ANALYSIS ON TRENDS OF ICT-BASED FASHION TECH BUSINESS MODELS

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ABSTRACT

ICT(Information and Communications Technologies) has been influencing on overall fashion industry which is considered as the representative field of emotional marketing. In particular, the fashion tech combining the ICT and fashion has been creating the visual effects and diversified in the entire fashion business processes beyond the developed of simple fashion device. Accordingly, this paper analyzed the trend of business models which have been implemented at present before the full-scale development of fashion tech. In accordance with the analysis results, this paper identified the expansion of integrated digital platform based on connectivity, intelligence and computerization in the physical aspects, activation of untact marketing related to individualization and unmanned operation in the social aspects, and pursuit of value consumption reflecting emotional bonding and spiritual bonding in the cultural aspects. The results will be used as the empirical data for the implementation of businesses related to fashion tech in the future. The continuing research and development on the ICT-based fashion tech will be the solution for the future fashion industry to cope with the rapidly changing preference and consumption patterns of the public.

Keywords: *Fashion Tech, Business Model, Digital Platform, Untact Marketing, Value Consumption*

1. INTRODUCTION

In the modern society, ICT has been used as the core technology in every aspect of life. Such technology convergence phenomenon has been the global issue as the fourth industrial revolution was mentioned in the Davos Forum(WEF; World Economic Forum) in Jan. 2016. WEF estimated that the 4th industrial revolution would have significant impact on the industrial structure and market economy model all over the world. The 4th industrial revolution became the term meaning the convergence phase of manufacturing and IT in 'Industry 4.0', one of 10 Projects of 'High-tech Strategy 2020' announced in Germany in 2010[1]. As all facts above indicated, it is expected that the convergence of manufacturing and IT will be more highlighted in the 4th industrial revolution era.

Fashion accounting for the significant part in the manufacturing industry has been combining technologies slowly as compared to other goods because of its special feature that it is directly applied to a human body and the recognition that it is one of representative emotional design industries while it is the basic element in a daily life and the most trendy consumer goods. However, starting with fashion accessories, the goods applying ICT has been rapidly developed and expanded to overall processes in the fashion industry in various ways without being limited to the development of goods simply reflecting advanced technologies. Nevertheless, it is difficult to identify the overall trend of fashion industry which progressively utilizes ICT because existing researches applying ICT to fashion mainly focused on wearable fashion. Accordingly, at this point, it is required to identify the current technologies in the fashion industry for deciding the approach to develop the technologies before full-scale application of fashion tech and to expand the ICT-based fashion tech business as the exclusive industry.

Thus, this paper aimed to analyze the trends of business models through the cases using the ICT-fashion tech in the fashion industry and then, provide the empirical data to fashion industry in Korea and abroad. The analysis results will be used as the basic data for effective fashion business and help to suggest the directions of new industries combining ICT and fashion in the future.

First, the ICT, fashion and the market status of fashion industry using ICT will be investigated. Next, the business model types will be identified around the fashion tech which is emerged as the main issue in the fashion industry. In accordance with the Korean Standard Industry Classification, the fashion industry is classified into the up-stream

which comprises the textile industry, middle-stream which comprises the apparel industry, and down-stream which comprises apparel and textile wholesale, retail and distribution industry. The fashion industry generally includes the apparel industry in the middle-stream and wholesale, retail and distribution industry in the down-stream. Thus, on the aspect of value chain, the fashion industry is classified into apparel design, manufacturing, distribution and other fields(including marketing and advertising)[2]. Accordingly, this paper divides and examines the ICT-based fashion tech business model cases into design, manufacturing, distribution and other fields in accordance with the fashion industry classification standards and analyzes the trend of fashion tech businesses in the physical, social and cultural aspects.

For collecting the cases to analyze, this paper selected 16 technologies except wearable device which has been actively investigated separately from other technologies in the fashion industry, among AI, IoT, big data, 5th generation mobile communication, cloud computing, AR(Augmented Reality)/VR(Virtual Reality), 4th industrial revolution, robot, wearable device, O2O(Online to Offline), 3D printing, mobile payment, mobile commerce, Giga internet, mobile App and applications and location-based service, the key words in ICT field announced by The Federation of Korea Information Industries from 2014 to 2018. Next, for the balanced collection of data in Korea and abroad, 8,000 articles, 500 articles per key word, were searched in Naver, one of representative search engines in Korea, for the period from Sep. 1 to Dec. 7, 2018, and the relevant cases were selected.

2.   GENERAL DELIBERATION

2.1   ICT and Fashion

Fashion has been advanced through the technologies from the past up to now. The combination of technology and fashion started with the invention of sewing machine in the 19th century was activated through the development of composite materials in the 20th century. In the 21st century, it has been developed into Intelligent Fashion, Smart Fashion and Ubiquitous Fashion(i-Fashion) as combining ICT. For Intelligent Fashion and Smart Fashion of them, the primary fashion goods directly perform ICT functions as the 'hardware convergence' field. Ubiquitous Fashion(i-Fashion) as the 'software convergence' applies ICT to the overall fashion business rather than the change of fashion goods itself [3].

As explained above, the application of ICT has been rapidly spreading to the entire fashion industry in these days. And the compound word 'Fashion Tech(Fashion+Technology)'[4] was created. Accordingly, this paper defines the fashion tech as the combination of ICT and fashion.

