Fashion 4.0 – Digital Innovation in the Fashion Industry

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Abstract. Triggered by digital transformation, it is very likely that the clothing industry will undergo profound changes over the next few years. Smart Clothes, i. e. clothing characterized not only by its traditional protective and representational functions, but also by technological and digital features, have evolved as a promising opportunity for one of the world's largest economic sectors – the fashion industry. Since the rise of wearables (e.g. smart watches and glasses), intelligent apparel has recently appeared on the market, but has not yet received adequate attention in the literature. Biometric body analysis in sports and health care, assistance systems for sensory organs and muscular activities, as well as useful digital services through interactions with intelligent items as part of the Internet of Things (IoT) environment, are just some of the product concepts and use cases. From a business perspective, these developments make it necessary to reconsider product development approaches, business models and collaborations. In order to be able to assess respective challenges and opportunities of Smart Clothes, this article illustrates and classifies various developments regarding potential digital technology applications and product concepts in fashion. Subsequently, this article offers implications for product innovation and new business models.

Keywords. digital innovation management · smart clothes · business model innovation · digital transformation

1. Introduction

"If we believe that our future is going to be defined by these hard pieces of glass or plastic that sit in our back pockets, you're crazy, [...] It is going to convert into apparel."

–

Kevin Plank, CEO Under Armour (Saulles, 2016)

Digital assistants like *Alexa* or *Google Home* tell us about the weather and control the blinds. Our refrigerator can order milk from a food supplier and when we leave our workplace, the smart home heating system starts to prepare a pleasant temperature in our apartment. What sounded like science fiction a few years ago has already been realized technically today. The Internet of Things, an infrastructure of (everyday) devices that can connect and interact with each other (Wortmann & Flüchter, 2015), penetrates more and more areas of our life. These intelligent devices are usually connected to the Internet and autonomously collect, evaluate, and send data to react to certain situations. According to the European Commission, the "Internet of Things (IoT) represents the next step towards the digitisation of our society and economy, where objects and people are interconnected through communication networks and report about their status and/or the surrounding environment"(Rohen, 2013). This paper follows the definition that "the Internet of Things enables objects sharing information with other objects/members in the network, recognizing events and changes […] to react autonomously in an appropriate manner. The IoT therefore builds on communication between things (machines, buildings, cars, animals, etc.) that leads to action and value creation" (Aguzzi et al., 2014).

Computational or sensory electronic devices worn on the body, so-called wearables (Fernandez, 2014), such as the *Apple Watch* or the *Fitbit*, are already part of our daily routine. However, the acceptance of such wearables is usually limited to accessories such as watches and fitness trackers, whereas apparel worn on the body, such as pants and shirts, are not necessarily associated with innovative and digital characteristics. Of course, there have been many innovations in the fashion industry in terms of production processes, scale, design, material and distribution. However, disruptive digital and technological changes to the garment itself are rarely observed.

Smaller and more powerful devices, as well as digital technologies and service-oriented product concepts, however, indicate a change that could fundamentally affect our everyday life – an entire and permanent analysis, connectivity and support of our body by intelligent clothing: Smart Clothes. This term refers to garments with technical and digital features in addition to original protective and self-presentation functions (McCann & Bryson, 2009).

To address challenges and opportunities caused by technological and digital innovation in one of the world's largest manufacturing industries – the fashion industry – this article provides a comprehensive overview of respective developments and product concepts within the field of Smart Clothes. Subsequently, implications towards product development and new business models are explored and described. The article is primarily aimed at practitioners responsible for strategy, business development and digital innovation. It might also be a useful introduction for researchers and students who are interested in this field. The article does not deal with smart production possibilities, such as IIoT, industry 4.0, or 3D printing (as an introduction, see Kiel,

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Arnold, and Voigt (2017)). Also, this article does not address the possibilities of digital marketing and distribution channels, including omnichannel or social media (for further information, see e.g. Wagner (2017) and Wagner, Baccarella, and Voigt (2017)). Rather, this article addresses the potential of intelligent fashion products itself. To this end, the article first illustrates examples to indicate the current and future direction of concepts and developments. Afterwards, the challenges for business models are described and general recommendations to face the digitalization in the fashion industry are presented.

