

Diachronic Network Analysis of Variables that Affect the Value of the Textile Industry in South Korea

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한국 섬유 산업의 가치 제고를 위한 변수 요인의 통시적 연결구조 분석

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Abstract The Korean textile industry of the low-growth era is experiencing a period of stagnation due to various factors. Hence, it is time to set new goals for the future and find a direction to increase the industry's value. This study aims to explore the core texts related to variables affecting the Korean textile industry and business environment change factors. This goal is achieved using a network analysis from a diachronic point of view performed on articles of textile newspapers published in a chosen five-year period. This study also aims to discuss the implications for enhancing the value of the Korean textile industry. The conclusion of this study is as follows. First, regarding political and economic aspects, the government should strive to minimize the damage caused by political problems, provide full support to textile companies, and improve practical systems for smooth business operation. Second, concerning the socio-cultural aspects, the Korean textile industry must establish a strategic cooperative system to develop eco-friendly materials. Third, in terms of management changes of the textile industry, Korean textile companies need to focus on developing new materials to foster international competitiveness. For this, R&D investment and facility improvement strategies are required.

요약 한국의 섬유 산업은 저성장 시대의 다양한 요소들로 인하여 침체기를 겪고 있다. 침체기를 맞고 있는 섬유 산업은 앞으로 미래에 대한 새로운 목표의 설정과 섬유 산업의 가치를 높일 수 있는 방향성을 모색해야할 시점에 있다. 이에 따라 본 연구는 최근 5년간 섬유 신문 기사를 토대로 한국의 섬유 산업에 영향을 미치는 사회적 변화 요인 및 섬유 기업들의 경영 환경 변화 요인과 관련된 핵심 텍스트들을 연결망 구조 분석을 활용하여 통시적인 관점에서 그 양상을 탐구해 보고 한국 섬유 산업의 가치 제고를 위한 함의점을 논하고자 하는데 목적이 있다. 본 연구의 결과, 한국 섬유 산업에 영향을 미친 정치·경제적 측면의 제언점으로 정부는 정치적 문제로 인한 피해를 최소화 하고, 섬유산업에 있어 중소기업의 전폭적인 지원 및 국내 및 해외의 원활한 사업 영위를 위한 제도 개선에 힘써야 한다. 둘째, 한국 섬유 산업에 영향을 미친 사회·문화적 측면의 제언점으로 한국 섬유 산업은 친환경 소재 개발을 위해 다양한 조직들과의 연계를 통한 전략적 협력 체계를 구축해야 한다. 셋째, 한국 섬유 산업의 경영 환경 변화의 제언점으로 한국 섬유 기업들은 국제적 경쟁력을 기르기 위해 신소재 개발에 힘써야 하고, 이를 위해서는 지속적인 연구개발 투자와 설비개선 전략이 필요하다.

Keywords : Textile Industry, Diachronic Network Analysis, Value Enhancement, Newspaper Articles, South Korea

This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea(NRF-2019S1A5A8032638)

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Received January 27, 2022

Revised March 2, 2022

Accepted March 4, 2022

Published March 31, 2022

1. Introduction

The Korean textile industry has been the most significant area of national industrial development since the 1960s, due to a combination of Korean innovation and experience, such as apparel exporting of original equipment manufacturer (OEM) and launching of domestic brands. The textile industry, which accounted for more than 30% of Korea's total exports in the 1970s, was one of the core national industries that laid the foundation for the country's economic development[1]. However, the volume of textile exports has steadily declined, from \$14.8 billion to \$13.7 billion over the last 28 years, even as total Korean exports have increased by nearly nine times since the 1990s, from \$65 billion to \$574 billion[2,3]. In addition, the textile industry recorded a trade deficit in 2016 for the first time, as exports continued to decline while imports increased.

It is time to establish new targets and strategies for the revitalization of the Korean textile industry amidst this stagnant period and to enhance the value of Korean textile companies. Newspapers capture in the mass media the social aspects of a specific era among the various mass media forms. Newspapers can be researched easily as each edition is archived, and it is published at regular intervals[4]. Newspaper articles present information as both text and images. Text can be used to express trends reflecting the language, culture, and social characteristics of people living in the same era or the potential consciousness of consumers, and it is a symbolic indicator of meaningfully structured social phenomena[5]. Texts in newspaper articles can be used to explore the trends and factors affecting the textile industry.

The purpose of this study is to explore the changed aspect of the Korean textile industry from a diachronic perspective in the last five years utilizing semantic network analysis. The

key texts in domestic textile newspapers are drawn from articles related to the political, economic, social, and cultural aspects of the Korean textile industry and business environment in Korean textile companies. In approaching the issue, this study discusses implications for enhancing the value of both the Korean textile companies and the Korean textile industry.

