48

A Study on the Digitalization of the Fashion Industry

Mi-Ryang Lee* and Moon-Sook Kim
Dept. of Fashion Design, Anyang Technical College*
Dept. of Clothing Science, Seoul Women's University

Abstract

The digitalization of the fashion industry refers to 'the reception of the digital environment by the industry'. The paper presented 3 conceptual categories of 'technological environment', 'information environment' and 'business environment' concerning the scope of digitalization, including from the introduction and use of new technical media to new ways of thinking following the paradigm changes. And it demonstratively analyzed digitalization factors and digitalization level of fashion businesses related to the factors by 7 fashion categories.

The analytic result and its suggestions are as follows. First, five digitalization factors of the fashion industry are defined : manufacturing process automation, computer systemization, information networking, e-business, and small batch production. Second, the digitalization degree of fashion firms decreases in the order of information networking, small batch production, manufacturing process automation, computer systemization, and e-business, with information networking on the top and e-business, recent focal point of interest, at the bottom. Third, as for the digitalization of each clothing category, men's formal dress and unisex display the highest level of the general digitalization.

Key wards: digitalization of the fashion industry, digital environment (technological env., information env., business env.)

I. Introduction

The environmental changes of the 21st century are accelerated by the development of digital technology and the spread of digital environment. It is expected that the consumers of the future digital world will be provided with better products and services by companies that are innovating business processes using digital networks.[1] Therefore firms take notice of the digitalization of business processes and the development of a knowledge system as well as the construction of a stable information system. The fashion industry also is required to reform its structure according to the environmental changes in the 21st century. Previous case studies show that the fashion industry's digitization can be an important means to reform the fashion business structure for its competitive advantage. Also for the fashion industry's digitalization, it is important to realize the value of exploiting technological advantages of digitalization following the development of computer-related technologies, and of computers and information technology (IT). The domestic fashion industry, influenced by the digital environment, is experiencing changes in its system and strategies including automation, informationization, B2B and B2C, with growing interest in them.

E-mail : mskim@swift2.swu.ac.kr

[1] William H. Gates Ⅲ, Speed of thinking. (Seoul : Cheong-rim Publisher, 1999)

As the development of digital technology and information inflow are so rapid, fashion firms are required to pursue digitalization actively for the industry's development and competitive advantage, and it should be done on the level of corporate strategies based on the understanding of the evolving environment of digital technology.

This study, first of all, illustrates and examines the meaning of the fashion industry's digitalization pursued by fashion businesses. Second, it demonstratively investigates and analyzes digitalization factors, and differences of digitalization level among different fashion items related to the factors by 7 fashion categories. For it, a questionnaire survey was conducted of 129 domestic fashion brands in Korean fashion industry.

II. Digitalization and Environment

1. Digitalization

1) Concept

Digitalization is a higher idea developed from such concepts as computer technology, high-tech, technology and IT, and is widely used in many areas including the networks of digital information technology. Digitalization includes both active technology focusing on application and information technology focusing on objects of new technology and equipment. Digital coding is related to the system of information recording and transfer, and a digitalization process requires physical equipment and media (systems, tools and media) as well as physical energy for saving and retrieving[2]. At the core of digitaliza-

tion lies : first, media, that is, equipment and system environment represented by technology such as computers and the internet ; second, activities of information gathering and application using media, building database and operations using networks ; third, the influence of paradigms resulting from the previous factors.

Therefore it refers to an active state, in which all kinds of information are processed, edited, accumulated and circulated in digital codes. Digitalization influences the whole society resulting in paradigm changes, and a series of such phases is defined as digitalization in a comprehensive term.

2) Value of Digital Information

Today information concept is gaining diverse meanings including new factors on the level of distribution due to the development of digital technology. Na[3] takes notice of information data as digitally processed data, and Bel[4] points out that the future society of mankind will have 'information' as its main power. Today's digitally processed information is very precise, and can be processed fast on a large scale automatically. Levy[5] argues that digital method is the only one that satisfies the four features simultaneously, and as a result, efficient and complicated processing of information is possible. Information networking is being realized by information processed and accumulated by digital technology, interest in their applications, and the continuously developing technology. It is expected that information in the 21st century is used not as mutually isolated and independent knowledge but through a correlated and integrated information system, and therefore, the value of information

[2] Pierre Levy, Cyber Culture : *A Report of European Parliament - New Technology and Cultural Cooperation, and Communication* (Seoul: Literary Publishing House, 2000).

