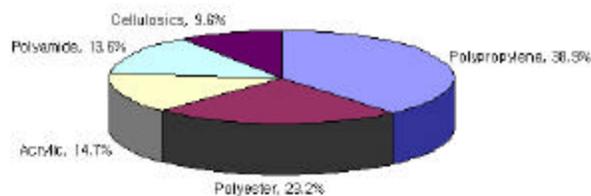


Figure 5. Share of Polypropylene Fibers vs. Total Fiber Industry in EU.
Source: Polyolefins lead in expanded EU. *Nonwovens Report International*, pp. 3.

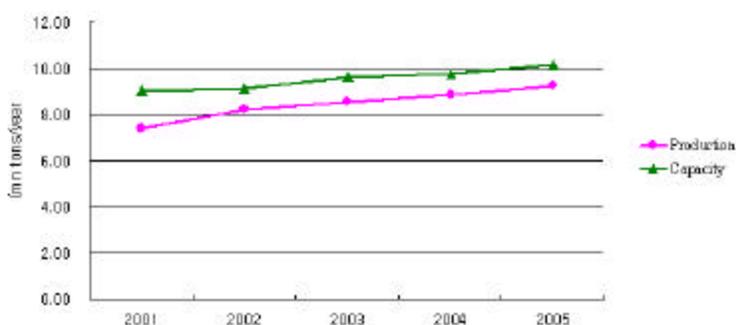


Figure 6. Western Europe Polypropylene Market.
Source: EDANA estimates (2005)

Natrajan, V. (2005, February). The Global Outlook for Nonwoven Raw Materials. *Nonwoven World*, pp. 63-68.

The global polypropylene markets are expected to keep pace with GDP growth rates in terms of demand, capacity and consumption. The production cost of polypropylene is directly related to the olefin feedstock, and the Middle East can develop and increase polypropylene production with abundant raw materials (Chemical Week Association (Chemweek), 2003; Natrajan, 2005). Therefore, the key drivers affecting the future global polypropylene supply-demand and pricing will be:

- Rapid growth in commodity polymer demand from China
- Huge capacity addition in the Middle East with access to cheap olefin feedstock

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- Asian downstream capacity addition exceeding feedstock capability
- PP nonwovens growth in spunbond nonwovens

(Anson, 2004; Chemical Week Association (Chemweek), 2003; Engelhardt, 2003, INDA, 2004; Natrajan, 2005)

Polyester(PET) Markets

The outlook for the global polyester industry points to a significant capacity in Asia while the price of Monoethylene glycol (MEG) feedstock pressures will affect the entire global polyester industry. The most notable capacity increases in polyester fiber is from China (Figure 7; Japan Chemical Fiber Association (JCFA), 2005).

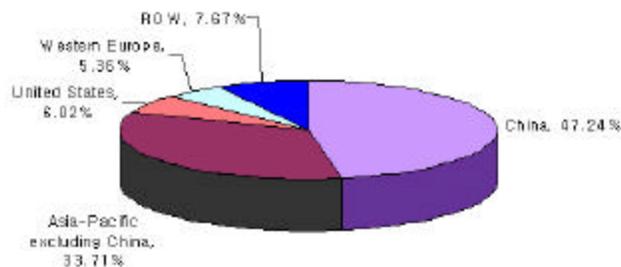


Figure 7. Production of Polyester Fiber by Region, 2004.
 Source: Japan Chemical Fibers Association (JCFA) estimates (2005).
 JCFA. (2005) "World Chemical Fiber Production in 2004."

Retrieved November 1, 2005 from http://www.jcfa.gr.jp/english/what_data/production2004.pdf

Figure 8 and Table 8 illustrate the worldwide production of polyester (Japanese Chemical Fiber Association (JCFA), 2005). Between 2001 and 2005, the total polyester staple fiber production grew by a little less than 0.9 million tons from 2004 levels. According to the table, Asia-Pacific including China increased its share of the world's polyester

staple fiber market from 65% to 72% while U.S. increased from 6.4% in 2004 to 8.1% in 2005. Since other producing regions did not make significant economic changes, the major interest among polyester producers is China's role in the global polyester market (CIA, 2005).

