Research Trends and Suggestions on Korean Knit Field Centered around Domestic Journal Papers between 1980 and 2006

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Abstract

This research extracted and analyzed 54 papers on knit field published in "The Research Journal of the Costume Culture", "Journal of The Korean Society of Clothing and Textiles", "The Journal of The Korean Society of Costume. "The Science and Technology of Clothing Appearance and Fit", "Journal of The Korean Society of Design Culture", "Textile Science and Engineering (Formerly Journal of the Korean Fiber Society", "Journal of The Korean Society for Clothing Industry", "Journal of the Korean Living Science Association", and "Journal of The Korean Home Economics Association" to analyze papers on knit field in textile science in depth. The result of the research shows that the number of papers is small compared to other fields and it is being researched limitedly due to relatively high ratio of subjects such as designs and patterns, knit hand assessment, and manufacturing fashion trends.

Key words : knit, knitwear, knit apparel industry.

Ⅰ. Preface

Recent textile industry is fanning out towards direction of individualization, diversification, and luxurization. The increasing manufacturing trends are to have decreased product lifecycle, large variety small quantity production, and short lead time. Knit products have good elasticity and drape and are preferred because of their excellent insulation and ventilation resulting from voluminous bulkiness and soft touch. As the trend in knit products also moves towards large variety small quantity production, the trends are increase in demand and also luxurization of consumer trends, both domestically and internationally.[1] Despite the fact that knit products are important items which should be cultivated as high value-added items with competiveness in Korean fashion industry, they are having difficulties in domestic and overseas markets due to knit products from developing countries such as China growing fast based on their cheap labor.[2] It is reality that medium and small companies go into series of bankruptcies not only because of cheap products but also high-end knit products from France, Italy, and Japan whose import has increased by two to threetimes in recent years. Domestic knit industry

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1) J. W. Jee, "How to Promote of Knit Industry," *Chonju Kijeon Women's College Thesis* Vol.20 (2000), pp.22-23.

2) Y. M. Lee, J. O. Park and Y. H. Lee, "A Study on Design Process and Production in the Knitwear Industry," *The Research Journal of the Costume Culture* Vol.12 No.2 (2004), pp.300-311.

must achieve design and manufacturing that can produce high added value with less labor in order to reduce burden from high domestic labor cost and secure competitive advantage over countries with low labor costs.

Among these, development of whole garment knit technique can be said to be another revolution in knit industry since color sensation of Benetton from Italy, which altered flow of supply in time and cost aspect and even eliminated post-production finishing. Whole garment knit still requires high capital equipment and expert manpower is in shortage but it is seen as an industry for developed country that best suits large variety small quantity production because of realization aspect of potential efficiency, zero inventory, quick response system, and large variety small quantity production, possibility of transforming labor intensive industry to plan and proposal and knowledge intensive industry.

It can be said that the share of Korean knit industry is small until now in terms of world class-technology, design, planning, and cost. Industry has already publicized many realistic problems and their solutions of Korean knit industry but it is determined that research on knit products is not being performed actively in textile science field as much as other fields. It is attempted to classify knit research field and review the trends of published papers.

Therefore, the goal of the study is to put forth improvements to future knit research by in-depth research and criticism on selected papers from 1980 to 2006 from nine domestic journals, in order to analyze papers on knit field in textile science in depth. The analysis of the paper includes analyses on research contents, methods, subjects, and statistical methods.

Ⅱ. Theoretical Background

1. Concept of Knit and Classification

Knit is to create a loop by using one or many continuously supplied threads and connect these loops. Wide fabric made in such way is called knit and knit is broadly classified into weft knit and warp knit. In weft knit, threads are put together in horizontal direction connecting one loop by one loop continuously. It can be knitted using flat bed knitting machine like fabrics to make it flat or adjust the width or it can be manufactured into tubes by circular knitting machine like nylons without seams. Disadvantages are that elasticity of width is large and it unravels when one loop is unraveled. Most of knitwear, sweaters, and socks are in this classification. In warp knit, many warps are fabricated into knitas fabric progresses in a zigzag manner vertically. Unlike weft knit, several hundreds of weft threads are required and fabric is made as each warp threads are connected by loops. Warp knits include tricot machine, Rachel machine, Milanese machine, and etc. Warp knitting machines have very fast knitting speed and thus have excellent production efficiency. They are represented as the fastest method to make fabric with filaments threads.[3] Refer to the 〈Table 1〉 for knit classification by knitting method.