[3] Byung-hyung Na, 'Present State and Task of Education Informationization'. *National Assembly's analytic data of pending problems* 167, (1998): 2-3.

[4] Daniel Bel, *The Coming Post Industrial Society a Venture in Social Forecasting* (N. Y. Basic Books, 1973).

[5] Pierre Levy, *op. cit*, p.83.

will be increased.

2. Digital Environment and Digital Paradigm

The digital environment is divided into material and intangible environments. The material environment refers to the environment with the primary influence of material changes and technical development in the building of digitalization base. Systems and equipments are included here. The intangible digital environment means the second influence - the changes of thought and value brought by the development of new and convenient technologies.[6] (See Table 1) With the environmental changes, companies are expected to attempt to improve productivity and efficiency through IT. Their main economic activities may include : ① building the internet base ② e-commerce among businesses ③ digital distribution of goods and services ④ internet shopping of tangible commodities[7]. In addition to that, the business environment, the market, and the organization may have ① new technical paradigm ② new business environment paradigm ③ new corpo-

rate paradigm ④ new paradigm of geographical order. Furthermore, digitalization emphasizes the potentiality of interaction, mental flexibility going along with information technology[8], mentality with balanced thinking, and diversity value systems. Such values, connected through communication network of computer, may bring holistic thinking[9], which identifies environmental factors with other systems in broad perspective.

Paradigm changes today require the 'Homo sapiens information' who is competent for digital media.[10]

III. Digitalization of the Fashion Industry

1. Status of Studies

The digitalization of the fashion industry refers to 'the reception of the digital environment by the industry'. It involves the introduction and use of digitalized media and equipments, processing of tangible or intangible information by digital methods, and building of information

<Table 1> Classification of digital environments

Classification		Features	
Digital Environment	Material Environment	· Technical media development · Materal changes in base building (Systems, eqiupments)	First influence
	Intangible Environment	· Technical changes of application/use · Changes in activities	Second influence
		· Changes of value/thought	

· Sources : Tables based on the data from Lee, Miryang. (1999) 'A study on educational direction in fashion design according to the digital environment I.'. Design science study. 12 (4).

---

[6] Miryang, Lee, "A Study on Educational Direction in Fashion Design According to the Digital Environment I." *Design science study* 12, no.4, (1999); 39.

[7] United States Department of Commerce. *Digital is economy : Commerce Department's Report for a New World's Economy.* (Seoul: Communications Books. 1998), 29-30.

[8] Seong-jae Kim, (ed.). *Aesthetics of Media.* (Seoul: Nanam Publishing House, 1998), 58.

[9] Soon-jong Lee, "Design for the future." *Design.* 248, (1999): 200-203.

[10] Kim, Seong-jae, *op. cit.* p.59, p.74.

database to distribute or use. The process is under way in the business in the forms of automation, informationization and e-business through the internet. So far studies have mainly focused on the automation of production · physical distribution · distribution, CAD/CAM systems, informationization, information technology · system on the level of QR, and recent e-business using the internet. The studies characteristically deal with the aspects of few new technologies that are used independently or temporarily in a restricted area. Studies on digital technology are limited in grasping the whole accurately, since they are multi-dimensional studies on presently developing future conditions, and are related with various fields of social science. However, the fashion industry's digitalization needs to be studied in broad perspective in an attempt to introduce it, considering the present situation in which the infrastructure for digital information and technology, and multi-dimensional digital environment are under construction.

The study uses the term digitalization as a concept higher than the previous one of automation, informationization, and e-commerce including both digital media · technology represented by computers and the internet, influencing the world at large, and systems · information technology for improving efficiency in fashion companies in relation to the fashion industry. This includes database building of tangible and intangible information, the influence of its use as well as the physical introduction of digitalization equipment.

The features of the digitalization are examined in three sections of technological, information and business environments based on previous individual studies.