2.2   Market Status of Fashion Industry using ICT

The global fashion industry market reached 837 Billion USD in 2014 as showing the annual growth rate of 5.2% from 2010 to 2014. It is estimated that the annual average growth rate until 2019 will reach 1 Trillion 317.3 Billion USD with the average annual growth rate 6.3%[5](Table 1). Furthermore, it is expected that the fashion market using ICT will increased by 12.9% per year from 613.9 Million USD in 2006[6](Table 2). As described above, fashion has been showing the high growth rate in overall industries in the world. In particular, the fashion market using ICT has been rapidly expanding.

Table 1: The global fashion industry market (unit: million) (Source: "2016 Fashion Industry Competitiveness Survey")
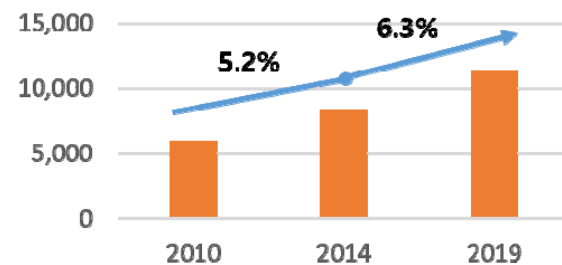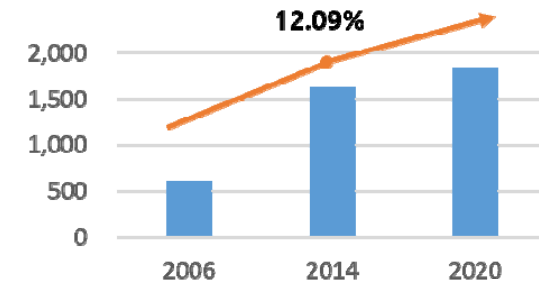

Table 2: The Fashion market using ICT (unit: million) (Source: "New Growth Strategy of Fashion Apparel Industry by Activation of Fashion Design and ICT Convergence")

3.   ICT-BASED FASHION TECH BUSINESS MODEL TYPES

This paper collected the common platform, system and service of fashion industry from the

articles selected for the analysis and reclassified the fashion technology business model cases in accordance with the fashion industry classification standards. In accordance with the reclassification, the business model types were identified as follows. First, the design category was classified into curation for purchase and styling of fashion goods and consulting related to the development of goods, in accordance with the retail and manufacturing business of fashion industry classified depending on the development of unique goods[7]. Next, the business model type in the manufacturing field was classified into mass-customization related to machinery and facilities and smart factory for efficiency of labor on the basis of the capital and labor related to ICT among 3 requisites for production. For the distribution part, the business model type was classified into the smart store for the growth of offline stores and omni-channel related to online distribution in accordance with the offline and online distribution, the representative distribution types. In other fields, the business model types were classified into digital marketing applying the advanced technology to the conventional marketing approach and live promotion, the real time commerce service approach of the new concept, on the basis of the marketing and advertising depending on the fashion industry classification as mentioned above.

3.1 Design

The fashion tech business generally comprises the fashion curation in the concept of personal shopper helping consumers for shopping mainly by providing information on trends and the fashion merchandising having the direct influence on the development of goods. The characteristics of both concepts are to analyze the big data comprising fashion images on internet and SNS using the algorithm based on the artificial intelligence and to use the data for planning fashion goods.

First, the fashion curation is to analyze fashion data source on internet and data based on the information entered by a user, fashion malls visited by a user and on the goods a user had look around and to recommend similar images or goods based on the analysis results. Furthermore, the fashion curation provides the virtual styling service by body measurements. The representative cases include Amazon, the e-commerce business in USA, Naver, the internet search engine in Korea, Stitch Fix, the fashion startup business in USA, and StyleShare in Korea. Amazon developed 'Echo Look' using the GAN(Generative adversarial network) in 2017,

which recommends the clothing suitable for a user using the camera which can scan 360 degrees to generate 3D images and machine learning technology. Naver has been operating the curation commerce service by independently developing the 'AiRS(AI Recommender System), the deep learning-based AI system recommending the goods similar to the fashion on SNS or streets and 'AiTEMS(Ai+items)', the personalized system recommending goods depending on each individual's interest and preference in 2017[8].

Stitch Fix, one of representative company operating the fashion curation system using AI in the fashion industry, has been providing the custom recommendation service by making a variety of fashion styles suitable for customers' preference and body type using AI since its first introduction of learning machine algorithm at the end of 2012(Figure 1). Furthermore, Stitch Fix has been progressively grafting ICT to fashion including opening of the concept store using 'Fashion AI' of Alibaba in Hong Kong in 2018[9]. StyleShare in Korea established in 2011 is cutting the most distinguished figure in the same industry. StyleShare combining SNS and fashion analyzes the fashion images using AI by sharing the fashion styles uploaded by about 3.5 million users. Moreover, StyleShare is called 'facebook in the fashion industry' in Korea as recommending goods suitable for styles and enabling to purchase goods through it[10].

Next, the fashion consulting applies AI to design processes for the public or provides on-demand service for individuals. The representative cases developing the design process using AI include Google, the Internet search engine in USA, and Tencent, the internet service specialist in China. Google developed the 'Data Dress', the app designing the clothing using the behavior data of a user in cooperation with 'Ivyrevel', the fashion brand affiliated to H&M, the fast fashion brand of Sweden, in 2017[11]. The 'Data Dress' is the custom AI design tool which collects data on a user in a daily life through a smart phone and creates the design suitable for the user.