2. Literature Review

2.1 Definition and structure of the Korean textile industry

The fashion industry can be divided into a distribution industry that sells finished products, an apparel industry that produces garments, and a textile industry that supplies fabrics and raw materials necessary for the production of clothing and textile accessories[6,7]. The fashion industry consists of a chain structure of the interconnected industries mentioned above. The textile industry, which occupies a key position in the fashion industry and produces materials for making clothes, plays a central role in the operation of the entire chain structure[7].

The Korean textile industry has an overseas-dependent and export-led industrial structure, which involves imports of raw materials from abroad and the export of finished products that are processed overseas[8]. The industry consists of the upstream which is the spinning process in which natural and chemical raw materials are produced into fibers and processed into yarn, the middle stream which is the fabric process in which cloth is woven and the dyeing process in which fabric is colored, and the downstream process of manufacturing in which fabric is sewn to make clothing or textile products[9]. The Korean textile industry is an industrial structure in which processes at each stage are subdivided and organic and cooperative production activities between each stream are complicated[9]. Large

corporations tend to dominate weaving and chemical fiber production related to the raw materials in Korea, while medium-sized companies typically engage in textile designing, knitting, dyeing, and processing, and small businesses manage trade with domestic customers and international exports[10].

The Korean textile industry has the disadvantage of high dependence on imports and exports, but its importance also lies in the large number of workers it employs because the production structure is composed of multiple stages. In addition, the industry is composed mainly of small and medium-sized companies rather than large corporations, and thus may be better placed for future industrial restructuring.

2.2 The development process of the Korean textile industry

Starting from the truce of the Korean War in 1953, the government tried to rebuild the consumer goods industry, such as food and textiles, through a post-war restoration project in order to stabilize people's livelihood and solve the shortage of daily necessities. The Korean textile industry has reached the stage of self-sufficiency in the case of natural fibers due to the support of the latest production facilities with foreign countries and the introduction of cheap cotton in the United States. In particular, the reconstruction of the cotton facilities was quickly accomplished through the promotion of the "cotton textile emergency reconstruction plan (1953~57) by the Korean government[11]. The average annual growth rate of the textile industry reached 24.6% between 1953 and 1957, and the weight of the textile industry among the added value of the manufacturing industry increased to 18.5% in 1957[12]. Korean textile industry began to seek exports from the late 1950s due to the saturation of the domestic market[13]. It has played a leading role as a representative strategic export industry since the 1960s. The growth of

the Korean textile industry occurred as a result of policy support within the economic development plan promoted beginning in the early 1960s. The government policies for promoting the textile industry, such as assisting the modernization and replacement of the infrastructure and production facilities, providing access to overseas technology, and protecting the domestic textile market, contributed greatly to product quality improvement and exports[8,14,15]. In 1970s, the government played a role in assisting textile companies to move smoothly. At this time, the textile industry was small in size, old facilities, low technology level and productivity, and strong external dependence on raw materials, which required countermeasures. The government decided that the efficiency of the factory scale was urgently needed, so the government implemented a policy that allowed the expansion and construction of factories within a certain range[13]. In addition, each sub-industry within the textile industry is differentiated, and direct investment is active based on international strategies[11]. This government support helped the industry increase exports in the 1970s to over \$10 billion, making Korea a major textile export powerhouse along with Hong Kong and Taiwan. In the 1970s, as importing countries began to strengthen protection of their domestic industries, Korea proceeded to adjust its industrial structure. However, textile exports began to decline due to price competition from the emerging economies of China, Indonesia, and Pakistan, which displaced Korean production suffering from higher wages and labor shortages[8,14,15]. Accordingly, starting in the 1980s, the Korean textile industry promoted the advancement of modernization and technology improvement. The textile companies have strengthened their competitiveness through the development of high-tech materials and have made efforts to revitalize outsourcing through overseas production bases[14,15].

Despite these efforts, the Korean textile industry until the 2000s experienced a sustained downturn due to external factors, such as manpower shortages, wages higher than labor productivity, the growth of textile production in late-developing countries, and the reduction of demand in advanced countries due to economic downturns and protectionist barriers[8,13]. In order to escape this period of stagnation, the Korean textile industry is making various changes, including the revitalization of foreign investments made by Korean textile companies, expansion of automated facilities, and development of new materials for high-end production[8]. In addition, the Korean government and the textile industry have established infrastructure and common standards for its use in the textile market and information programs for manufacturers with the rise of e-commerce in the 2000[11,16]. Accordingly, several textile companies have established an online system, and a new environment has been created in which domestic and overseas consumers can compare the quality and price of textile products online.