2. Comparison of Manufacturing Processes between Sewn Knit and Whole Garment Knit

1) Manufacturing Process of Sewn Knit

In the manufacturing process of sewnknit, following procedures follow in sequence after front, rear, sleeves, and components are each knitted. i) Knit: Front, rear, sleeves, and components are each knitted. ii) First inspection: check for any defects before sending knitted fabric to iron and tailored linking. iii) First iron: Heat and steam are applied to fabric which completed the first inspectionto make tailoring easy. iv) Tailoring: Tailoring pattern is made on the confirmed pattern to include tolerances according to sizes and seam loss and the pattern is tailored. v) Linking: Shoulder AH seam, collar, pockets are examples of the linking areas. During prototype sample process, body needle count by sizes, stretching of bodice fabric, and curve on linkinglines are precisely learned,

3) Suk Keun Kim, *Knitting Technology* (Seoul: Munundang Publishing Co., 1996).

〈**Table 1**〉 Knit Machine Classification by Knitting Method

Warp Knit Machine	Tricot Machine			
	Rachel Machine			
	Milanese Machine			
	Crotched			
	Walter			
	Others	Weft-Picking Type-Co-We Knit Machine		
		Needleless Machine		
		Warp Knit Machine - Milano, Arachne Machine		
		Circular Knit Machine-Neck-Tie		
Weft Knit Machine	Latch Needle	Single-Bed Machine		
		Double-Bed Machine		
	Beard Needle	Cotton	Plain Stitch Machine	Socks Stitch Machine
				Under Wears Stitch Machine
			Rib Stitch Machine	Out Stitch Machine
				Socks Stitch Machine
				Under Wears Stitch Machine
				Trimmings Machine
		Compound Needle Machine		
		Slide Needle Machine		
		Gray Knit Machine		Circular Knit Machine
		Full-Fashioned Knit Machine		Sweater Weft Knit Machine
				Socks Stitch Machine

Ref. S. K. Kim.[4]

communicated, and confirmed to enable all operators manufacturing the same product can produce uniform products. vi) Overlocking: Process shoulders, AH, T-shirt cuff, and other seamed areas. vii) Machine sewing : Adjust stitch allowance to make the sewing finish tight and temporarily precise. viii) Super: Work sequence to connect front and back of the bodice and both sleeves is to start above the bodice and finish above the sleeve sewing. ix) Assembling: Used on tailored pocket, zipper, V-neck cuff, and etc. x) Work on button holes. xi) Hand Sewing: Sewing machine finishes the end after linking by wrapping. xii) Secondary inspection: Apply final finish on areas with missing or unraveled links following the prior processes. Specifications and applications of components and product balance are inspected and corrected overall. xiii) Finish iron: Product size and balance is fixed by insertion to premade mold. xiv) Label: Main label is attached in the center area of neck by hand sewing four corners with about a finger width margin. xv) Subcomponents: Other attachments are processed as noted in the work instruction. Final inspection is done. Delivery inspection is done. Tags are applied. Packaging is done.[5]

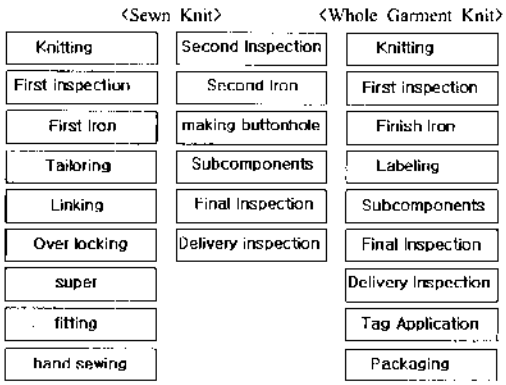
4) S. K. Kim, op. cit., p.72.

5) "Sweater Knitting Manual," Korea Federation of Knitting Industry Cooperatives (2004 [Searched 27 Jan. 2008]); available from World Wide Web@http://www.knit.or.kr

2) Manufacturing Process of Whole Garment Knit

Three tubular (sleeve-body-sleeve) are knitted simultaneously and exit machine with up to neck area finished. Afterwards, inspection, finish iron, label, subcomponents, final inspection, delivery inspection, and tag application are carried out in sequence.[6]

Such whole garment knit is suitable for large variety small quantity manufacturing environment because it can lead the next generation knit market and the interests are being focused on as a developed country industry. Whole garment knit also simplified the process by eliminating process steps from the conventional knit process and thus is being listed as the optimal industry for high value-added large variety small quantity manufacturing. Therefore, introduction of whole garment knit machine by domestic companies is becoming active and it is forecasted that the market can be increased in the future. The advantage of such whole garment knit is a dramatic reduction in time and cost. In case of knit manufacturing time, it has direct impact on cost, product variety, and product flow. Therefore, it is estimated that the ratio between the actual production time and the total process time can be changed to 20:80 from previous 10:90 by utilizing whole garment knit. Comparison of manufacturing processes between sewn Knit and whole garment Knit is as follows (Fig. 1).