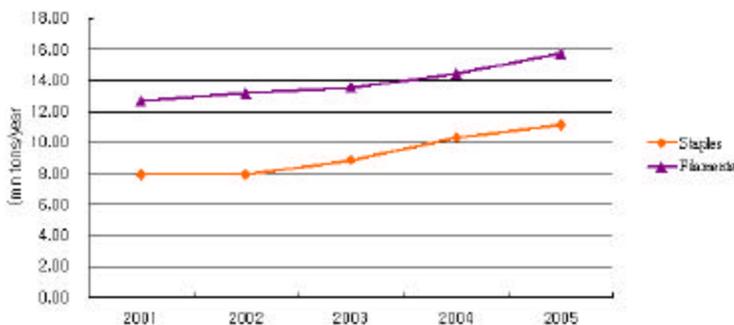


Figure 8. Global Polyester Fiber Production Growth.
 Source: EDANA estimates & JCFA estimates.

JCFA. (2005). "World Chemical Fiber Production in 2004."

Retrieved November 1, 2005 from http://www.jcfa.gr.jp/english/what_data/production2004.pdf

Natrajan, V. (2005, February). The Global Outlook for Nonwoven Raw Materials. *Nonwoven World*, pp. 63-68.

Table 8.
Worldwide Polyester Fiber Production

Country	2003		2004		Change from the previous	
	Staples	Filaments	Staples	Filaments	Staples	Filaments
USA	0.86	0.52	0.93	0.54	8.19%	3.47%
China	3.49	5.65	4.38	7.10	25.68%	25.69%
Taiwan	0.88	1.56	0.91	1.62	3.43%	3.86%
S. Korea	0.60	1.28	0.57	1.09	-4.20%	-14.71%
India	0.61	1.02	0.67	1.09	9.84%	7.68%
Asean	0.95	1.07	0.93	1.28	-2.83%	19.81%
W. Europe	0.55	0.75	0.59	0.71	6.91%	-4.93%
Japan	0.23	0.30	0.22	0.30	-3.48%	1.02%
ROW	1.13	0.70	1.17	0.69	3.63%	-1.28%
World Total	9.28	12.83	10.36	14.42	11.57%	12.37%

Source: Japan Chemical Fibers Association (JCFA) estimates (2004 & 2005)

JCFA. (2004). "World Chemical Fiber Production in 2003."

JCFA. (2005). "World Chemical Fiber Production in 2004."

Retrieved November 1, 2004 and November 1, 2005 from http://www.jcfa.gr.jp/english/what_data/production2004.pdf

The global polyester filament yarn production expansion shows a similar pattern with the trend in polyester staple fiber. The major interest among polyester filament yarn producers should also be the Chinese role in the global market growth. Further echoing the polyester staple fibers trend, the Asia-Pacific region's polyester filament yarn production share will be at least 85% from 2005 while the other key regions show a declining filament production (Natrajan, 2005). Consequently, a new host of polyester filament yarn producers is expected to emerge from Asia-Pacific countries, especially from China (Julian, 2005). Therefore, the global polyester markets face a different set of key drivers from polypropylene markets (Julian, 2005; Natrajan, 2005):

- Massive Chinese polyester fiber capacity
- Global monoethylene glycol (MEG) tightness
- Growth of spunbond polyester nonwovens

Five Major Factors Affecting the Future World Nonwoven Market

The nonwoven industry continues to grow with the development of new technology. This growth can be accelerated or slowed by global economic situations, investments in technology development, oil

price fluctuation, and other factors. We suggest five major factors affecting the future market as: i) international or domestic economic and demographic conditions, ii) strategic alliances and investments by companies, iii) technology and science development, iv) rapid growth of Chinese nonwoven industry, and v) raw material market situation.

Economic and Demographic Factors

Global nonwoven market has been changed due to demographic factors. The aging population and the development of medical health care have provided market opportunities for nonwovens. The use of newly developed medical and pharmaceutical products has replaced the need for many kinds of surgery and health care procedures.

It is well known that the growth of income in most nations has been strong with annual increases. Lower per capita incomes in some areas will be partially offset by more two-income families and it will positively impact the consumption of nonwoven products. Demand for nonwoven materials will rise as the middle class population grows in some developing countries. There is a culture that stresses to reduce the use of short-life products² in many developing countries. This will be overcome as disposable incomes increase (INDA, 2004). Future generations of

consumers will be more accepting of short-life products than long-life products³ and will expect environmentally friendly products (Parker, Hermans & Schaefer, 2004).