Tencent analyzed 100 billion pictures posted on QQ Zone, the SNS, using the AI-based face identification and image processing technology. Furthermore, it found out the colors preferred by the Chinese customers in 20s, the main consumer group in the fashion industry, by combining the big data on clothing sold to 95-generation who was born between 1995 and 2000 in VIPSHOP, the e-commerce company. On the basis of the results above, Tencent presented the goods reflecting the

consumers' preference by hosting the 'The Present & The Future' during the New York Fashion Week in 2017 jointly with Chi Zhang, the fashion brand in China[12](Figure 2).

The on-demand service case is ZOZOTOWN of StartToday, Japan. ZOZOTOWN measures the body sizes of potential customers by sending the ZOZOSUIT to them only provided that the potential customers request since the first half of 2018[13](Figure 3). The size measurements are

used to identify the quantity of goods per size to manufacture and to enable consumers to search goods or to recommend goods to consumers. Using such a platform, the fashion industry could reduce the inventory risk and enhance the efficiency of planning using the big data on body sizes out of the conventional method which merchandisers decided the quantity of goods to manufacture and distribute on the basis of the sales data and their senses.
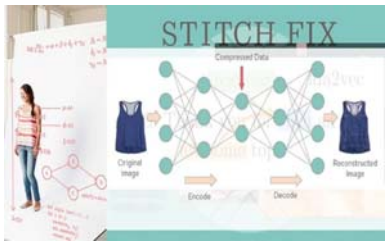

Figure 1. Stitch Fix, 2012
(http://smartaedi.tistory.com)

Figure 2. Tencent×Chi Zhang, 2017
(http://www.newspim.com)

Figure 3. ZOZOTOWN, 2018
(https://ochimusyadrive.com)

3.2 Manufacturing

ICT-based fashion business in manufacturing category is observed in the change from the small quantity batch production to 'mass-customization', the personalized custom system mainly using 3D printing, and the change to Smart Factory, the intelligent manufacturing plant system applying the digital computerization solution to the manufacturing process.

First, mass-customization is implemented mainly using 3D printing. The representative cases include Chanel, the luxury brand in France, Iris van Herpen, the designer in the Netherlands, and Adidas, the sports brand in Germany.

Chanel created and presented about 10 pieces of tweed jackets and skirts using 3D printing in the Haute Couture Collection during Paris Fashion Week in 2015(Figure 4). The jackets, the iconic item of Chanel representing the fashion of the 20th century, is meaningful on the aspect that it reinterprets the classic jacket style into the new version of the 21st century. The jacket created by 3D printing applied the technology 'SLS(Selective laser Sintering)' which piles up powder materials instead of liquid resin only on the selected parts using the laser[14].

Iris van Herpen presented the clothing using 3D printing in the Haute Couture Collection in Paris in 2010 for the first time and launched the grotesque and unconventional 3D printing clothing replicating a body skeleton in '2012 A/W Capriole Collection' in 2011. In the following year, he was listed on '50 Inventions of the Year' by the <Time>[15](Figure 5). Furthermore, Herpen produced the shoes

presented in '2013 A/W Wilderness embodied Collection' using the 'Objet Eden', the 3D printer from Stratasys, Ltd. leading the advanced 3D printing system in prototyping and manufacturing field, and the Objet Connex, the material based on PolyJet showing high resolution. In particular, the 3D printing is the innovation in the fashion industry because it takes only one week to create a new style while it generally takes about 1 month to create a new style using the conventional design process[16].

'Futurecraft 4D' launched by Adidas in 2017 was produced using the Digital Light Synthesis developed jointly with Carbon, the 3D printer venture firm in Silicon Valley, USA(Figure 6). Using the 'Futurecraft 4D' technology, Adidas completed the highly functional sports shoes by producing the midsole which plays the most important role in sports shoes using light and oxygen for the first time in the world. The sports shoes are characterized by eliminating the existing prototyping or molding and being produced through the digital manufacturing process by analyzing the running data accumulated for 17 years. The technology directly prints out the goods inside the synthetic resin using the digital light synthesis technology based on UV. It is evaluated as the technology to realize the on-demand service by advancing the lead time by about 25 to 100 times faster than the existing lead time[17].

Smart Factory has been realizing the digitalization of manufacturing process of clothing. The representative cases of Smart Factory include Li & Fung, the biggest clothing and consumer

goods supplier in the world, Adidas, Amazon, and Hansae Co., Ltd. in Korea, the global fashion company exporting clothing all over the world through OEM and ODM. Li & Fung completed the simulation on virtual samples and virtual fitting system using the Virtual Sampling technology in 2017 in the pursuit of B2B business, the platform recreating 'the supply chain of the future'[18].

Adidas built the 'Speed Factory' which is fully operated by robots in Atlanta, USA. For 'AM4NYC', the limited sports shoes meaning 'Adidas made for New York City' launched in Apr. 2018, it took only 10 days to produce while it generally takes 1 and half year from designing a new sports shoes by a designer to launching it in the market. It also brought the effective result in reducing the labor from 600 to 10 workers required for producing 500,000 sports shoes per year[19]. Furthermore, Smart Factory established in Ansbach, Germany at the end of 2015 is selected as the symbol of the 4th industrial revolution[20].