3. Research method and scope

This study examines the changed aspect of the Korean textile industry from a diachronic perspective in the last five years utilizing semantic network analysis based on the domestic textile newspapers. The research questions are as follows.

- Research question 1. What political and economic factors have affected the Korean textile industry?
- Research question 2. What social and cultural factors have affected the Korean textile industry?
- Research question 3. What factors have changed the business environment of the Korean textile companies?

- Research question 4. What are the implications of these changes for enhancing value and reducing risk in the Korean textile industry?

The frequency and density of keywords related to social change factors affecting the Korean textile industry and its companies were calculated using data from domestic textile newspapers(*Korean Textile Economy Newspaper, International Textile Newspaper, TIN News, Textile Life, and Fashion Journal*) from 2015 to 2019. Specifically, both social change factors that influenced the textile industry and factors that changed the business environment of textile companies were extracted and collected from five years of newspaper article titles to determine the trends of the textile industry and its companies. Next, the consistency between the titles and the articles were reviewed through in-depth analysis of the actual content of the article. The political and economic change factors, social and cultural change factors and change factors in the business environment that have influenced the textile industry by year were extracted from the main texts using the refining function of the big data analysis software TEXTOM. A total of 23,981 articles on these factors were extracted from five years of data. Next, the frequency, density, and repetition of keywords was arranged by an algorithm and depicted as a network using the NetDraw tool in the UCINET software package.

4. Diachronic Network Analysis of Variables Affecting the Value of the Korean Textile Industry

This section presents a ranking of the densities of extracted factors from the highest to the lowest clusters. Analyzing the derivation of the densities reveals the connectivity between

different keyword clusters associated with factors that influenced the Korean textile industry from 2015 to 2019.

4.1 Semantic network analysis of variables that impacted the Korean textile industry in 2015

Fig. 1 maps the connectivity of each keywords using the UCINET 6 program. First, the clusters of political and economic factors that affected the industry in 2015 were ranked by density as follows: Kaesong Industrial Complex (3.311%) followed by the inflow of low-cost textiles from developing countries(3.027%), FTA(2.296%), minimum wage(1.89%), and tax increases(1.524%). Second, the clusters of social and cultural factors were ranked by density as follows: Eco-friendly (0.203%) followed by Middle East Respiratory Syndrome(0.198%). Third, the changing factors relevant to the business environment were ranked by density as follows: overseas investment in Southeast Asia(4.306%) followed by high-tech materials development(2.377%), overseas investment in Africa(1.442%), and unfair trade(1.178%), and investment in high-tech facilities(0.955%).

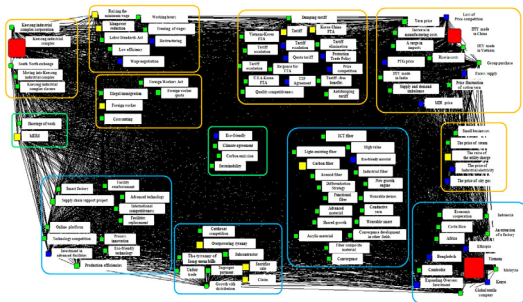


Fig. 1. The visualization of semantic network analysis for variable factors impacted on Korea textile in 2015 tilizing UCINET 6

4.2 Semantic network analysis of variables that impacted the Korean textile industry in 2016

Fig. 2 maps the connectivity of each keywords using the UCINET 6 program. First, the clusters

of political and economic factors that affected the industry in 2016 were ranked by density as follows: Kaesong Industrial Complex(6.466%) had the highest density value followed by FTA(1.824%), tax increases(1.645%) the inflow of low-cost textiles(1.542%), and minimum wage(1.481%). Second, the clusters of social and cultural factors were ranked by density as follows: eco-friendly(0.342%) followed by the Terminal High Altitude Area Defense missile system(0.081%). Third, the changing factors relevant to the business environment were ranked by density as follows: overseas investment in Southeast Asia(3.273%) followed by high-tech materials development(2.997%), overseas investment in Africa(0.783%), investment in advanced facilities(1.744%), and unfair transactions(0.505%).