Strategic Alliances and Investments Factors

The nonwoven industry has gone through a decade of mergers and consolidations as companies sought to reduce costs and broaden their technology base as the industry matured (“Freudenberg and Vilene”, 2005; “Freudenberg expands”, 2005). Consequently, companies require more strategic alliances to compete effectively as the nonwoven industry becomes more global. In INDA’s view (2004), the nonwoven industry will continue to evolve into a few large world nonwoven producers with many medium-sized local or regional nonwoven producers to survive keen competitions for production development and excellent service (INDA, 2004).

The United State’s market growth in the nonwoven industry has been higher than the average of global market growth (Table 5). The market growth in Asian-Pacific and Latin America was 155% and 138%, respectively, while the U.S. nonwoven market increased 57%. This fact makes nonwovens strategically attractive to mergers, acquisitions and capital investment activities because of developing countries’ market potential. The consolidation and strategic alliances of nonwoven industries are expected by companies attempting to expand their markets and increase their technological capabilities since the highly competitive production availability allows more nonwoven companies to enter the nonwoven business as a market of opportunity. Therefore, nonwoven producers serving high volume markets will be impacted because the capital cost of market entry is relatively low. This could contribute to overcapacity (Borneman, 2004; INDA, 2004).

Technology and Science Factors

The nonwoven industry requires innovation at the technology and final product stages in order to prevent becoming

a commodity industry (Mansfield, 2004). It is important for nonwoven producers to view and understand product development from an end-use and ultimate customer perspective (Anderson, 2005). In other words, improving the quality of people’s life by providing innovative products is a key priority of the nonwoven industry (Groten, 2004; “Rapid reaction”, 2005).

Some nonwoven producers in developing countries are shedding research and development (R&D) costs as a cost saving measure. This could have a negative impact on future industry development. The lack of R&D investment can hurt their nonwoven industry in the long term (“Revenue & forecast”, 2005).

The nonwoven industry continues to move towards integrated polymer-to-nonwoven forming systems (Lyons & Kaufmann, 2004; “Nanofiber line”, 2005). Composite fabrics made by combining processes and value-added treatments will become more prominent. Since company-based R&D concentrates on product and process development, not on basic research, this void has to be filled by company supported consortia or universities (i.e. NCRC) (“NCRC Focus”, 2005).

There is considerable know-how in the traditional textile sectors that can assist nonwoven producers (“Patented spunmelt”, 2005). For example, the use of advanced finishing techniques can improve the properties of nonwovens (Borneman, 2004). However, nonwoven technologies, such as hydroentanglement, can offer traditional textile manufacturers opportunities to add special value to their end-products (Richer, 2005). Therefore, it is significant that both the nonwovens industry and the textile industry create new hybrid, high-performance products that will define the future (INDA, 2004).

Chinese Growth Factors

The production of nonwovens in China is rapidly growing. China’s nonwoven production was 0.76 million tons in 2004 compared with 0.62 million tons in 2003 according to the latest statistic data released from China Nonwovens Technical

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Association (CNTA) and China Nonwovens Information Center (CNIC) (Chinese Nonwovens, 2005). China's production has increased 22.6%, approximately 2.5 times higher than the growth rate of China's GDP, 9.2% (CIA, 2005). China's nonwoven market is expected to continue to expand ("China still," 2005; INDA, 2004). However, China's future market is not very bright in the raw material aspect. One of the main risks facing China is a shortage of raw materials by the potential increase of oil prices. It is expected that Chinese polypropylene and polyester capacities will grow as much as its GDP growth of 8~10% (INDA, 2005). Indeed, the prospect of China emerging as a strong driver of polypropylene and polyester in nonwoven industries presents mixed challenges since Chinese petrochemical majors have intensely pursued vertical integration, from oil refining to fiber and fabric production, on a mass production scale (Bruin, Capstick-Dale & Haller, 2004; INDA, 2005).

Raw Materials Factors

Understanding of raw material markets is essential to analyze and forecast the world nonwoven production. To obtain the most current information, an interview with Mr. Edgar Acosta, market analyst, DeWitt & Company Inc., was conducted. Mr. Acosta indicated that polypropylene is in a structural shortage because of supply interruptions in the U.S. after the hurricane season. The system has not yet been "righted." Therefore, polypropylene price is still suffering from the "hangover."