2. Technological Environment

Technological environment refers to the automation of equipments and systems. Today's automatic equipments involves precision automation with the capacity of continuous and feedback control of a much higher level through the computer. The automation in fashion industry was developed mainly for the manufacturing process, but now it is expanded and developed into the distribution and physical distribution. The automation in fashion industry is summed up as in <Table 2> according to preceding studies. The table classifies the automation applied to the industry presently, and shows the relevant operations and detailed techniques of digital technology in the automation processes of a manufacturing process, production planning and management, and physical distribution. Today's digital technology refers to the computer integrated manufacturing (CIM), in which it develops into 'system automation' with the introduction of automation systematized by area and integrated to generate a synergy effect in the whole factory. The manufacturing process of the future fashion industry shoud be automated for CIM to connect or integrate the four basic production techniques - sewing preparation, sewing and joint, material fabrication, and system management and adjustment. It also includes the construction of a basis and system for the use of information. The digitalization of technology can be a foundation for higher productivity and management efficiency with the improvement of the operational environment and management of material resources.

3. Information Environment

Fashion firms continuously do intelligence activities to reflect environmental changes to manufacturing and supply of goods. The industry, however, is far behind other industries in information management and processing due to the backwardness of its information technology, lack of accumulated data, and bad circulation of information between parties in general. It is resulted from the features of fashion-related information : first, information is concentrated on the analog part of sensitivity ; second, information sources are variously structured according to the needs of each area and process ; third, fashion information is cumulative knowledge

<Table 2> Automation of the Fashion Industry

	Supported Digital Technologies	
	Relevant Operations	Detailed Techniques
Manufacturing Process	• Sewing preparation - Automated production process (cloth spreading, checking, cutting, grading, marking) • Sewing -Automated sewing process (Sewing, pressing) • Final stages	CAD/CAM Numerical control equipment Production system controlling intelligent machine using computer
	Unit production Short lot production	Short-cycle process UPS(Unit production system) Automation by stage (MA-FA-FMC-FMS)
Production Planning/ Managment	• Planning-quantity related to production, request. delivery date, inventory, process planning, material purchase, shipping of finished goods, management • Writing requests for manufacturing specifications • Management-production order information, data on factory, manufacturing control, equipment, human resources management	Search function Network type Standard data building for system use CIM
	• Organizing, manpower management, adjustment and control, use of POS data, information sharing with client firm	
Physical Distribution	• Auto transfer-product supply/transers, internal physical distribution management • Inventory control (IC), stock reduction • Advanced consignment report, shipment	Bar-code system (KAN, Own physical distribution codes) Inventory system, logistic, Automatic conveyance system
	Electronic reorder Petty order system	Automatic stroing system Automatic guided system Automatic guided vehicle (AGV) Total physical distribution information system EDI(Electronic data intercahnge), PLU(Price labeling unit), POS(point of sale system), EOS(electric odering system) SCM(shipping container marking) ASM(advanced shipping marking)

requiring both individualand quantitative totalization.[11] In fact, the informationization level of the textile industry is reported to be very low compared to other industries with 27.8% of computer introduction rate. Also computer systems are reported to be used mostly for standard operations, as personnel and wage management show the highest level (85%)[12]. This shows that

---

[11] Ju-young Kim, and Young-seok Son, "A Study on Directional Changes of Marketing Resulting from the Development of Information Technology". *Marketing Study* 12, no.2 (1997): 185.

[12] National Computerization Agency. *National Informationization White Paper.* (1995), 195.

textile and fashion industries are in their early stages in terms of the operation of computing and information systems. Such poor situations should be improved. The rationalization and efficiency of business should be achieved in physical and technical aspects by promoting digital information systematization expanding and using information tools adequate to business strategies.

4. Business Environment

Influenced by the 21 century environment of digital technology, producer-oriented market is changed into consumer-oriented one with new consumerism. As a result, various changes occur in consumer purchase behaviour, within companies, and in market structure. The changes related to consumer purchase behaviour include changes in information search behaviour, purchase decision, purchase influencers, and distribution and transaction process for purchasing.[13] Changes within companies occur in communication methods and decision-making ways[14], organizational structure[15], and practical changes like operational processes resulting from a rearrangement of operations. The changes of market structure are related to a competitive structure and relation changes between competing firms in the industry, the arrival of electronic commerce (EC). The studies of Nouwens & Bouwman (1996) and Bak & Kim (1994)[16] predict the appearance of a network-style market struc-

ture due to digital information and technology. As today's environmental changes demand companies to reform ctheir operational structures and to improve their competitiveness through strategic applications of information technology[17], new marketing and paradigm should be studied to view consumer behavior in the new environment. Therefore digital management in the fashion industry takes the customer satisfaction concept as its final object, and can be achieved through the introductions of QR, e-business, small batch production and spot production systems, reordering system, and the diversification of product values. Moreover, the introduction and application of new technologies to reform business process (BP) can bring such effects as the restructuring of operational process, construction of advanced information infrastructure, information sharing system, and active proposition-type design.