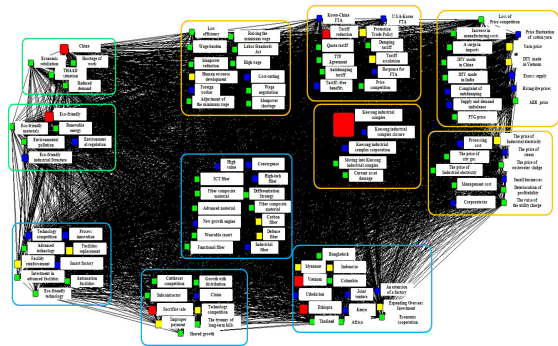


Fig. 2. The visualization of semantic network analysis for variable Factors impacted on Korea textile industry in 2016utilizing UCINET 6

4.3 Semantic network analysis of variables that impacted the Korean textile industry in 2017

Fig. 3 maps the connectivity of each keywords using the UCINET 6 program. First, the clusters of political and economic factors were ranked by density as follows: minimum wage (6.016%) followed by the inflow of low-cost textiles (3.637%), Kaesong Industrial Complex(1.909%), FTA(1.387%), the Electrical Appliances and Consumer Products Safety Control Act(1.256%), and tax increases(0.968%). Second, the clusters of

social and cultural factors were ranked by density as follows: The law banning Korean culture in China(0.968%) followed by eco-friendly(0.209%), and Trump’s economic policy(0.131%). Third, the changing factors relevant to the business environment were ranked by density as follows: overseas investment in Southeast Asia (1.675%) followed by the Fourth Industrial Revolution (1.517%), and overseas investment in the US(1.461%).

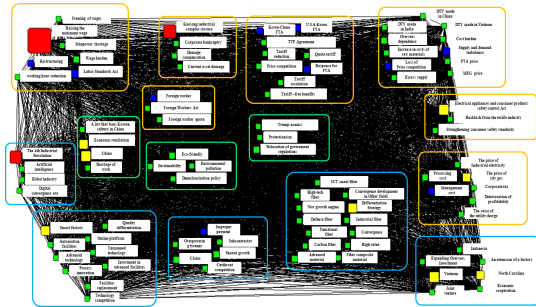


Fig. 3. The visualization of semantic network analysis for variable Factors impacted on Korea textile industry in 2017 utilizing UCINET 6

4.4 Semantic network analysis of variables that impacted the Korean textile industry in 2018

Fig. 4 maps the connectivity of each keywords using the UCINET 6 program. First, the clusters of political and economic factors were ranked by density as follows: minimum wage (8.512%) followed by Kaesong Industrial Complex (4.208%), the inflow of low-cost textiles from developing countries(1.537%), the Electrical Appliances and Consumer Products Safety Control Act(1.005%), tax increases(0.439%), FTA(0.345%), and foreign workers(0.251%). Second, the clusters of social and cultural factors were ranked by density as Eco-friendly(0.973%). Third, the changing factors relevant to the business environment were ranked by density as follows: overseas investment in Southeast Asia(2.669%) followed by developing high-tech materials(2.353%), the Fourth Industrial Revolution(1.036%), and investment in advanced facilities(0.502%).

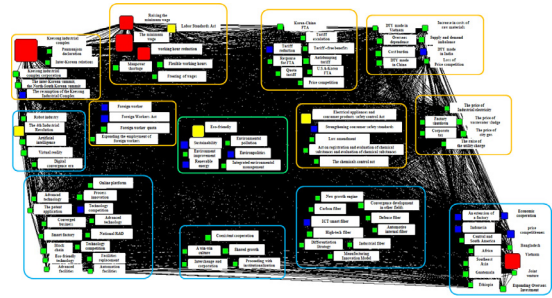


Fig. 4. The visualization of semantic network analysis for variable Factors impacted on Korea apparel industry in 2018 utilizing UCINET 6

4.5 Semantic network analysis of variables that impacted the Korean textile industry in 2019

Fig. 5 maps the connectivity of each keywords using the UCINET 6 program. First, the clusters of political and economic were ranked by density as follows: minimum wage (3.693%) followed by Gaeseong Industrial Complex (3.597%), foreign workers(2.762%), the inflow of the low-cost textiles from developing countries(1.541%), the Electrical Appliances and Consumer Products Safety Control Act, the Act on Registration and Evaluation of Chemical Substances, and the Chemicals Control Act(0.931%). Second, the clusters of social and cultural factors were ranked by density as eco-friendly(7.065%). Third, the changing factors relevant to the business environment were ranked by density as follows: overseas investment(6.004%) followed by recycled material development(3.595%), advanced material development(4.914%), and smart factories(2.665%).

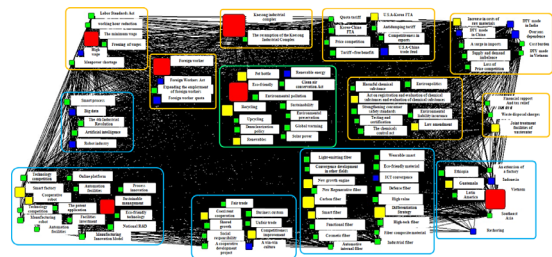


Fig. 5. The visualization of semantic network analysis for variable Factors impacted on Korea textile industry in 2019 utilizing UCINET 6

5. The analysis of factors that have affected the Korean textile industry in five years

The factors that have affected the Korean textile industry in the past five years were divided into political and economic factors, social and cultural factors, and factors that change the business environment of textile companies.