Amazon developed the platform which computerized the entire manufacturing process after acquiring the patent on the on-demand apparel manufacturing in 2017. Moreover, Amazon applied for the patent on the robot tailor marking the cutting line on the textile using fluorescent ink in consideration of the physical features of individuals in 2018[21].

Hansae implemented 'HAMS (HANSAE Advanced Management System)' as a part of Smart Factory to enhance the efficiency of manufacturing in 2018. HAMS can manage and supervise the entire manufacturing data in about 30 factories in the world using the PDA. This Smart Factory accurately counts the production of goods, reduces the ratio of defective goods and improves the manufacturing efficiency as the computerized spreader and computerized cutting table(CAM), and digital counter cut the textile instead of human workers[22].

Figure 4. Chanel, 2015 Fall Collection (https://www.racked.com)

Figure 5. Iris van Herpen, 2012 A/W Capriole Collection (http://www.future00.com)

Figure 6. Adidas, Futurecraft 4D (https://sneakernews.com)

3.3 Distribution

ICT-based fashion technology is observed in two types; Smart Store applying the concept of IoT and AR/VR technology, experiential store and unmanned store; Omni-Channel meaning online for offline and offline for online.

First, Smart Store is classified into the two types, one based on the concept using AR/VR technology with the focus on the digital signage technology analyzing the information of customers and recommending clothing and the other based on the concept changing the paradigm of stores. The representative cases using the digital signage are MemoMi Labs, the startup in USA, and Amazon. Amazon presented the 'Smart Mirror' creating a model for a customer and displaying virtual scenes on the screen using the special mirror reflecting and passing light through it and the display camera project by acquiring the patent on the reproduction of the virtual image of a customer putting on the clothing in 2018[23]. MemoMi Labs and Intel

enabled customers to check their appearance put on the fashion items on the mirror by jointly developing the 'Memory Mirror' applying the MR(Mixed Reality) technology in 2015[24] (Figure 7).

Smart Store features the application of AR/VR technology. The representative cases include Zara, LF Co., Ltd. which is one of leading fashion companies in Korea, and eBay, the online auction and shopping mall. Zara enabled the customers to experience the contents in the designated AR spots in about 130 stores after downloading 'Zara AR' application on their smartphone in 2018[25]. LF provided the virtual fitting service in the experience booth for the virtual fitting demonstration using the 'CLO', the 3D fitting solution, in early Dec. 2018. Moreover, LF developed the solution with which customers select the options in the virtual space and request custom made for the clothing they select[26]. Meanwhile, "eBay has been operating the virtual reality department store in cooperation

with Myer, the retailer in Australia, for the first time in the world, since 2016. With the 'eBay Site Search', consumers can look around 12,500 goods of Myer and get access to prices and information of goods in real time."[27]

The examples of Smart Store changing the paradigm of stores are experiential stores and unmanned stores. The representative case of experiential stores is Adidas Gangnam Brand Center opened in Korea in 2017(Figure 8). As the digital store enhancing the online and offline experience activities, this store provides a variety of experience activities and convenient shopping environment including the 'Sports Activity Experience Space' where consumers put on soccer shoes and play the interactive game[28].

The case for the unmanned store is Amazon(Figure 9). Amazon introduced the 'Amazon Go', the unmanned store without cashiers, as the pilot store, in 2016 and officially opened it in Seattle in Jan. 2018. 'Amazon Go' uses the automatic payment system using the 'Just walk out' technology. When consumers do shopping and just walk out of the 'Amazon Go' store, the payment is automatically completed[29].

Next, Omni-Channel, the system rapidly distributed for mutual growth of online and offline stores, has been gradually expanding to O4O(Online for Offline) service beyond the O2O

service. The example of O2O service is Gucci, the luxury brand of Italy. Gucci has been operating the 'F90 Project' service in 10 cities including London since 2017, which delivers the latest 'Ready to Ware' goods to consumers within 90 minutes through Gucci boutiques when consumers purchase those goods through mobile commerce[30].

In Korea, the system directly visiting consumers and receiving the orders from them for enhancing the O2O strategy is becoming popular. The representative case is LFmall, the official online shopping mall of LF. LFmall has been operating the 'e-tailor service', the moving store concept system which a professional tailor visits the customers who request the service and receives the orders from them, since 2017[31]. The service aims to strengthen the O2O strategy and activate the exclusive online PB(Private Brand) and LFmall.

The case of O4O service is Hyungjimall operated by Fashion Group Hyungji, the fashion company in Korea. Hyungjimall implements the O2O service and 'Store Bidding Priority System' for win-win operation with their agencies and use those services as the O4O platform. The 'Store Bidding Priority System' is the service system helping the sales in the offline stores by enabling their agencies to bid for goods which consumers purchase online within 2 hours from the time of purchase[32].

Figure 7. MemoMi Labs, Memory Mirror, 2015 (https://www.engadget.com)

Figure 8. Adidas, Gangnam Brand Center, 2017 (http://www.fi.co.kr/)

Figure 9. Amazon, Amazon Go, 2018 (http://www.habernediyor.com)

3.4 Other Fields

Other fields are classified into two concepts; the digital marketing as the integrated network marketing interconnecting enterprises and customers without the limit of time and space; and the live promotion enabling bidirectional communication between customers and users using a wide range of contents.