〈**Fig. 1**〉 Comparison of Manufacturing Process Sequences between Sewn Knit and Whole Garment Knit.

3. Current State of Korean Knit Industry

Difficulties Korea faces in the knit industry are difficulties matching prices as business administrators (48.0%), shortage of knit design experts (22.0%), shortage of knit industry experts (20.0%), and shortage of process experts (10.0%) according to a research by J. W. Nam (2004)[7] and price reduction (99.3%), increased labor cost (63.5%), excessive competition among domestic companies (60.6%), and encroachment of domestic market by imports (35.8%) according to a research by Y. S. Lee (2007)[8]. This reflects the reality of Korea where disadvantages lie in price competiveness against China and design, quality, and planning against developed countries.

Looking at business activity trends of companies in the domestic knit industry (Table 2), shares of current knit industry within the manufacturing industry are 1.3% by the number of business entities, 1.0% by number of employees, 0.6% by production, and 1.4% by export revenue of as of 2003. 2003 numbers show decrease from 1999 and manufacturers and distributors in knit industry forecast small scale but deterioration of export market environment and domestic consumer market environment in the next five years compared to past periods.[9] Especially, companies specializing in manufacturing forecast more pessimistically about the future industry environment compared

6) "Sweater Knitting Manual", op. cit., p.8.

7) J. W. Nam, "Comparative Analysis of Manufacturing Processes between Whole Garment Knit Wear and Cut & Sew Knit Wear" (Master's Thesis, Konkuk University, Seoul, 2004).

8) Y. S. Lee, "The Competition Analysis & Leading Strategy in Knitted Apparel Industry," *Proceeding of the Journal of the Korean Society of Clothing and Textiles Spring Annual Conference* (2007), pp.30-26.

9) Korea Apparel Industry Association, *Knit Apparel Industry: The Competition Analysis & Leading Strategy*, (Gwacheon: Korea Apparel Industry Association, 2005).

〈Table 2〉 Activity Trends of Companies in the Domestic Knit Industry

	Number of Business Entities (ea)		Number of Business Entities (ea)		Production (billion KRW)		Export Revenue (million USD)	
	1999	2003	1999	2003	1999	2003	1999	2003
Manufacturing Industry	297,416	326,973	3,170,029	3,411,003	479,733	677,371	143,685	193,817
Market Share (%)	1.6	1.3	1.2	1.0	0.7	0.6	1.5	1.4

Source: Korea National Statistical Office Research Report on the Mining and Manufacturing Industries[12]

〈Table 3〉 Trends in Production of Domestic Knit Products

Business Category	Product Name	Unit	2000	2001	2002	2003	Change (%) (2000 vs 2003)
Weft Knit	Sweaters	Thousand Pieces	170,327	171,134	180,717	160.477	⇧5.8
	Others	"	13,561	14,268	15,067	15,471	⇧14.1

Source: Korea Federation of Knitting Industry Cooperatives[13]

to distributors active in the consumer market. Among those, manufacturers specializing in overseas export forecast severe deterioration in the future industry environment more so than the manufacturers doing business with the domestic market (Table 3). Production in knit industry started to decrease after the peak in 1990. 170 million sweaters were produced in 2000 but about 160 million was produced in 2003 which is 5.8% decrease.[10] The biggest reasons behind it are intensifying competition in the international consumer market as new manufacturing bases created with competitiveness from low cost labor in third world countries like China and lack of timely supplying capability and product planning to respond to drastic changes in tastes in consumer markets.[11] Decreases in machinery possession and number of employers as well as new investments have been intensifying since 90s. Deterioration in manufacturing base inevitably results in debilitation of production and product competiveness and the reality is ultimately ignorance in the consumer market.