Mr. Acosta expects that Monoethyleneglycol (MEG), a major raw material for polyester production, will be produced in sufficient quantities since MEG projects continue to be added at 0.4 – 0.8 million tons per project, quickly exceeding natural growth rates. Price decreases in polyester are wholly dependent on oil markets. From a macro level it is important to ascertain what the true shortage in the world demand of oil will be to find a normalized oil price. In the U.S., the polyester price is directly influenced by the oil price, while the polyester prices are controlled by supply/demand issues in Asia. In addition, the distribution of cotton also has an effect on the polyester price in the U.S. It is expected that the polyester price will be lower in the coming years due to over capacity in China. As a result, nonwoven company in the U.S. needs to closely monitor polyester production level in China.

Future of Global Market in Nonwoven Production

Two nonwoven trade associations, INDA and EDANA, have forecasted the volume of nonwoven production to increase at a rate of 7.3% globally for the period of 2004-2009, and reach 6.32 million tons in 2009 (Table 9). Square meter volume will grow faster due to the continuing trend toward lighter weights of cover stock materials (INDA, 2004).

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Table 9
Worldwide Nonwovens Production (2004-2009)

	2004	2009	Growth Rate 2004-2009
Tonnes (Million)	4.4	6.3	7.3%
Dollars (billion)	15.9	22.4	7.1%
Square meters (millions)	110.0	163.0	8.2%

Source: INDA & EDANA estimates (2004)

INDA. (2004). *Worldwide Outlook for the Nonwovens Industry: 2004-2009*. (INDA report), Cary, NC.

Figure 9 provides an overview of the future nonwovens production by region. According to INDA, 58% of nonwoven materials will be produced in North

America, Western Europe and Japan in 2009 (INDA 2004). Five years earlier, in 2004, these regions accounted for slightly higher than 64% of world nonwoven output (Figure

2). North American nonwoven industry will advance 5.3% per year for the period between 2004 and 2009 (INDA, 2004). Otherwise, China is expected to be the

largest single nonwoven producer in 10 years. The other leading nonwoven producers in the Asia-Pacific regions will be Taiwan and Korea (Table 10).

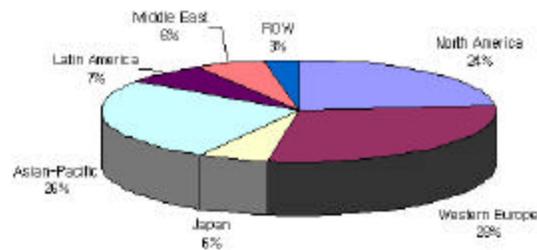


Figure 9. Nonwoven Production by Region (2009).

Source: INDA & EDANA estimates (2004)

INDA. (2004). *Worldwide Outlook for the Nonwovens Industry: 2004-2009*. (INDA report), Cary, NC.

Table 10.

World Nonwoven Production Growth by Region (2004-2009)

	(mn tons)		
	2004	2009	Growth Rate
North America	1.16	1.54	32.76%
Western Europe	1.36	1.87	37.50%
Japan	0.31	0.39	25.81%
Asian-Pacific	1.02	1.72	68.63%
Latin America	0.31	0.43	38.71%
Middle East	0.18	0.38	111.11%
ROW	0.09	0.18	100.00%
World	4.43	6.51	46.95%

Source: INDA & EDANA estimates (2004)

INDA. (2004). *Worldwide Outlook for the Nonwovens Industry: 2004-2009*. (INDA report), Cary, NC.

Mexico, Argentina, Brazil, Chile, Colombia and Venezuela produced over 90% of all nonwovens in the Latin region (Thurston, 2005). Mexico and Brazil's combined volume in 2004 totaled about 0.2 million tons. This is two-thirds of total of the Latin American nonwoven production in 2004. Latin America is expected to increase the production up to 38.71% by 2009 because of the growth of GDP and population (INDA, 2004). The total

nonwoven output from the Middle East was 0.18 million tons in 2004. Middle East will increase the growth of market more than two times by 2009 with using an advantage of new Middle Eastern monoethylene glycol (MEG) project which is planned for the development of Middle Eastern textile industries (Chemical Week Association, 2003). In addition, India, Pakistan, Russia and Turkey are expected to be potential nonwoven producers because of abundant

labor resources and comparably low-priced raw materials although the lack of technological investment currently prevents their expansion to international markets (Mumessillik, 2005).