First, the fashion marketing applying the fashion tech is characterized by the change into the digital marketing by introducing mainly the RFID (Radio Frequency Identification) system. RFID system is the technology identifying objects or persons using RF(Radio Frequency)[33]. It is used as "the

technology reading the data stored in the tag through the reader using the radio frequency wireless technology"[34] in fashion industry. As the representative company introducing RFID technology, Zara completed the optimum inventory management solution in 2014. In other words, the lead time was reduced to less than 5 weeks by the analysis on big data through internal data standardization and external data integration[35]. The reduced lead time induced the small quantity batch production and timely sales. Accordingly, the sales and consumers' preference can be estimated and finally sales has been maximized.

Furthermore, the digital marketing is expanding its scope even to the marketing using AR/VR. At present, the overall industries including fashion have been quickly advancing to V-commerce, the video commerce age, after e-commerce along with the gradual increase of streaming shoppers. Thus, the main issue in every industry field is to develop the video contents using mobile video. V-commerce is mainly implemented by production of exclusive online video on SNS or YouTube or AR fashion shows. The representative cases are Moncler, the exclusive alpine fashion brand in France, and LF Co., Ltd. Moncler presented the multimedia fashion show very similar to media art by applying the digital technology during the Fashion Week in Italy in Sep. 2018[36] (Figure 10). In the fashion show, Moncler became the hot issue by presenting the video produced to fit to clothing instead of models. LF strengthened the digital marketing and contributed to generalize the internet cast method by implementing the 'LF TV', the platform based on the internet network providing a variety of video contents in 2018[37].

The basis of industry emphasizing the realism as described above was developed to the live promotion and has been expanded to the commerce platform of new concept linking information of goods, contents and sales. The representative fashion enterprises deploying the live service include Burberry, the luxury brand in UK, and SHOPSHOPS, the global commerce network in USA. Burberry World Store, the online store operated by Burberry, has been implementing the 'World Live' service since 2012(Figure 11). 'World Live' has been broadcasting the fashion shows in real time through the supersized digital screen and hundreds of speakers in its major stores in the world with the flagship store on the Regent Street, London as the starting point[38]. SHOPSHOPS operates the 'mobile video commerce platform' for export to China and sells goods to consumers in China through the live broadcasting[39].

Meanwhile, the live promotion has been expanded to the Chatbot using AI, voice guide, ordering and payment system. The representative enterprises using Chatbot include LVMH(Louis Vuitton Moët Hennessy), the luxury fashion group in France, and Lotte Department Store, the distributor in Korea. LVMH uses the website and iOS App through the collaboration with Le Bon Marché, the department store in France(Figure 12). LVMH provides once to one video customer service for a personal shopper for the first time in the industry. Moreover, LVMH launched the '24 Sevres', the new e-commerce platform operating customer chatting service on facebook and messenger and Stylebot[40]. Lotte Department Store also launched the AI chatbot 'LOSA(Lotte Shopping Advisor)' in 2017. LOSA recommends the goods by data analysis using the AI deep learning recommendation engine[41]. The chatbot service analyzes the features of customers through voice conversation and chatting using the mobile units and provides a variety of shopping guides including the information on goods using the image recognition function.

The case using real-time SMS and voice service is O Shopping of CJ ENM, the internet commerce enterprise in Korea. CJ O Shopping started the AI voice ordering and payment service in 2018 using 'NUGU', the AI technology of SK Telecom, the leading mobile communication service provider in Korea. With the service, consumers can order and pay goods during the live broadcast only using AI voice recognition. When the customer information of home shopping company is connected to the NUGU App, the relevant customers can order goods during the live broadcast[42].

Figure 10. Moncler,
2019 S/S GENIUS Collection
(https://www.designscene.net)

Figure 11. BURBERRY,
World Store, 2012
(http://luxury.designhouse.co.kr)
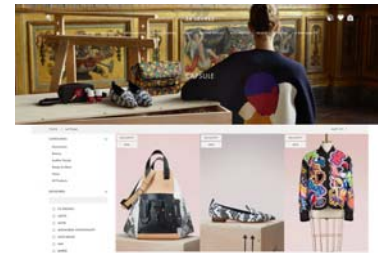
Figure 12. LVMH(Louis Vuitton Moët
Hennessy), 24 Sevres, 2017
(https://windermerepremier.wordpress.com)

As facing the 4th industrial revolution age, the modern fashion industry has been reorganized into the fashion tech business model on the basis of ICT under the influence of technology in the entire

process from planning and design to manufacturing and distribution along with the development of ICT. Such business model types were classified into the fashion curation and consulting in the design field, mass-customization and Smart Factory in the manufacturing field, Smart Store and omni-channel in the distribution field and the digital marketing and live promotion in other fields. The representative cases per type are presented in the Table 3 below.