4. Comparison between Korean and Chinese Knit Industry

Comparing technical competiveness of men's knitwear between Korea and China, China is shown to have superiority over Korea with enormous facilities and manpower. Chinese men's knitwear industry is shown to have strengths in latest facility investments from heated investments by advanced foreign companies and labor from abundant manpower. However, design, information technology level, and quality are shown to be very insufficient. The development speed of them are fast but it's been determined that competitive gap cannot be narrowed within a decade. In this point, Korean knit industry should plan to

10) "Status of Knit Industry" Korea Federation of Knitting Industry Cooperatives (Feb. 2005 [Searched 27 Jan. 2008]); available from World Wide Web@http://www.knit.or.kr

11) Y. S. Lee, op. cit., p.9.

12) "Report of Mining and Manufacturing Industry," Korea National Statistical Office [Searched 20 Nov. 2007]); available from World Wide Web@http://www.nso.go.kr

13) Ibid., p.13.

〈Table 4〉 Comparison of Technical Competitiveness between Korean and Chinese Knitwear

Category	Details		Korea	China
Equipment and Facility Competitiveness	Overall	Korea < China		
	Knitting Machine		○	
	Iron		○	
Quality Control Competitiveness	Overall	Korea > China		
	Design		○	
	Material Choice		○	
	Pattern Production		○	
	Sample Production		○	
	Work Instruction Issue		○	
Manpower Competitiveness	Overall	Korea > China		
	Planning and Design Manpower Level		○	
	Research and Development Manpower Level		○	
Manufacturing System Competitiveness	Overall	Korea = China		
	Sewing Specification System		-	-
Information Technology Competitiveness	Overall	Korea > China		
	Company Intranet Usage		○	
Design Competitiveness	Overall	Korea > China		
	Silhouette Line, Detail Line		○	
	Material Organization		○	
	Dye		○	
	Decoration		○	
	Process Technology		○	

Ref: Samsungdesignnet, Comparison of Men's Knits[14]

achieve the capability to rival that of developed countries by strengthening design manpower and quality.

5. Comparison of Technical Competitiveness among Major Knit Industry Countries (Korea, China, Italy, Japan)

A review of the industry base competitiveness of knitwear manufacturing nations shows that Italy has dominance in design planning such as design planning, manufacturing network, and securing manpower while Japan has dominance in quality control such as manufacturing management technology including manufacturing quality, quality guarantee, and delivery time observance, and competitive information. However, there was no category where Korea had dominance. It is the result of pursuing manufacturing of size through simple sewing and processing for the past six decades that there is no differentiation in price competiti-

14) "Comparison of Men's Knit," Samsungdesignnet (May. 2006 [Searched 20 Nov. 2007]); available from World Wide Web@http://samsungdesign.net

〈**Table 5**〉 Comparison of Technical Competitiveness among Major Knit Industry Countries

Category	Competition Factor	Country Dominating Competition
Equipment and Facility	Optimization of the scale of equipment on production floor	Italy
	Bringing Machinery up-to-date	Japan =Italy
	Raw material storage facility and method standardization	Italy > Japan
Planning	Intelligence and analysis	Italy
	Product line up and planning	Italy
	Securing expert designers	Italy
	Sample room standard	Italy
Manufacturing Base	Securing material and subcomponent supply	Italy
	Securing partner plant (raw material company and production company)	Italy
	Excellent manufacturing manpower possession	Italy
Manufacturing Quality	Manufacturing quality stability (product shape and size stability, etc)	Italy > Japan
	Systematic quality assurance	Japan > Italy
	Timely response to quality issues	Japan
Price	Price level to quality	China
Service	Delivery time observance	Japan
	Information technology	Japan
	Effort to cooperate with trading companies	Japan
Company Credibility	Operation and trade record	Italy > Japan
	Smooth employer-employee relation and organizational activity	Japan > Italy
	Company management credibility	Italy > Japan

Ref : Samsungdesignnet[15]

veness or product to be able to compete with China.

Ⅲ. Research Method

1. Data Collection

Data for the research was collected by using keywords "knit", "knit manufacturing", and "knitwear" on selected journals from domestic textile science journals, "The Research Journal of the Costume Culture", "Journal of The Korean Society of Clothing and Textiles", "The Journal of The Korean Society of Costume, "The Science and Technology of Clothing Appearance and Fit", "Journal of The Korean Society of Design Culture", "Textile Science and Engineering (Formerly Journal of the Korean Fiber Society", "Journal of The Korean Society for Clothing Industry", "Journal of the Korean Living Science Association", and "Journal of The Korean Home Economics Association" and analyzed related papers between 1980 and 2006. Subjects researched and analyzed are shown in 〈Table 6〉. No major difficulty was experienced in paper selection process but sorting process was necessary to exclude papers on research of textile structure by physicochemistry experiments or papers of which goal is to deve-