5.1 Research Question 1: Political and economic factors that have affected the Korean textile industry in the past five years

The political and economic factors were categorized as follows: the minimum wage, the Kaesong Industrial Complex, low-cost textiles from late-developing countries, FTA, the rise in taxes, foreign workers, the Electrical Appliances and Consumer Products Safety Control Act, the Act on Registration and Evaluation of Chemical Substances, and the Chemicals Control Act.

·Minimum wage: The increase in the minimum wage was implemented to improve the living conditions of low-wage workers and resolve income inequality but had an adverse effect on employment rates. Bankruptcies among small and medium-sized companies have been increasing due to reduced demand in a deteriorating international economy and the loss of price competitiveness due to cheap imports from developing countries. The actual wage increase rate for small and medium-sized companies is about two times higher than the increase rate suggested by the government[17]. In addition, Korean labor law allows only 52 hours of work per week and applies the same minimum wage to both Korean and foreign workers[18]. Textile companies demanded a differential application of the minimum wage, but the government expressed its position that it was unacceptable[19]. This could lead to deterioration in the management of

textile companies and the collapse of the domestic textile industry.

·The Kaesong Industrial Complex: The suspension of operations at the Kaesong Industrial Complex clearly reflects the geopolitical risks that South Korea faces. Some 73 out of the 124 companies in the complex (58%) were textile-related firms. In accordance with the government's decision, the textile companies of the Kaesong Industrial Complex were forced to withdraw without prior notice and suffered serious financial damages due to loss of raw and subsidiary materials, disruption in production, and missed delivery of seasonal products. In addition, as the number of company urgently transferring production to the Chinese region has gradually increased, textile companies that moved into the Kaesong Industrial Complex recently suffered damage due to lost orders. Their image and stock prices fell as a result.

·Low-cost textiles from late-developing countries: The burden on Korean textile companies are increasing, and the quality of their management has deteriorated due to the reckless import of inexpensive fiber, chemical fiber, and Drawn Textured Yarn from developing countries such as India, Vietnam, and China. In particular, the increase in fiber raw materials and yarn prices, which depend heavily on China and India, will lead to loss of price competitiveness of Korean textile, which in turn leads to a deterioration in the profitability of enterprises. [20]. In addition, despite the recession in the textile industry, imports of polyesters from China, India, and Vietnam have increased exponentially, causing damage to domestic companies[21]. The reckless import of fibers without quality verification can increase the dependence on textiles of developing countries in the future, negatively impacting the textile industry. This can also be seen in the results of the increase in imports of foreign materials decreases the will of domestic companies[22]. The government needs to

regulate and inspect the quality and quantity of these inflows to stabilize the ecosystem of the Korean textile industry.

·FTA: The government and related organizations should minimize the burden of customs duties on textile companies through diplomatic efforts. For the representative example, Korea could expect the effect of preoccupying Korean companies in the Central American market compared to competitors such as China and Japan by signing FTAs with five Central American countries[23]. Through this, Korea can diversify its export market by establishing a network in the Americas. On the other hand, in the case of the Korea-China FTA, the production base of textiles for small and medium-sized domestic textile companies will collapse[24]. The government should also explore ways to protect domestic producers while maintaining access to overseas markets through agreements such as the FTA and the Trans-Pacific Partnership. In particular, there is a need for institutional arrangements that will provide protection for Korean textile companies from inexpensive textile imports from developing countries.

·Rising taxes: Korea became a leading producer of textiles through the active promotion of industry by the government. However, the government has impeded the revitalization of Korean textile companies through the current corporate tax code, industrial electricity and city gas fees, and high costs of treating wastewater from dyeing facilities. Korean textile companies, which mainly use electricity or gas, are withdrawing their businesses due to heavy electricity and gas costs[25,26]. By contrast, Vietnam has improved the managerial environment by providing two-year tax exemptions on revenue, a 50% tax reduction for the following four years, and support for wastewater treatment expenses. As a result, Korea's tax treatment of textile companies has accelerated their relocation overseas. There is not only a risk that textile students will be

unable to find work in the future but also a risk of the leakage of intellectual property that has accumulated over time in the industry. These findings suggest that the government should implement policies that consider not only the consumer's position but also the position of textile firms.