5. Digitalization of the Fashion Industry

This study defines the industry's digitalization in terms of three categories of technological, information and business environments. First, the technological environment refers to the process automation by a system using or focusing on digital technology. It also includes the construction of a basis and a system for information application. Digitalization in this section can be the foundation for better productivity and

---

[13] Gwang-ho An and Seo-il Chae, "A Positive Study on Store Selecting Behavior Using Multinominal Logit model." *Management study.* 22, no.2 (1993): 101-120.

: Ju-young Kim, and Young-seok Son, *op. cit.* p.177.

[14] J. F. George, G. K. Easton and G. Northcraft, "A Study of Collaborative Group Work With and Without Computer-Based Support", *Information Systems Research,* 1 (1990): 394-415.

: P. Suzanne, Sherry Weisband, Schneider, K and Connolly Terry, "Computer-Mediated Communication and Social Information: Status Silence and Status Difference", *Academy of Management Journal,* 38(1995): 1124-1151.

[15] Peter K. Manning, 'Information Technology in The Police Context: The 'Sailor' Phone', *Information Systems Research* 7, no.1 (1996): 52-62.

[16] Hyo-sik, Bak and Gi-chan, Kim. "A Comparative Study of Strategies of Small/medium-sized Firms in Korean and Japanese : Focusing on the Networking Strategies among Companies." *Management study* 23, no.4(1994): 147-182.

[17] Ju-young Kim and Young-seok Son, *op.cit.* p.175.

<Table 3> The Digitalization of the Fashion Industry

	Details	Areas	Expected Effects

Equipment/ system environment ▼ Technology digitalization	· Operational process
	  - mechanization
	  - automation
	· With digital technology
	  -equipment introdution
	  - system building
	· For information database
	  - basic environment building
		Production
		Physical distribution
		Distribution
		Marketing
		Managing customer
		Planning
		Designing
			· Material quantity
			· resources management Improving operational evironment
			↓
			Improving productivity
			Basis for higher managing efficiency
			
			· D/B of process from process
			↓
			Creation of information

Information technology environment ▼ Information digitalization	· Information management
	  - using digital infor. technology
	  - building D/B
	  - using information communication
	· Buiding network/websits
	· Building/operation ofinfor.- infra
	(Digital network building)
		Marketing
		Managing customer
		Planning
		Designing
			· Info. collection for market-oritened purposes, D/B building, digitalized broadcasting
			↓
			Synergy effect of D/B use/range
			Bilateral communication

Marketing strategy environment ▼ Digital management	· Introducing new tech. paradigm
	· Adopting new promotional channels
	  - e-business (B2B/B2C)
	· Pursuing reactivity for market/customers
	  - small batch production
	  - spot production
	  - reordering system
	· Investment in tech./know-how
		ProductionDistribution
		Marketing
		Managing customer
		Planning
			New technical paradigm, diversifiation of product values, demolition of value uniformity
			↓
			Individuation/perfection of customer

management efficiency by improving operational conditions and management of material quantity and resources in the industry. Second, the information environment means database building and systematization, use of information and communication, building and operation of websites and networks, and construction and operation of information infrastructure. Third, the business environment refers to the activity of setting business strategies introducing new promoting channels and new technical paradigms by adopting digital environment and culture in fashion management.

<Table 3> summarizes the details and expected effects on the three aspects of the digitalization.