15) "Comparison of Technology Competitiveness among Major Knit Industry Countries," Samsungdesignnet (Feb. 2007 [Searched 23 Nov. 2007]); available from World Wide Web@http://samsungdesign.net

〈**Table 6**〉 Review and Analysis Subjects (1980-2006)

Journal Title	Frequency	%
The International Journal of Costume Culture	12	22.3
The Journal of The Korean Society of Costume	9	16.7
The Science and Technology of Clothing Appearance and Fit	7	13.0
Journal of The Korean Society of Design Culture	6	11.1
Textile Science and Engineering	4	7.4
The Research Journal of the Costume Culture	9	16.7
Journal of The Korean Society of Clothing and Textiles	3	5.5
Journal of the Korean Living Science Association	3	5.5
Journal of The Korean Home Economics Association	1	1.8
Total	54	100.0

lop a new fabric by modifying properties of existing fabric, even though they are included in the knit field. It was because they were judged to be out the research goal to review knit related papers. Content-analysis method was applied on the selected papers.

2. Data Analysis

Data analysis is classified into first, changes in year and distribution among journals, second, year and distribution of subjects, third, analysis of research method, fourth, analysis of statistical method, and fifth, analysis of research subjects to examine characteristics of selected papers on the knit field. Data statistics were executed with SPSS 14.0 statistics package.

3. Reliability Level of Data Analysis

Data analysis must be carried out by multiple relevant experts but the characteristics of content-analysis method requiresteps for the researcher to create measurement tools and collect data. In order to reduce prejudice and ensure objectivity in collection process and recording, test-retest method was performed where another analysis is performed one week after the initial analysis. The result shows 0.78 reliabilitycoefficient in the initial analysis and 0.76 in the second analysis. This method was chosen to increase the reliability level of data but is deemed to require complements from other experts in the future.

4. Content-Analysis Method

According to Kerlinger (1964)[16], content-analysis method is defined as a method of study and analysis to solve research subjects regarding communication through analyzing the content of communications produced by people in lieu of direct observations, surveys or interviews. It is a characteristic of content-analysis method for the researcher to become a research tool and eliminating the researcher's prejudice and subjectivity to objectify the research process becomes a major issue. According to Paoletti (1982)[17], content analysis has the following four steps. First, a clear goal or hypothesis must be established, second, securing premade research tools like survey to measure variables is required, third, sample collection process without involving prejudice must proceed, and finally, a systematic recording of the collected data followed by a data analysis process using appropriate statistical methods is required.

16) F. N. Kerlinger, *Foundations of Behavioral Research. Educational and Psychological Inquiry* (New York: Holt, Rinehart and Winston, 1964).

17) Jo. B. Paoletti, "Content Analysis: It's Application to the Study of History of Costume," *Clothing and Textiles Research Journal* Vol.1 No.1 (1982), pp.14-17.

Methodological characteristics of content-analysis in objective, systematic, quantitative and extent, value, and analysis unit aspect raised by Y.S. Ahn (1996)[18] are explained as follows. First, objective aspect means the researchers' personal characteristics or prejudices are not involved in the analysis results and the same conclusions must be reached when repeated by other researchers. Systematic aspect means samples are selected through appropriate process and each question requires identical probabilities to be included in the analysis and assessment process must be systematic and all contents being considered must be handled in a precisely identical method. Quantifying in content analysis is said to help simplifying the analysis, translation, and assessment process and enables usage of statistical methods. Second, in the extent aspect, not only the content of mass media but also the delivery processes of the content are being analyzed. Third, in the value aspect, not only the contents of mass media are logically explained but it is also inferred what kind of influence is demonstrated during the delivery, in other words, analyzed what influence is demonstrated socially. Fourth, in analysis unit aspect, characteristics of languages used in the content-analysis process are important.

This research was carried out according to Paoletti's (1982)[19] content-analysis processes as follows. First, a research subject was established as an analysis on research contents, research methods, research subjects and statistical methods of papers on knit field amongst those published between 1980 and 2006 in seven selected domestic journals related to textile science. Second, a survey was developed to measure the papers. Third, samples acquired through related keywords to find papers related knit field were pre-inspected to select final samples considering relevance to the research. Fourth, after test-retest method was performed to improve the reliability level, data were collected using survey and were recorded to the survey. Finally, collected data were analyzed with appropriate statistical methods.