Table 3: ICT-based Fashion Tech Business Model Types

Field	Type	Description	Cases
Design	Fashion Curation	Recommending goods using big data and AI algorithm	Alibaba(China), Aliblotteaba(China), Alina(Korea), Awear Solutions(Israel), brich(Korea), Choosy(USA), Colorful Board(Japan), Eison Triple Thread(USA), Forever 21(USA), Google(USA), GU(Japan), Heuritech(France), kakao(Korea), KT(Korea), Lotteimall(Korea), Naver(Korea), Omnius(Korea), Pashaly(Japan), Rent the Runway(USA), Samsung C&T Corporation_SSF SHOP(Korea), Shinsegae co.,Ltd(Korea), SHINSEGAE Mall(Korea), SK planet_11st(Korea), Stitch Fix(USA), StyleShare(Korea), SURPRISE(Korea), Thread(UK), VUE.ai(Korea), WishLink(Korea), ZIGZAG(Korea)
		Virtual styling service using body measurement by AI machine learning	Amazon(USA), eBay(USA), FnC Kolon Corp._LUCKY CHOUETTE(Korea), INTERPARK(Korea)
	Fashion Consulting	Design process platform applying AI	Falguni&Shane Peacock(India), Google(USA), Marchesa(USA), Tencent×Chi Zhang(China), Tommy Hilfiger(USA)
		On-demand service using big data, AI and 3D scanning	Lotte Shopping Co.,Ltd.(Korea), Lotteimall(Korea), Janne Kyttanen(Finland), Kumkang Co., Ltd.(Korea), Tandy(Korea), THB GLOBAL(Korea), ZARA(Spain), ZOZOTOWN(Japan)
Manufacturing	Mass-customization	Mass custom production system using 3D printing	Adidas(Germany), Ariel Swedroe(USA), Balenciaga(France), breezm(Korea), Chanel(France), Continuum Fashion(USA), Danit Peleg(Israel), Feetz(USA), HSL_Bijouets&Exnovo(Itary), Iris Van Herpen(Netherlands), Janne Kyttanen(Netherlands), Julia Daviy(USA), Julian Hakes(UK), kipLing(USA), K2(Korea), maioun(Korea), MARIMARI(Korea), Melinda Looi(Malaysia), Michaella Janse van Vuuren(Republic of South Africa), Michael Schmidt and Francis Bitonti(USA), Nervous System(USA), New Balance(USA), NIKE(USA), Prototech(Korea), Reebok(USA), Shapeways(USA), Victoria's Secret(USA), Yuima Nakazato&Sun Junjie(Japan)**,** 3D SYSTEMS(USA)
	Smart Factory	Unmanned and computerized system using IoT	Adidas(Germany), Amazon(USA), Hansae Co., Ltd.(Korea), Levi's(USA), Pan-Pacific Co., Ltd.(Korea), SEKANSKEEN_Knititude(Korea), UNIQLO(Japan)
Distribution	Smart store	Indoor digital signage & relevant service using AR/VR	Alibaba(China), Amazon(USA), FnC Kolon Corp.,(Korea), Hansae Co., Ltd._Hansaedreams(Korea), MANGO(Spain), MEH_The Ridge 354(Korea), MemoMi Labs(USA), Nepa(Korea), Samsonite(USA), Samsung C&T Corporation_BEAN POLE(Korea)
		Experiential stores using AR/VR and unmanned store platform based on AI sensors and cameras	Adidas(Germany), Adidas(Germany-Korea), Amazon(USA), Amazon_Japan(Japan), eBay(USA), E.LAND WORLD_SPAO(Korea), GU(Japan), GUCCI(Italy), Hyundai Department Store Co., Ltd.(Korea), HYUNDAI HOME SHOPPING NETWORK CORPORATION(Korea), J.ESTINA(Korea), JD.COM(China), JMjean(Korea), LAB101(Korea), LF Corp.(Korea), Lotteimall(Korea), lululemon(Canada), Macy's(USA), Paragon(Singapore), Shinsegae co.,Ltd(Korea), SK stoa Co., Ltd.(Korea), TOPSHOP(UK), UNDER ARMOUR(U.S.A-Korea), UNIQLO(Japan), ZARA(Spain)
	Omni-Channel	Offline O2O service for online	Alibaba_taobao(China), BABA FASHON(Korea), BELLADONO(Korea), E ·LAND RETAIL_Elandmall(Korea), FnC Kolon Corp._KOLON MALL(Korea), GUCCI(Italy), Handsome Corporation_THEHANDSOME.COM(Korea), LF Corp._LFmall(Korea), LOUIS VUITTON(France), MANSOLE(Korea), Net-A-Porter(UK), Samsung C&T Corporation_ROGATIS(Korea), Samsung C&T Corporation_SSF SHOP(Korea), SEJUNG Corporation(Korea), Shin Won Corporation_SHINWONMALL(Korea), SISUN INTERNATIONAL_INTERVIEW STORE(Korea), SK planet_11st(Korea), SUNGJOO GROUP_MCM(Korea)
		Online O4O service for	ABC-MART(Japan), Farfetch(UK), FASHION GROUP HYUNGJI_HYUNJIMALL(Korea),

		offline	KASHIYAMA the Smart Tailor(Japan)
Other Fields	Digital Marketing	Goods planning and inventory management platform using RFID system	Amazon(USA), BURBERRY(UK), Decathlon(France), E.LAND WORLD_SPAO(Korea), Entrupy(USA), GERRY WEBER International AG(Germany), H&M(Sweden), JD.COM(China), Levi's(USA), Lotteimall(Korea), SHINSUNGTONGSANG.CO.,LTD.(Korea), Rakuten(Japan), Shopify(Canada), Sport Zone(Portugal), UNIQLO(Japan), ZARA(Spain)
		V-commerce platform using AR/VR	CJ ENM O shopping (Korea), E.LAND WORLD_SPAO(Korea), Hyejin Hong_ The studio K(Korea), LF Corp.(Korea), Moncler(France), Nepa(Korea), Samsung C&T Corporation(Korea), Shinsegae International_S.I.VILLAGE(Korea), Shinsegae International_VOV(Korea)
	Live Promotion	Live streaming service platform using AR/VR	BURBERRY_World Flagship Store(UK), LF Corp.(Korea), Lotteimall(Korea), TMON INC.,(Korea)
		Chatbot and voice service using AI algorithm	CJ ENM O shopping (Korea), Huimai_ UGO SHOP(China), Hyundai Department Store Co., Ltd.(Korea), HYUNDAI HOME SHOPPING NETWORK CORPORATION(Korea), INTERPARK(Korea), Irvine Company_Fashion Island(USA), K-SHOPPING(Korea), Lotteimall(Korea), Lotte Shopping Co.,Ltd.(Korea), LVMH(Louis Vuitton Moët Hennessy), Naver(Korea), Shinsegae Group(Korea), SHOPSHOPS(USA), SK planet_11st(Korea)