IV. Method

1. Method and the Procedure

The digitalization of the fashion industry refers to the reception of the digital environment in the industry. This study conducted a questionnaire survey to positively analyze the digitalization factors of the fashion industry and digitalization degree for the factors. The digitalization criteria consist of questions developed by the researcher through a prior test in terms of the digital environments of technology, information and business. There were 10 technology-related questions, 4 information-related questions and 7 business-related questions used. Each item was measured in a total of 11 points. The

answers consisted of "Not at all" (0 point), "Average" (5 points), "Very much" (11 points). And the higher the total score, the higher degree of digitalization becomes.

In this study, performance referred to questions concerning effectiveness among subjective measurement criteria. As a result, performance variables of 11 questions are constructed includ

<Table 4> Factor Analysis and a-reliability Coefficients of Digitalization.

Items	Factor loading	Factors	Eigenvalue (explanatory power)	Corrected item-total correlation	avalue
Computer-integrated manufacturing	.830	<Factor 1>	3.29	.711	.809
Unit production system	.787	Manufacturing	(15.71)	.659	
DB of manufacturing process	.571	process		.537	
Production planning/management system	.559	automation		.576	
Building market-oriented database	.471			.497	
Computerized automatic transfer	.844	<Factor 2>	2.70	.665	.866
Computerized manpower management/ control	.716	Computer	(12.86)	.713	
Flexible manufacturing system	.669	systemization		.727	
Production order information/ factory management programs	.582			.759	
Building internal standard data system	.450			.600	
Website operation by brands/firms	.748	<Factor 3>	2.79	.530	.738
Preparing external info. infrastructure	.699	Information	(13.30)	.551	
Using internal information networks	.630	networking		.617	
Data saving/Document management by computer	.519			.455	
Introducing B2C	.836	<Factor 4>	2.95	.769	.863
Introducing B2B	.793	e-business	(14.07)	.739	
Introducing e-business	.761			.712	
Know-how investment/ digital information technology	.591			.640	
Small-batch production system	.823	<Factor 5>	1.82	.476	.617
Spot production system	.663	Customer- oriented	(8.69)	.449	
Use of CAD/CAM	.508	small batch production		.374	

ing five questions on customer satisfaction, four on financial outcome and two on corporate image. There were 10 technology- related questions, 4 information- related questions and 7 business-related questions used. Each item was measured in a total of 11 points. The answers consisted of "Not at all" (0 point), "Average" (5 points), "Very much" (11 points). And the higher the total score, the higher degree of performance.

Statistical package SPSS/PC+ 10.0 was used for the positive analysis, with the analytic methods of frequency, factor analysis, a-reliability coefficients, and pearson's correlation coefficients.

1) Correlation Analysis of Propriety and Reliability for Digitalization

Factors and reliability were analyzed to examine the reliability and propriety of the research units used in the study. As for the factor analysis, main factors were analyzed by the orthogonal rotation method using only those with an eigenvalue over 1. Reliability was analyzed using Cronbach αon the variables left from the factor analysis, and only those with a corrected item-total correlation over. 4 were used for the analysis. To verify the three categories of digitalization, detailed questions were presented in the questionnaire and then the resulting factors were analyzed. As a result, 5 factors of technological, information business environments were obtained as shown in <Table 4>.

Factor 1 was named "manufacturing process automation" with 5 loaded items : computer-integrated manufacturing (CIM), unit production system (UPS), manufacturing process database, use of production planning and management system, and building market-oriented database. Factor 2 was named "computer systemization" with 5 loaded items : computerized automatic transfer, computerized manpower management and control, flexible manufacturing system (FMS), use of production order information/factory management programs, and building inter-

nal standard data system. Factors 1 and 2 concur with the proposal for the technological environment among the 3 digitalization categories. Factor 3 was name "information networking" with 4 loaded items : website operation by brands and firms, preparing construction and use of external information infrastructure, use of internal information networks, and data saving and document management using the computer. This concurs with the proposal for the information environment. Factor 4 was named "e-business" with 4 loaded variables : the introduction of B2C, introduction of B2B, introduction of e-business, and know-how investment and digital information technology. Factor 5 was named "customer- oriented small batch production system" with 3 loaded variables: operation of small batch production system, operation of spot production system, and use of CAD/CAM. This concurs with the proposal for the digital business environment. The results concur with the 3 digitalization categories presented earlier, and proves that the digitalization was characterized by the technological, information, business environments of equipments and systems.