Ⅳ. Research Results

1. Distribution by Year and Journal

Changes in the distribution of the 54 selected papers for this research by year and journal are shown in 〈Table 7〉. Papers in knit field increased from a single piece (1.8%) in Textile Science and Engineering in 1985 to 17 pieces (31.5%) in 2006. Studies centered around materials had been performed before studies on knit design and Knitting were active. Papers on knit field were limited to a few journals until 1980's but started to be published in numerous journals since 2000's. By journals, the most, 12 papers (22.2%), in knit field were published in the International Journal of Costume Culture followed by 9 papers (16.7%) in Journal of the Korean Society of Clothing and Textiles, 9 papers (16.7%) in the Journal of The Korean Society of Costume, and 7 papers (13.0%) in Fashion Information and Technology. Especially in 2006, a paper encompassing various detailed subjects in knit was published in Fashion Information and Technology and concentrated on assessing the present and future of the current knit industry. It is shown that despite more studies performed than the past, researches still fall short in comparison with other fields.

2. Distribution by Year and Detailed Subjects

Knit field research subjects were classified into design and pattern, knit hand assessment, consumer behavior, industry environment, materials, dying, and fashion trends. These were further classifiedinto each subjects and the result is shown in 〈Table 8〉. Design and pattern is classified into design, pattern design, and pattern. Pattern design is very important in the knit field unlike other fields. It is because pattern design has higher efficiency in terms of time, manpower and labor cost than changing overall silhouette or pattern for

18) Young Seup Ahn, *Introduction to Methodology of Social Science* (Seoul: Bomunsa Publishing Co., 1996).
19) Jo. B. Paoletti, op. cit., p.14.

〈**Table 7**〉 Distribution by Year and Journal Unit: Number of Papers (%)

Journal Title/Year	1985	1987	1991	1994	1996	1998	1999	2001	2002	2003	2004	2005	2006	Total
The Research Journal of the Costume Culture								1 (1.8)	2 (3.7)		3 (5.6)	3 (5.6)	3 (5.6)	12 (22.3)
Journal of The Korean Society of Clothing and Textiles					1 (1.8)	1 (1.8)			1 (1.8)	1 (1.8)	1 (1.8)	2 (3.7)	2 (3.7)	9 (16.7)
The Journal of The Korean Society of Costume		1 (1.8)	1 (1.8)	1 (1.8)				2 (3.7)		1 (1.8)	1 (1.8)		2 (3.7)	9 (16.7)
The Science and Technology of Clothing Appearance and Fit													7 (13.0)	7 (13.0)
Journal of The Korean Society of Design Culture								1 (1.8)			1 (1.8)	3 (5.6)	1 (1.8)	6 (11.1)
Textile Science and Engineering	1 (1.8)			1 (1.8)		1 (1.8)	1 (1.8)							4 (7.4)
Journal of The Korean Society for Clothing Industry											1 (1.8)		2 (3.7)	3 (5.5)
Journal of the Korean Living Science Association							1 (1.8)		1 (1.8)			1 (1.8)		3 (5.5)
Journal of The Korean Home Economics Association											1 (1.8)			1 (1.8)
Total	1 (1.8)	1 (1.8)	1 (1.8)	2 (3.7)	1 (1.8)	2 (3.7)	2 (3.7)	4 (7.4)	5 (9.3)	3 (5.6)	8 (14.8)	9 (16.7)	17 (31.5)	54 (100.0)

whole garmentknit or low volume production. It is found that related studies are increasing reflecting this.

Hand assessment of knit is to study the feel of fiber or stitchthrough surveys or experiments. It is a factor that affects the productivity, design, and sales of knit and more active research is required.

Consumer behaviors are classified into decision making, purchase behavior, satisfaction/dissatisfaction, and preferences. Among these, purchase behavior was the highest with 7 papers (12.5%). Industry environment was classifiedinto industry and manufacturing. Manufacturing is a field that is studied steadily. Past and future of the knit manufacturing can be examined and the future directions can be inferred through studies.

Fashion trends field is centered around overseas collections applying knit fashion. It serves as an opportunity to compare Korean knit fashion and fashion trends of other countries. Very few studies are done in materials and dye fields and more varieties of researches are deemed to be necessary.