·Foreign workers: Although textile production requires large amounts of labor, the Korean textile industry is experiencing a serious labor shortage, as Koreans increasingly avoid employment in the industry. Accordingly, foreign workers comprise a large proportion of the textile labor force. However, because of government restrictions on the employment of foreigners, the labor shortage has persisted. Foreign workers are also avoiding textile companies in a situation where they cannot work overtime with the introduction of the 52-hour working week system[27]. In addition, according to the new allocation principle, which can only recruit 4 people a year, it takes more than 2 years to recruit 10 people[28]. This led to a situation in which textile companies gave up their management. To solve this problem, the government should ease restrictions on the employment of foreign workers, expand education to promote the employment of Koreans, and expand awareness of the textile industry.

·The Electrical Appliances and Consumer Products Safety Control Act, the Act on Registration and Evaluation of Chemical Substances, and the Chemicals Control Act: The Electrical Appliances and Consumer Products Safety Control Act was implemented to promote the safety of consumers, but the policy included an initial grace period due to the backlash from the textile industry. The Act on Registration and Evaluation of Chemical Substances and the Chemicals Control Act increased the burden on textile companies by mandating over 40 inspections a year and steep inspection fees from organizations affiliated with the Ministry of Environment, city

halls, ward offices, fire departments, and the Ministry of Trade and Industry. There is concern that these laws will adversely affect the business environment due to harmful substances standards that are 10 times more restrictive than in Japan and 100 times more restrictive than in the US. Although the government has passed these laws to protect consumers, the resulting use of low-quality foreign products instead of domestically produced dyes could threaten consumer safety. In addition, the registration costs for hazardous materials are estimated at one trillion won, which could cause price hikes and consequently reduce export competitiveness. Textile companies that dye textiles have the cost burden of registering more than 300 chemicals, and small enterprises can face chain bankruptcy[29]. Even advanced countries such as the United States and Japan, there is no mandatory registration of chemical substances of 1 ton or more[29]. The government needs to pass a revised bill that balances consumer and producer interests through an adequate review process involving discussion with textile companies. It should be noted that consumer protection laws can disrupt the ecosystem of the textile industry, which raises the costs to consumers.

5.2 Research Question 2: Social and cultural factors that have affected the Korean textile industry in the past five years

The social and cultural factors that have affected the Korean textile industry were categorized into eco-friendly society.

·Eco-friendly society: Global concern over the protection of the environment has affected the development of industry. Regulations on substances related to products in countries such as CPSIA(Consumer Product Safety Improvement Act) and CSPA(Children's Safe Products Act), California Proposition 65 in North America, REACH in Europe, GB in China are competitively increasing[30]. Textile firms must achieve

sustainable growth as global companies by providing eco-friendly products and adopting eco-friendly management as the industrial paradigm is shifting to a green economy. For the representative example, Gore-Tex is developing eco-friendly water-repellent products without PFC due to PFCs classified as environmental pollutants in developed countries cannot be used[36]. Gore-Tex has invested \$15 million for 5 years since 2016 in the development of alternative materials, and applied non-water repellent technology developed through RND[31]. Through this, Gore-Tex is not only developing functional clothing, but also carrying out social responsibility for eco-friendliness. Accordingly, Korean textile companies need either to operate their own R&D centers to develop eco-friendly materials or to develop them through memoranda of understanding with external institutions or university research institutes. In other words, a preemptive approach to the changing social environment can facilitate the development of eco-friendly products suitable for the new market. Such measures by Korean textile companies can minimize the risks to the industry and create an efficient environment that can generate profits.

5.3 Research Question 3: Changes in the business environment of the Korean textile industry in the past five years

The business environment factors for the Korean textile industry are divided into two aspects. First group is factors of technology environment consisted of Advanced textiles development, Recycled textiles development, and 4th industrial revolution. Second group is factors of organizational environment were categorized into overseas investment, investment in advanced facilities, smart factory, unfair transactions and shared growth.

5.3.1 Factors of technical environment in the business environment of the Korean textile industry in the past five years

·Development of advanced materials and recycled materials: Korean textile companies are gradually developing advanced materials and recycled materials to keep pace with the Fourth Industrial Revolution and changes in the social environment. The current global economic downturn has made it difficult to create economic value. However, in the future, Korean textile companies can dominate the market through new textile development, such as smart fibers, advanced materials development, and recycled fibers using polyethylene terephthalate. For the representative example, Bantex is actively exporting by developing 'Heater Rex' of solar heating fiber and 'Dry Zone' of fiber that dries in one second[32]. In addition, Korean textile companies will have a competitive advantage if they develop industrial materials, such as automotive textiles or cosmetic fibers, or continue to pursue manufacturing innovation through the development of high value-added composite materials rather than focusing on the production of fashion materials. Japanese chemical textile companies are already expanding their investments to foster industrial textiles such as automobile textiles as the axis of growth industry in the future[33]. Hyosung, a Korean textile company, is expanding its competitiveness through the development of carbon fibers used in the space, aviation, automobile, and defense industries[34]. Furthermore, this can be an opportunity for new business models.