4. ICT-BASED FASHION TECH BUSINESS MODEL TREND

On the basis of the analysis results on the fashion technology business model cases above, the tendency that ICT was used in the fashion industry was analyzed physical, social and cultural aspects which were directly related to this paper among the macro environment analysis approaches[43]. First, the physical aspect means the technological change occurring in the fashion industry as being included in the technological element in the macro environment analysis. Next, the social aspect means the social phenomenon of a variety of components related to the fashion technology business. Finally, the cultural aspect means the material and mental value of an individual or a group related to consumers.

4.1 Physical Aspects

The physical aspects of fashion tech can be characterized by the integrated digital platform. Since the modern society stepped into the hyper-connected society and the internet and communication technology have been developed, everything including persons, objects, data or processes are interconnected one another. Such social feature influences on the general industries and the boundary between industries has been fading away. The application of advanced technology in the fashion field is recognized as the mandatory process to cope with the current of the times. As we understood the declaration that the 4th industrial revolution "made the society more intelligent by connecting everything"[44] in the Davos Forum in 2016 with respect to that

phenomenon, the fashion tech business model is observed as interconnection, intelligence and computerization.

The interconnection is caused by the connection in various fields including connection between systems and online and offline connection on the basis of the network in the hyper-connected society. Such a phenomenon can be explained by the digital marketing in the fashion industry. The fashion industry has been interconnected along the entire stream of fashion industry from digital design using big data and AI, manufacturing in Smart Factory based on custom sampling and computerized system using 3D printing to the distribution using AR/VR in accordance with the development of integrated digital platform.

The example of intelligence is fashion curation and consulting, which is related to the development of AI algorithm using big data. It's the feature of the 4th industrial revolution that technology and industrial structure becomes the hyper-intelligent through the interaction and convergence between AI and big data which are selected as major change agents of the 4th industrial revolution[45]. The fashion industry is to commercialize goods by reflecting the preference and taste of the public. Thus, with the rapid change of trends and diversified emotion of consumers, MDs had lots of difficulties in planning goods only through their intuition. However, the fashion industry could have been successfully improving the accuracy rate in estimating the demand of goods and prices in the curation and consulting process, increasing the sales and reducing the inventory rate by analyzing the big data based on the activities in SNS or other

medium and RFID systems and identifying the consumption patterns of consumers.

The computerization is related to the change of eco-system in the manufacturing industry, mass-customization and Smart Factory. The consumers in the modern society want the goods which differentiate them from others as well as reasonable price. To satisfy such desire, the demand has been moving to the customized goods beyond the small quantity batch production, the existing manufacturing approach. Accordingly, the enterprises have been introducing the computerization system to adjust the unit price of manufacturing and sales price and implementing the Smart Factory. Such movement induces the computerization on the manufacturing sites. Moreover, on the basis of the computerization, the enterprises including Amazon or Adidas have been expanding the mass-customization system, smoothly managing inventories and increasing high productivity as pursuing the on-demand business.

4.2 Social Aspects

The social aspect of fashion tech is represented by the untact marketing. As examined in the social aspects, the hyper-connected society where everything is interconnected one another presents us the convenience for living, but the public has been gradually complaining the feeling of fatigue including the generation of new coinage 'Nomophobia(No mobile-phone phobia)' due to the excessive connection[46]. It generates the phenomenon which people prefer untact service as being reluctant to meet others and try to avoid the relationship with others except the essential relations. For fashion style, people also show the trend preferring the style enhancing their individualities rather than following one trend due to the viewpoints of others. Such phenomenon are reflected on the individualization and unmanned service in the fashion tech business models.

The individualization is related to the omni-channel, fashion curation, fashion consulting, live promotion and mass-customization. The social phenomenon which people are reluctant to directly contact others induces the preference on anonymity meaning separation from a society and makes omni-channel service including O2O and O4O common. Furthermore, what is emerging as the important issue in the fashion industry is to analyze the the styles demanded by individuals on the basis of AI and propose the independent design for each individual in the goods style as well as in the marketing aspects. In addition, it is estimated that the enterprises will start the custom manufacturing

revolution to satisfy the customization desire of consumers, that is, 'one style per person', in the future[47]. Such trend of the times can be verified through the high popularity of Stitch Fix. Wall Street Journal evaluated Stitch Fix as the subscription-model success as focusing on the emergence of Stitch Fix increasing the sales by 29% over the same quarter in the previous year as achieving 316.7 million USD of sales in the third quarter in 2018 in the article titled "Is Stitch Fix the Netflix of Fashion?" dated on Jun. 7, 2018[48].