2. Wearables and Smart Clothes

2.1. Terminology and classification

In line with the high penetration rate of smartphones, we are experiencing a fascinating new trend in the wearables market: Early technology adopters are showing a growing interest in a mobile ecosystem of devices designed to improve the quality of our life by providing services that a single device cannot achieve on its own (Rogers, 2010).

These devices are called wearables and include intelligent watches, wristbands, glasses, shoes, clothing, hearing aids, implants and helmets, i. e. electrical devices worn on the body. Wearables can capture, communicate with, and respond to a wide range of data from the body and the environment, and can thus be assigned to the Internet of Things (IoT) (Hiremath, Geng, & Kunal, 2014). This article deals with intelligent apparel, the so-called "Smart Clothes", as part of the main group wearables (see Figure 1). This paper will interchangeably use the terms garments, apparel, and clothes for any piece of clothing that people wear to cover their bodies (Marriam-Webster, 2018).

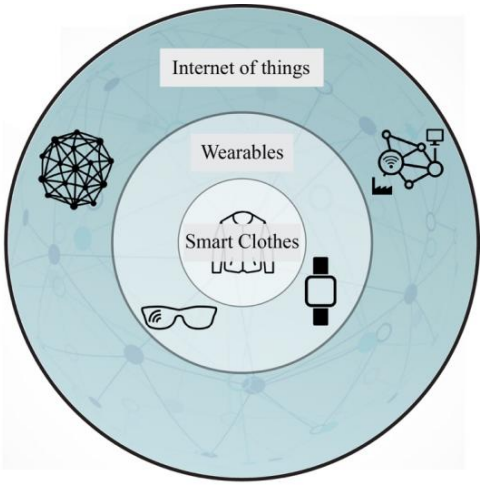

Figure 1. Term classification (own illustration)

2.2. Development

As early as the 1970s, Steve Mann from the Massachusetts Institute of Technology (MIT) studied intelligent clothing and its potential. However, technical difficulties initially slowed down his efforts (Vargas, 2009). Research interest in the field of Smart Clothes has then been continuously growing with the advent of the Internet and technological advances in the beginning of the new century.

Following improvements in the area of smaller, cheaper and more powerful sensors, innovative pioneers of the fashion industry, such as *adidas*, *Nike* or *Ralph Laurent*, as well as new actors to this industry, such as *Google*, are now introducing product concepts, equipped with technical components and digital attributes. Clothing items are endowed with technical hardware and digital characteristics, providing the customer with new services and advantages, whilst at the same time challenging current business models in the fashion market.

3. Smart Clothes – Use cases

Innovative companies are recently presenting a promising outlook on the future developments within the context of Smart Clothes. There are three main areas of application: (1) Sports and health, (2) environmental monitoring, organ of perception and exoskeleton, as well as (3) communication and interaction.

3.1. Sports and health

Manufacturers of sportswear have already recognized that new products and business models comprising the analysis of biometric data in sports may have great potential. Particularly in professional sports activities, most injuries can be attributed to a lack of muscle warming or overuse. Accurate measurement of body activity during a workout allows not only recognizing and reacting to threats during exercises at an early stage, but can also indicate data-driven training methods. Since professional athletes are among the most well-paid professionals in the world, their injuries can cause considerable costs, arising from treatment and rehabilitation, as well as from missing ticket and merchandising revenues. These prospects have prompted sporting goods manufacturers to invest in intelligent sports apparel, which enables real-time monitoring of body and muscle activity to provide optimal control and customization of athletes' training. New materials and sensor technology, integrated into the material of garments and sensors covering large parts of the body's respective areas, now enable a more accurate measurement of the body's data such as heart rate, lung activity, muscle activity, skin's galvanic conductivity, blood pressure, body position or acceleration (Borges et al., 2008).