·Fourth Industrial Revolution: The Fourth Industrial Revolution, which consists of the convergence of information and communication technologies (ICT), is here. This is an industrial change that is expected to build virtual physical systems that can automatically and intelligently control objects by integrating the real and the virtual through robots or artificial intelligence. However, it is not an exaggeration to say that the

textile industry has remained stuck in the Second Industrial Revolution, engaging in mass production using electricity. The Textile trend in present is diversifying into smart fabrics with IT Like interactive fabrics and fabrics that have a communication function that stores information or 3D printing fabrics[35]. The industry here has moved only to early Third Industrial Revolution through the introduction of online supply chains and automated production systems. In addition, as textile materials are a key input of the apparel industry, the time has come to develop advanced materials through ICT convergence.

5.3.2 Factors of organizational environment in the business environment of the Korean textile industry in the past five years

·Overseas investment: Overseas investment by Korean firms is gradually accelerating. This means that Korea is a difficult managerial environment for textile companies due to labor shortages, increasing production costs and taxes, excessive regulations, and inadequate government support. As a result, the competitiveness of the industry is rapidly deteriorating, and Korean textile companies are actively seeking opportunities to move production overseas. It can be argued that this situation has resulted from the neglect of the industry in national policy. The Korean government's economic policies, such as a sharp increase in the minimum wage, mandatory full-time employment, and limits on foreign workers, are not well adapted to the reality of the textile industry and, consequently, have encouraged firms to invest abroad. By contrast, the state of North Carolina in the US has adopted business-friendly policies in nearly all of these areas, including land prices, labor policy, electricity taxes, and corporate taxes[36]. Korean firms account for 4.2% among the companies in North Carolina[37]. This shows how important the managerial environment is for operations. In addition, North Carolina provides incentives for

textile companies to create jobs. The significant industry-academic cooperation between textile companies and North Carolina State University, which is the most famous textile university in the world, is also noteworthy[36]. Along with this, Ethiopia also benefits from abundant workforce, low wages, low electricity bills and no tariff benefits in the US and EU[38]. The Korean government needs to examine these cases and develop greater understanding of the reasons why textile companies move their factories overseas.

·Investment in advanced facilities and smart factory : Despite the global economic downturn, Korean firms are investing in advanced facilities. This is because Chinese companies have high quality and high productivity with modern facilities, which reduces the competitiveness of Korean materials[39]. Also, they are investing in smart factories that use robots rather than human labor to avoid the problems caused by wage increases and labor shortages. The Korean textile industry is experiencing a labor shortage due to a decline in the fertility rate and lack of interest in textile work. In this situation, smart manufacturing innovation based on ICT can transform the industry through factory automation to reduce costs, the creation of business models for new markets, and the development of talented personnel.

·Unfair transactions and shared growth: Business disputes are inevitable regardless of industry characteristics. Because of the high proportion of outsourcing, the textile industry frequently features production systems involving short and long-term contracts between textile supplier and fashion design companies who act as leading partners. Often, the firm occupying the superior position acts unfairly toward its partner in these transactions. For example, There is a vicious act of lowering the price of fabric by 50% by deliberately and habitually filing a claim after receiving fabric from an original subsidiary

company[40]. In addition, promotional companies are continuing to present unreasonable long-term bills or to discount textile price to textile company as business partners[41]. If these acts become public, they can damage the textile company. Although Unfair transactions may provide short-term benefits to conglomerates, it reduces the number of potential domestic partners. As a result, there is a possibility of international disputes when requesting an order from foreign suppliers. Large corporations in the textile sector must take the lead in establishing a culture of coexistence with their textile partners and workers in order to eliminate unfair behavior.

6. Research question 4: Implications for enhancing value and reducing risk in the Korean textile industry

Based on the above analysis, the implications for enhancing value and reducing risk in the Korean textile industry are as follows. First, the political and economic factors affecting the industry suggest that the government should work with textile companies to develop new policies that recognize geopolitical issues. The government's approach of unilaterally implementing changes in policy without prior consultations with companies negatively impacts the Korean textile industry. To solve this problem, smooth communication between the government and companies must be established, and the government should create a system that can minimize the damage caused by political problems, institute a grace period for the application of new laws, and provide financial support to the industry. In addition, the government should coordinate with Korean textile companies on issues surrounding corporate taxes, industrial electricity and gas fees, and labor costs. In particular, the government should actively support cooperative projects, particularly among

small and medium-sized companies that may have difficulty doing so on their own, taking into account the characteristics of the Korean textile industry. The industry will grow when the government's full support is combined with voluntary structural reform and technological development by textile companies.