Eigenvalues for each factor are 3.29 for Factor 1, 2.70 for Factor 2, 2.79 for Factor 3, 2.95 for Factor 4, and 1.82 for Factor 5. Explanatory powers by factor are 15.71% for Factor 1, 12.86% for Factor 2, 13.30% for Factor 3, 14.07% for Factor 4, and 8.69% for Factor 5, with the total explanatory power of 64.63%. And as shown in <Table 4>, the reliability analysis on the deducted factors produced the Cronbach α values, over .6, generally required level, by factor : .809 for Factor 1, .866 for Factor 2, .738 for Factor 3, .863 for Factor 4, and .617 for Factor 5.

2) Correlation Analysis on Each Research Variables

Pearson's correlation coefficients was executed on the criteria by research unit, whose proprieties and inner consistencies were verified by the factor and reliability analyses. As in <Table 5>, correlations among the research

<Table 5> Average, standard deviation and correlation matrix among research variables

	Classification	Average (Standard deviation)	1	2	3	4	5	6	7	8	9	10
1	Customer satisfaction	7.19(1.40)	1.00									
2	Financial outcome	6.80(1.75)	.73 **	1.00								
3	Corporate image	6.98(1.38)	.65 **	.61 **	1.00							
4	Outcome total	6.99(1.33)	.89 **	.90 **	.84 **	1.00						
5	Manufacturing process automation	5.39(2.01)	.39 **	.26 **	.40 **	.39 **	1.00					
6	e-business	4.42(2.68)	.28 **	.35 **	.41 **	.39 **	.61 **	1.00				
7	Info. network	8.03(1.58)	.31 **	.25 **	.38 **	.36 **	.41 **	.49 **	1.00			
8	Computer systemization	4.87(2.53)	.22 **	.15	.28 **	.24 **	.68 **	.50 **	.30 **	1.00		
9	Small batch production	7.61(1.79)	.26 **	.30 **	.37 **	.35 **	.35 **	.34 **	.37 **	.39 **	1.00	
10	Digitalization total	6.10(1.57)	.46 **	.41 **	.54 **	.53 **	.83 **	.82 **	.64 **	.79 **	.61 **	1.00

** Significant correlation at p<.01. * Significant correlation at p<.005.

variables show the results of significant positive (+) in most cases. However, the correlation between computer systemization and financial outcome was not significant. The reason may be that they need time to reach the breakeven point concerning financial outcome, as most computer systems are very expensive.

2. Collection of Data and Samples

This study conducted a questionnaire to demonstratively analyze digitalization factors and digitalization level related to them. The subjects were selected among domestic brands engaged in fashion production, distribution and marketing by convenience sampling. Preliminary surveys were conducted with 6 companies during the period of March 23~30 2000, and with 5 companies, March 10~14 2001. Used survey methods were researchers' personal visits, or the distribution of questionnaires through fax or e-mail after explanation via the phone and collecting later. A total of 129 questionnaire were used for the study.

The general features of the respondents are described in <Table 6> and <Table 7>.

Business categories and clothing categories found 19 brands in men's formal dress, 18 in men's casual, 15 in women's formal dress, 25 in women's casual, 23 in unisex, 13 in sports wear, 6 in kids' wear, 9 in combined categories and 1 no answer. The types of companies are 63 affiliates of a large enterprise, 48 fashion specialized firms, 16 small and medium sized firms, and 1 no answer. There were 5 directors, 19 Vice-chiefs or division heads, 11 team managers, 24 department heads, 35 deputies, and 10 plain

<Table 6> General Features of Sample 1

Categories		Freq.	Ratio(%) (n=129)			Freq.	Ratio(%) (n=129)
Categories	Men's formal dress	19	14.7	Comany types	Conglomerate's affiliates	63	48.8
	Men's casual	18	13.9		Fashion specialized firms	48	37.2
	Women's formal dress	15	11.6		Small/medium sized firms	16	12.4
	Women's casual	25	19.3		No answer	2	1.6
	Unisex	23	17.8	Position of sample	Directors	5	3.9
	Sports wear	13	10.0		Vice-chiefs/ division heads	19	14.7
	Kids' wear	6	4.6		Team managers	11	8.5
	Combinations	9	6.9		Dept. heads	24	18.5
	No answer	1	0.7		Deputies	35	27.1
					Plain clerks	10	7.8
					No answer	25	19.4