3. Analysis of Research Methods of Papers

In this study, research methods are classified into seven classificationsand the result is shown in 〈Table 9〉. Of total sixty papers, most were experiment method with 17 papers (28.3%), followed by survey method with 16 papers (26.7%), research study method with 12 papers (20.0%), knit technique analysis with 7 papers (11.7%)

〈Table 8〉 Distribution by Year and Detailed Subjects Unit: Number of Papers (%)

Subject/Year		1985	1987	1991	1994	1996	1998	1999	2001	2002	2003	2004	2005	2006	Total
Design and Pattern	Design								1 (1.8)					2 (3.6)	3 (5.4)
	Pattern Design										2 (3.6)	2 (3.6)	2 (3.6)	3 (5.4)	7 (12.5)
	Pattern						2 (3.6)					1 (1.8)	1 (1.8)	2 (3.6)	6 (10.7)
Knit Hand Assessment					1 (1.8)							1 (1.8)	1 (1.8)	2 (3.6)	5 (9.3)
Consumer Behavior	Decision Making			1 (1.8)					1 (1.8)						2 (3.6)
	Purchase Behavior		1 (1.8)							2 (3.6)	2 (3.6)		1 (1.8)	1 (1.8)	7 (12.5)
	Satisfaction / Dissatisfaction									1 (1.8)					1 (1.8)
	Preferences				1 (1.8)				1 (1.8)				1 (1.8)		3 (5.4)
Industry Environment	Industry									1 (1.8)				1 (1.8)	2 (3.6)
	Manufacturing	1 (1.8)			1 (1.8)			1 (1.8)	1 (1.8)			1 (1.8)	1 (1.8)	3 (5.4)	9 (16.1)
Materials						1 (1.8)							1 (1.8)		2 (3.6)
Dyeing													1 (1.8)		
Fashion Trends												2 (3.6)		4 (7.1)	6 (10.7)
Miscellaneous												1 (1.8)			1 (1.8)
Total		1 (1.8)	1 (1.8)	1 (1.8)	3 (5.4)	1 (1.8)	2 (3.6)	1 (1.8)	4 (7.1)	4 (7.1)	4 (7.1)	8 (14.3)	8 (14.3)	18 (32.1)	54 (100.0)

〈Table 9〉 Analysis of Research Methods

Research Methods	Frequency	%
Experiment Method	17	28.3
Survey Method	16	26.7
Research Study Method	12	20.0
Knit Technique Analysis	7	11.7
Content Analysis	4	6.7
Interview Method	3	5.0
Observation Method	1	1.6
Total	60	100.0

and the fewest was observation method with 1 paper (1.6%). The experiment method includes knit hand assessment and post-knit physical properties experiment. Knit technique analysis is not classified in other textile science fields and the knit technique was classified into a research method and analyzed in this study. It is because knit patterns are used to overcome monotony of design as design production of knitwear is more difficult than fabrics and the development of knit technique is very important in the knit field. It is being introduced as one of the most important factors of future knit development plan.

4. Analysis of Research Subjects of Papers

〈Table 10〉 shows the age and gender of the research subjects. 20's and 30's are highest (26.5%) and 60's are lowest (2.9%). Studies on elderly are lacking while the issue of Korea becoming aged society is being raised as a serious social problem. Ratio of females (73.9%) was much higher than male (13.0%) and 13.0% of papers included both genders in the research subject. Textile science is excessively disproportionate towards females than males and needs for studies on males are expected to rise as more contemporary men are interested in their appearancesor fashion.

5. Analysis of Statistical Methods of Papers

Analysis of statistical methods is shown in 〈Table 11〉. Frequency analysis and ANOVA are highest with 15 papers (17.2%) and MANOVA was lowest with 1 paper (1.1%). This reflects the fact that research study method and content analysis method contribute to the majority of the research methods. ANOVA, factor analysis, and reliability analysis are used often in researches on marketing aspects. Duncan test was disproportionately used as post-verification for ANOVA and various post verification of statistical methods are deemed to be necessary.