Second, the analysis of social and cultural aspects affecting the Korean textile industry indicates that several changes are necessary. A strategic system of cooperation with similar industries in other fields to adapt to changes associated with eco-friendly production should be established. Environmental issues are emerging as a major variable that determines the future of national economies. However, the reality is that textile companies are small and do not have their own research institutes or human resources to develop them. To solve this problem, universities must provide educational programs related to the recycling. In addition, it is necessary to break down industrial boundaries and establish a culture of mutual growth through business agreements between textile companies, companies in other fields, and academia. This can solve both present and future problems of textile companies and create employment opportunities for future textile students.

Third, changes in the management of the Korean textile industry should include the development of strategies to create high-value, high-functional materials. This includes eco-friendly textiles, smart textiles, and convergent textiles. The Korean textile industry is knowledge and technology-intensive, and it is time to upgrade the industrial structure facing the 4th industrial revolution era. In other words, it is necessary to switch to a multi-species small quantity system that can respond quickly to changes in the global market, which increasingly demands high sensitivity, high functionality, high-quality, and high-tech industrial fabrics. To solve this problem, it is essential to improve international

competitiveness by upgrading technology through continuous investment in R&D for material development, building smart factories, and establishing joint development strategies across industries. Thus, textile companies must overcome their small scale in order to develop new materials. It is necessary to promote a strategy for qualitative improvement and high functionality of textile products through the improvement of their own technology. In addition, companies should pursue development of new products and product differentiation in order not to rely on the technology of other advanced countries. To generate new growth, the textile industry must develop new technologies in order to respond to future demand. This requires coordination with academia or research institutes. In addition, textile production is subdivided into different processes at several stages, which is an industrial structure that makes organic and cooperative production activities between streams complicated. As a result, it is necessary to establish an organic cooperative relationship by forming a close network between industries to prevent excessive price competition, stop the decline of exports, and improve production, sales, and follow-up management.

7. Conclusions

The purpose of this study was to identify factors affecting the Korean textile industry and explore their implications for enhancing its value, using diachronic network structure analysis of five years of data. The results of the study are as follows.

First, the political and economic factors that have affected the industry in the past five years are: the minimum wage, foreign workers, the Kaesong Industrial Complex, low-cost textiles from late-developing countries, FTA, the rise in

taxes, the Electrical Appliances and Consumer Products Safety Control Act, the Act on Registration and Evaluation of Chemical Substances, and the Chemicals Control Act. Efforts should be made to resolve the labor shortages facing the textile industry through environmental improvement and systematic support and education in the textile ecosystem. The government should also allow increased employment of foreign workers to overcome the current labor shortage. These measures will address both present and future problems facing textile companies and ensure that textile students have job opportunities. The implication of these factors for enhancing value and reducing risk in the Korean textile industry are as follows. The government should propose a new policy to address geopolitical issues related to the textile industry and to provide a more practical approach to communication with textile firms. In other words, the government should minimize the damage caused by political problems and provide support for small and medium-sized companies to ensure continued profitability. In addition, the government should encourage on-shoring by Korean textile firms by reducing corporate taxes, cutting industrial electricity and gas fees, and making adjustments for labor costs. Second, the social and cultural factors that have affected the Korean textile industry in the past five years include an eco-friendly society. The implications for enhancing value and reducing risk in the Korean textile industry are as follows. A strategic system of cooperation with industrial sectors and organization should be established to develop eco-friendly materials. Third, the changes in the business environment of the textile industry in the past five years include overseas investment, development of advanced materials and recycled materials, 4th industrial revolution, investment in advanced facilities, and unfair transactions. The implications of these factors for enhancing value and reducing risk in Korean textile companies

are that they should develop eco-friendly textiles, smart textiles, and convergent textiles, which are high value-added, high-functional materials that can differentiate Korean firms from those making cheap materials in the Southeast Asian market, including China. To expand the development of new materials, a strategy of continuous investment in R&D and facility improvements is required. In addition, a culture that breaks down industrial boundaries and promotes coexistence must be established through business agreements between textile companies, companies in other fields, and academia; this would be in keeping with the convergent values of the Fourth Industrial Revolution. The textile market, currently in a stagnant period, is expected to experience a second boom.

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