<Table 7> General Features of Sample 2

		Freq.	Ratio(%) (n=129)			Freq.	Ratio(%) (n=129)
No. of emplyees	Uner 100	10	7.8	No. of dept. employees	Under 10	38	29.5
	100~199	14	10.9		10~19	34	26.4
	200~299	10	7.8		20~29	21	16.3
	300~499	18	14.0		30~39	16	12.4
	500~999	35	27.1		40~49	14	10.9
	1000~1999	7	5.4		No answer	6	4.7
	Over 2000	5	3.9				
	No answer	30	23.3				

clerks among the respondents. And 10 firms had employees under 100, 14 had 100~199, 10 had 200~299, 18 had 300~499, 35 had 500~999, 7 had 1000~1999, 5 had over 2000, and 33 firms did not answer. 38 departments had employees under 10, 34 had 10~19, 21 had 20 ~29, 16 had 30~39, 14 had 40, and 6 did not answer.

V. Result and Discussion

1. Digitalization Analysis by Clothing Category

<Table 8> Digitalization Analysis by Clothing Category   (n=128)

Categories / Digitalization	Men's formal dress (n=19)	Women's formal dress (n=15)	Men's casual (n=18)	Women's casual (n=25)	Unisex (n=23)	Sports (n=13)	Others (n=15)	F ratio	P value
M. process automation	6.23 (2.07)	5.21 (2.41)	5.49 (1.88)	5.03 (1.82)	5.51 (2.02)	4.94 (1.88)	5.11 (1.90)	.777	.608
Computer systemization	5.54 (2.53)	5.01 (2.54)	4.84 (2.96)	4.54 (2.35)	5.07 (2.80)	4.17 (2.26)	4.58 (2.21)	.438	.876
Info. networking	8.18 (1.39)	7.90 (1.91)	7.72 (1.75)	7.76 (1.48)	8.38 (1.44)	8.35 (1.09)	7.82 (2.05)	.489	.841
e-business	4.99 (2.70)	3.75 (2.84)	4.47 (2.65)	3.87 (2.53)	5.32 (3.02)	4.02 (2.65)	4.13 (1.91)	.811	.580
Small batch production	8.02 (1.22)	7.80 (2.10)	7.31 (2.22)	7.68 (1.45)	7.54 (2.26)	7.28 (1.30)	7.63 (1.72)	.354	.927
Digitalization Total	6.53 (1.53)	5.94 (2.09)	6.30 (1.49)	5.71 (1.41)	6.46 (1.74)	5.75 (1.28)	5.55 (1.15)	.750	.630

Each clothing category of fashion brands wasanalyzed by one-way ANOVA to examine the degree of digitalization. Clothing was divided into 7 categories of men's formal dress, women's formal dress, men's casual, women's casual, unisex, sports wear and others. The result is shown in <Table 8>, significant statistical differences are not found, however men's formal dress and unisex show a relatively higher digitalization level in the technological section. Unisex, sports wear, and men's and women's formal dresses have a higher level in the information section.

Unisex, and men's and women's formal dresses display a relatively higher digitalization in the business section. The general digitalization level including technology, information and business, decreases in the order of men's formal dress and unisex with a higher digitalization level. Though without statistical significant difference between clothing items, the study presents a demonstrative result that shows the present changes on the fashion industry digitalization considering the fact there are no domestic or foreign studies are found on the digitalization.

The reasons for the higher technology digital

ization of men's formal dress may be its easy standardization with little style variation and the advantages of automation with a quality certification system. The reasons for the higher information and business digitalization of unisex may be that information and strategies related to its product planning are important as items consist mostly of single units. Also it is easier to introduce e-business in unisex due to the clothing's feature.

Further studies are expected to follow investigating and analyzing the digitalization of clothing categories through a sample survey of a bigger size in the future.

VI. Conclusion

The digitalization of the fashion industry refers to 'the reception of the digital environment by the industry'. The paper presented 3 conceptual categories of 'technological environment', 'information environment' and 'business environment' concerning the scope of digitalization, including from the introduction and use of new technical media to new ways of thinking following the paradigm changes. By doing so, it suggested a conceptual frame to integrate digi-

talization ideas, which were dealt with in frag-
ments individually by researchers so far without
a scientifically established concept.