Fitness trackers can be seen as the first successful commonly accepted realization of wearables in sports. Products by *Garmin*, the *Apple Watch* or the *Fitbit*, pushed the trend towards tracking sports performance for a large part of the population. However, the wrist is not necessarily the most effective and inconspicuous location of sensors and storage units.

It was the lifestyle fashion brand *Ralph Laurent*, who were among the first to launch a sophisticated smart shirt in 2014 – the *Polo Tech*[2]. The tight-fitting training shirt has silver fibers woven directly into the material and a small sensor-filled black box that measures biometric values such as steps, heart rate, respiration and energy level. This product was developed in cooperation with the company *OMsignal*[3], which now itself provides Smart Clothes and connects them via its own platform. Start-ups such as *Athos*[4] and *dorsaVi*[5] followed, developing sports outerwear and underwear. *Sensoria*[6] develops socks and shirts equipped with sensors which, in conjunction with a virtual coach on the smartphone, create running analyses and training recommendations for athletes. With a small sensor that can be attached to any pair of pants, *Lumo*[7] introduced a convenient way to use sport pants in a new way. Among other things, this sensor measures acceleration, braking movements and speed, and is intended to provide conclusions about the running behavior. *Lumo* also offers its customers a digital coach that creates individual training plans based on the acquired data. The large and established companies of the sports fashion industry such as *adidas* and *Nike* have initiated developments to meet the demands of the ongoing digitalization process. *Nike* developed the *Nike+* sensor in 2006, which measures, in combination with the *Apple iPod,* sports activities and has since started further research projects and filed patents[8]. In cooperation with the US basketball league *NBA*, the program *NikeConnect*[9] has been initiated in 2017 and is intended to offer individual and exclusive digital services to the fans in combination with a tag integrated in a basketball jersey. *adidas* is supplying professional athletes with smart shirts to demonstrate training progress and generate new training plans[10].

Not only in the field of sports, but also throughout the entire healthcare system, garments with technical and digital capabilities monitoring body activity, offer promising use cases. Precise personal body data from the sensors of intelligent apparel in combination with predictive analytics can create an automated, data-controlled feedback and monitoring system in the hospital environment that recognizes dangerous situations at an early stage (Axisa, Dittmar, & Delhomme, 2003; Pantelopoulos & Bourbakis, 2010). These types of systems will potentially be able to provide feedback on rehabilitation training that is specifically and individually tailored to the patient. *Owletcare*[11] specializes in monitoring toddlers to provide concerned parents with an overview of their child's health. The pharmaceutical and beauty industry also builds on innovations in the field of Smart Clothes and is investing in apparel made from medical textiles that can release moisturizers, perfumes or medical ingredients. It is therefore conceivable that Smart Clothes could, in the future, accelerate the wound healing process and transform body odors or administer medication.

The sports and health sector has put forward many applications and established itself as a pioneer in the Smart Clothes market. In course with the progressive health trend in our society, the accurate, continuous and unobtrusive measurement of body data could make a promising contribution to a more connected future.

3.2. Environmental monitoring, organ of perception, and exoskeleton

As soon as one gets behind the wheel of a car, numerous auxiliary and assistance systems are activated, which monitor and assist a person's activities. Imminent danger can be recognized, speed and distance to the vehicle in front are measured and adjusted independently. These kinds of help and assistance systems are conceivable when thinking about clothes, too.

Elderly people or those who suffer from physical disabilities are often limited in their movement by dwindling muscle strength which makes sitting upright, getting up, or other physical tasks increasingly demanding. Therefore, technical supporting systems worn on the body in Smart Clothes could assist physical activities. The *Superflex-suit*[12] by the design agency *fuseproject* is equipped

[2] https://www.theverge.com/2015/8/20/9178923/ralph-laurens-polotech-smart-shirt-is-the-ultimate-preppy-tech
[3] https://omsignal.com/
[4] https://www.liveathos.com/
[5] https://www.dorsavi.com/us/en/movementsuite/
[6] http://www.sensoriafitness.com/
[7] https://www.lumobodytech.com/lumo-run/
[8] https://qz.com/315924/the-patented-nike-shirt-that-could-track-your-heart-rate-and-blood-pressure-while-you-exercise/
[9] https://news.nike.com/news/nikeconnect-jersey-app-guide
[10] https://ark-invest.com/research/adidas-smart-shirt
[11] https://owletcare.com/
[12] https://fuseproject.com/work/superflex/aura-powered-suit/?focus=product

with actuators that can support the muscular work of the person wearing a type of garment that is commonly called artificial exoskeleton (Van Dijk, Herman, & Edsko, 2011) (see Figure 2).