Table 11 shows the projected production growth of the four basic nonwoven technologies in tons from 2004 to 2009. While the carded technologies are

expected to lose market share, their combined volume will continue to rise boosted primarily by the spunlaced and needle-punched technologies. Spunlaid volume is increasing at a faster pace and it will almost equal carded production in 2009 (INDA, 2004).

Table 11.
Global Nonwoven Production by Process (2004-2009)

	2004	2009	Growth Rate 2004-2009
Carded	2.06	2.82	37.11%
Spunlaid	1.85	2.76	49.57%
Air Laid	0.33	0.62	86.75%
Wet Laid	0.20	0.25	26.50%

Source: INDA & EDANA estimates (2004)

INDA. (2004). *Worldwide Outlook for the Nonwovens Industry: 2004-2009*. (INDA report), Cary, NC.

Figure 10 illustrates the growth of spunlaced and needle-punched nonwovens and the increasing demise of resin and thermal bonded nonwoven technologies. Needle-punched and spunlaced technologies have increased their share of the total carded category due to the increase of the global population as well as the rise in building

construction. Carded thermal and resin bonded nonwovens, which had over 50% of the carded technologies in the early 1990s, accounted for about 35% of the total in 2004. This trend will continue since hygiene producers continue to switch from the thermal bonded cover stock to the lower cost spunlaced materials (INDA, 2004).

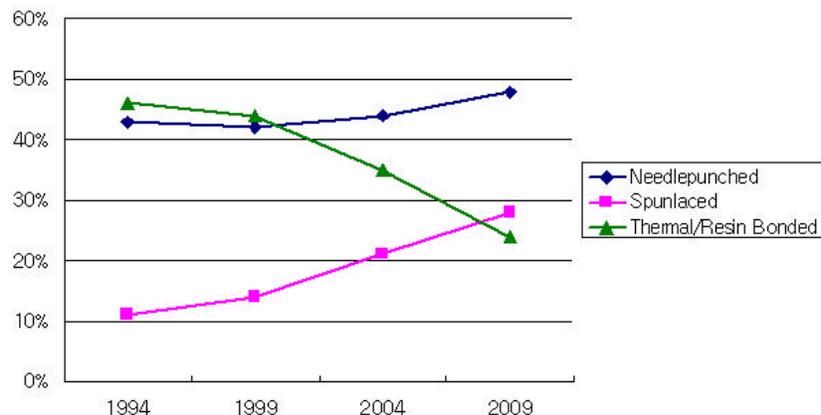


Figure 10. Global Market Share by Technology (1994-2009).

Source: INDA & EDANA estimates (2004)

INDA. (2004). *Worldwide Outlook for the Nonwovens Industry: 2004-2009*. (INDA report), Cary, NC.

As mentioned previously, the global nonwoven production is expected to rise to 6.3 million tons by 2009 or increase two million tons from the 2004 production (Table 11). INDA forecasts that this growth will require a combine capital investment of 4.6 billion dollars over the five years, based on current costs to install modern technologies. As Figure 10 shows the potential growth of spunlaced nonwovens, at

least half of the investment, almost 2.5 billion dollars, is expected to be required to install spunlaced technologies (INDA, 2004). According to the trends in production and consumption of nonwovens, this investment will make the rapid reaction to the end-use customers and satisfy them with improved technology.

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Footnote:

- 1) Nonwovens is defined as a fabric manufactured directly from fibers without weaving, knitting or tufting. (Dictionary of Fiber & Textile Technology, 1999)
- 2) Disposable nonwovens (i.e. diaper, hygiene, napkin, etc.)
- 3) Semi-permanent nonwovens (i.e. carpet backing, carpet of automobile, construction materials, etc.)
- 4) A light weight nonwoven material used to contain and conceal an underlying core material. (Dictionary of Fiber & Textile Technology, 1999)

Appendix

Source: European Union (EU). (2006). Retrieved February 15, 2006 from <http://europa.eu.int/> and http://europa.eu.int/comm/trade/issues/bilateral/regions/candidates/index_en.htm

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