Meanwhile, the individualization of fashion tech can be explained by mass-customization for producing chatbot or voice service and goods used in the consulting to purchase goods. The fashion industry is concentrating on the application of system to the individualization trend now. The main issue in each industrial field in the modern society is the 'one-person consumption' according to the increase of one-person household. The major features of one-person household includes increase of custom service needs, usage of digital device for convenience and efficiency, and increasing consumption of digital contents through social media[49]. All those features are related to individualization. Along with such social trend, the fashion business model has been also rapidly reorganized.

Next, the unmanned service is related to Smart Store, omni-channel and live promotion. The consumer who are accustomed to digital device collect and share information using their mobile devices and prefer to get information by themselves using the systems in the stores including digital signage rather than direct contact with the workers in the stores. Accordingly, as reflecting such trend, the fashion tech business model has been reorganizing the payment system for consumers not to contact the workers in the stores anymore including voice payment service and gradually increasing unmanned service even in offline stores using cameras, integrated sensors and RFID system. Moreover, the fashion tech business model enables consumers to get the information they want to get in real time using chatbot replacing real persons.

4.3 Cultural Aspects

The cultural aspects of the fashion tech are related to the contents-oriented value consumption. In the modern society enriched in material aspects, consumers emphasize the emotion including experience and participation when purchasing goods rather than goods itself. In other words, consumers have the features of Smart Shopper who pursue the value consumption as concentrating on

consumption behavior itself and pursuing the cultural and industrial elements in enormous amount of information. In such a rapidly changing social environment, it is required for the fashion industry to change its way of thinking from conventional way of thinking focusing on goods to the way of thinking focusing on customer job depending on what customers want and need, that is, digital transformation, in order to quickly cope with the change. In particular, the millennial generation(born between 1980 and 2004) called 'Me Generation' and Z generation(born between 1995 and 2004) classified into the 'new human'[50] are rapidly emerging as the trend setter and leading such change. They define the value scale standards by themselves out of the conventional practices and emphasize the feeling and experience through experience. In addition, they prefer insincere taste and trust the information from reliable persons rather than unconditionally accept the information they search[51]. Thus, the industries have been implementing the influencer marketing and providing a wide range of cultural contents to get those generations. In this process, the fashion business model is gradually demonstrating the spiritualization as the opposite concept against materialization and emotionalization.

Emotionalization is related to Smart Store, digital marketing and live promotion. Klaus Schwab pointed out that the AR/VR/MR was the most innovative technology in the 4th industrial revolution in his book 『Fourth Industrial Revolution THE NEXT』. He also insisted that the border between human intuitions and ability would fade away, the way to commune with internet and digital environment would be changed and the meaning of experience should be looked back on due to AR/VR/MR[52]. Like his insistence, the services in the stores including AR/VR and V-commerce enable consumers to experience the brands without actually putting clothing on and make consumers accept the goods not as a simple goods but as a kind of culture by making consumers to experience the emotional aspects promoted by the brands. In other words, the enterprises focus on the development of contents which may stimulate the emotion of consumers rather than their material satisfaction.

Spiritualization is related to Smart Store, digital marketing and live promotion. The consumers have been recently recognizing shopping as the entertainment and cultural consumption[53]. In other words, the consumers in the modern times emphasizing the spiritual satisfaction out of the way

of thinking focusing on materials in the past show the tendency pursuing the spiritual value accompanying emotion and excitement as purchasing goods. Then, the fashion industry has been attracting the interest of millennial generation and Z generation emerging as the key consumers by introducing the concept 'Shopping + Entertainment' as arranging a variety of video and promotion materials adding entertainment elements to shopping online and offline.

5. CONCLUSION

In these days when the fourth industrial revolution is the global issue, the industries are not led by a specific technology but it is emphasized that each field in a society should be innovatively changed by converging a wide range of advanced technologies. Accordingly, each industry makes more account of convergence thinking now than any other times and attempts convergence among elements. The fashion industry also demonstrates the expandability through the systematic integration among elements as the border between fashion fields, between consumers, sellers and manufacturers, and between technology and fashion is becoming ambiguous.

In other words, the fashion industry has been expanding its business fields by combining a variety of elements in accordance with the trend above and in particular, the phenomenon applying the advanced technologies beyond the emotional handicraft industry is being accelerating. ICT also needs the convergence with fashion to expand its field from industry design to general living sphere and so a variety of technologies has been developed for the fashion industry. In accordance with the analysis on the trend of business model reflecting the fashion tech, that is, ICT-based fashion, this paper identified the conclusions as follows. First, the integrated digital platform based on interconnection, intelligence and computerization in the physical aspects has been expanded. Next, the untact marketing related to individualization and unmanned service in the social aspects has been activated. At last, the value consumption reflecting emotionalization and spiritualization in the cultural aspects has been pursued.

Fashion, one of the fields dealing with human emotion, tended to be closed as being recognized as the industry to which consumers' reaction can't be easily estimated. However, as discussed above, ICT is applied to the fashion in accordance with the changing demand of the times and the roles and functions of each fashion field are mixed and

restructured to one platform. Accordingly, the business model has been reorganized. Thus, at this point when the fashion industry has been integrated into the technology field out of its exclusive field, this paper deliberating the fashion tech reflected on the process in the fashion industry will help to set the directions of fashion tech business model in the future. Furthermore, the progressive convergence of ICT and fashion based on more professional and segmented researches will be the new driving force for expanding the border of fashion industry as well as coping with the quickly changing consumption patterns.

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