Next, it demonstratively analyzed digitaliza-
tion factors, and differences of digitalization lev-
el related to the factors by 7 fashion categories.
The analytic result and its suggestions are as
follows. First, five digitalization factors of the
fashion industry are defined : manufacturing
process automation, computer systemization, in-
formation networking, e-business, and small
batch production. Although they do not contain
all factors of the digitalization promoted by the
industry today, they have meanings being pres-
ented on the basis of interviews with fashion
businessmen and previous studies. As the result
of factor deduction concur with the 3 digital-
ization categories suggested in the study, it is
proved that the digitalization promoted by the
industry now is characterized by the technol-
ogical, information, business environments.

Second, the digitalization degree of fashion
firms decreases in the order of information net-
working, small batch production, manufacturing
process automation, computer systemization, and
e-business, with information networking on the
top and e-business, recent focal point of interest,
at the bottom. This shows that the industry
focuses mainly on the digitalization of informa-
tion networking, and business performance is
expected to improve much by the value and
reception of information networking among
other digitalization factors. The fact also corre-
sponds to the industry's tendency to shift to a
distribution-oriented industry.

The lowest level of e-business explains the
present vulnerable state of social infrastructure
related to e-business. The problem seems to a-
rise from the system's early stages, and requires
a technical solution in advance. Fashion busines-
ses need to improve the situation, since a great
deal of potential can be exploited with the
solution.

Third, Despite the lack of significant statisti-
cal difference among categories, as for the digi-
talization of each clothing category, men's for-

mal dress and unisex display the highest level
of the general digitalization.

So far the study defined and suggested the
digitalization concept of fashion industry in an
integrated dimension. Its significance may be
found in its demonstrative comparison of the
differences of digitalization degree by clothing
category based on 7 fashion categories. The
study, however, has its limit not covering
factors influencing the industry's digitalization
and its outcome. Further studies are expected to
be executed on the relation among research
units in the future.

References

An, Gwang-ho and Chae, Seo-il. 1993. A positive
    study on store selecting behavior using Mul-
    tinominal Logit model. Management study.
    22 (2): 101-120.
Bak, Hyo-sik and Kim, Gi-chan. 1994. A com-
    parative study of strategies of small/ medi-
    um-sized firms in Korean and Japanese :
    Focusing on the networking strategies a-
    mong companies. Management study. 23 (4):
    147-182.
Bel, Daniel. 1973. The Coming Post Industrial
    Society a Venture in Social Forecasting, N.
    Y. Basic Books.
Gates, William H. 1999. Speed of thinking.
    Seoul : Cheong-rim Publisher.
George, J. F., G. K. Easton and G. Northcraft
    1990. A Study of Collaborative Group Work
    With and Without Computer-Based Support,
    Information Systems Research, Vol.1: 394-
    415.
Kim, Ju-young, and Son, Young-seok. 1997. A
    study on directional changes of marketing
    resulting from the development of infor-
    mation technology. Marketing study. 12 (2).
    : 171-198.
Kim, Seong-jae (ed.). 1998. Aesthetics of media.
    Seoul: Nanam Publishing House.
Lee, Mi-ryang. 1999. A study on educational
    direction in fashion design according to the
    digital environment I.. Design science study.

12 (4): 33-45.

Lee, Soon-jong. 1999. Design for the future. *Design*. 248: 200-203.

Levy, Pierre. 2000. *Cyber culture : A report of European Parliament - New technology and cultural cooperation, and communication*. Seoul: Literary Publishing House.

Manning, Peter K., 1996. Information Technology in The Police Context: The 'Sailor' Phone, *Information Systems Research*, Vol. 7, No.1: 52-62.

Na, Byung-hyung. 1998. Present state and task of education informationization. *National Assembly's analytic data of pending prob*

lems. 167: 2-3.

National Computerization Agency. 1995. *National informationization white paper*.

United States Department of Commerce. 1998. *Digital is economy : Commerce Department's report for a new world's economy*. Seoul : Communications Books.

Weisband, Suzanne P., Sherry K. Schneider and Terry Connolly(1995), Computer-Mediated Communication and Social Information: Status Silence and Status Difference, *Academy of Management Journal*, Vol.38: 1124-1151.