〈Table 10〉 Analysis of Research Subjects

Demographical Statistical Characteristics		Frequency	%
Age	20's	13	38.2
	30's	9	26.5
	40's	6	17.6
	50's	4	11.8
	60's	1	2.9
	All Age Groups	1	2.9
Total		34	100.0
Gender	Male	3	13.0
	Female	17	73.9
	Both Genders	3	13.0
Total		23	100.0

〈Table 11〉 Analysis of Statistical Methods

Statistical Methods	Frequency	%
Frequency Analysis (Frequency)	15	17.2
ANOVA	15	17.2
Duncan Test (Post Verification)	12	13.8
Means	11	13.6
Factor Analysis	7	8.0
Chi-Square (χ^2)	6	6.9
Reliability Analysis	5	5.7
t-test	4	4.6
Multiple Regression Analysis	4	4.6
K-means Clustering Analysis	4	4.6
Correlation Analysis	3	3.4
MANOVA	1	1.1
Total	87	100.0

V. Conclusion and Suggestion

This research extracted and analyzed 54 papers on knit field published in textile science related journals, "The Research Journal of the Costume Culture", "Journal of The Korean Society of Clothing and Textiles", "The Journal of The Korean Society of Costume, "The Science and Technology of Clothing Appearance and Fit", "Journal of The Korean Society of Design Culture", "Textile science and Engineering (Formerly Journal of the Korean Fiber Society", "Journal of The Korean Society for Clothing Industry", "Journal of the Korean Living Science Association", and "Journal of The Korean Home Economics Association" between 1980 and 2006. The number of papers was yet smaller overall compared to other papers and papers on various subjects were limited as research subjects were concentrated on relatively limited fields. Study results are as follows.

First looking at the changes in distribution by year and journals, starting at one paper (1.8%) in Textile Science and Engineering in 1985, it increased to 17 papers (31.5%) in 2006. Papers on knit field limited to a few journals until 1980's started to be published in numerous journals in

2000's. By journals, the most, 12 papers (22.2%), in knit field were published in the International Journal of Costume Culture followed by 9 papers (16.7%) in Journal of the Korean Society of Clothing and Textiles, 9 papers (16.7%) in the Journal of The Korean Society of Costume, and 7 papers (13.0%) in Fashion Information and Technology.

Second, knit field research subjects were classified into design and pattern, knit hand assessment, consumer behavior, industry environment, materials, dying, and fashion trends. Design and pattern is further classified into design, pattern design, and pattern. hand assessment of knit is to study the feel of fiber or stitchthrough surveys or experiments and is deemed to be a factor that affects the productivity, design, and sales of knit. Consumer behaviors are classified into decision making, purchasebehavior, satisfaction/dissatisfaction, and preferences. Fashion trends field is centered around overseas collections applying knit fashion and serves as an opportunity to compare Korean knit fashion and fashion trends of other countries.

Third, research methods are classified into seven classifications. Of total sixty papers, most were experiment method with 17 papers (28.3%), followed by survey method with 16 papers (26.7%), research study method with 12 papers (20.0%), knit technique analysis with 7 papers (11.7%) and the fewest was observation method with 1 paper (1.6%), suggesting that variety of methods are not being used in terms of research methods. In the survey method, almost all studies use nonprobability sampling and it has been known to bea significant issue in generalizing the research results.

Fourth, the age and gender of the research subjects show that 20's and 30's are highest (26.5%) and 60's are lowest (2.9%). Ratio of females (73.9%) was much higher than male (13.0%) and 13.0% of papers included both genders in the research subject. Ratio of females were higher in the research subjects and researches on female subjects have a degree of validity as the fashion is more important subject for females than males in general. It also should not be overlooked that research subjects were excessively disproportionate as studies performed on males are few. In terms of age, it is true the importance of fashion decreases as age group heads towards elderly but studies on elderly are very important considering the trend towards aged society in Korea. Especially elasticity and drape, the most significant characteristics of knitwear, can supplement the changing physical conditions in old age. More studies are necessary in this aspect as researches on the old age group are active in other fields.

Combining the trends of prior researches from 1980 to 2006 into a conclusion, papers on knit field are disproportionately concentrated on a few lower level categories. That is, they are concentrated on design and patter, knit hand assessment, and manufacturing fashion trends and it should be avoided for the development of knit field. Especially related to the consumer behavior, researches are concentrated in the marketing environment and researches on the marketing management aspects are significantly in shortage. For future development of the knit industry, researches on various fields should be performed such as quality, distribution, and advertisement. It is very encouraging phenomenon that researches on the knit field have diversified noticeably since 2000. Continuous discussion should take place through follow-up researches regarding the directions of development on the knit field. It was confirmed that the knit field had been developing remarkably but much improvement was desired academically both in quality and quantity. Especially, difficulties were met during the study as many papers were handling subjects inclusively without showing concise subjects. That is, there were subjects and conclusions that did not show consistency. This clearly has to be improved considering that it requires the accumulation of research results not only through quality sides of the researches and papers but also through the dissipation of the research methods or information exchange for an academic field to be firmly established.

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