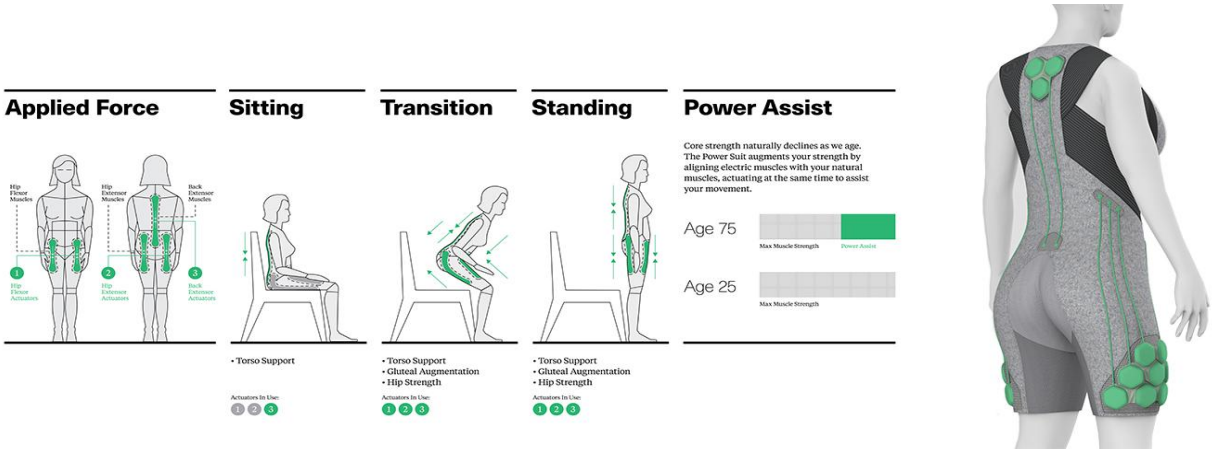

Figure 2. Concept Superflexsuit by fuseporject
Source: https://fuseproject.com/work/superflex/aura-powered-suit/?focus=product

Moreover, several companies are experimenting with integrating lights, feedback systems, and other technical enhancements to the garment. The startup *Loomia*[13] has presented products that heat up or glow in certain situations. *CuteCircute* from London developed the Twitter dress[14], which changes its color once it receives a tweet (See Figure 3). The Hug-Shirt[15] lets its wearers feel the external influences of another person wearing the shirt – such as a hug. The designer *Hussein Chalayan* created dresses that change their shape and fit while wearing by adding small actuators in the garment, which caused a small sensation at the Paris Fashion Week[16].

Figure 3. 10.000 LED dress by CuteCircute
Source: http://cutecircuit.com/press/mfa-dress-at-techstyle/

Furthermore, by means of haptic and visual feedback, Smart Clothes could potentially notify the wearer once the garment perceives certain triggers. Within the context of augmented and virtual reality applications, the combination of sensory perception and feedback systems of the garments are becoming increasingly interesting (Yurieff, 2017). Here, Smart Clothes can be used to transform the movements of the wearer into a virtual world and provide the person who wears it with context-related information[17].

[13] https://www.loomia.com/
[14] http://cutecircuit.com/the-twitter-dress/
[15] https://cutecircuit.com/the-hug-shirt/
[16] https://www.technologyreview.com/s/406705/transforming-clothes/
[17] https://www.machina.cc/

Moreover, the military research impressively shows possibilities and developments in the field of environmental sensors, sensory organs and exoskeleton (Cornwall, 2015). The *TALOS Exosuit* (Tactical Assault Light Operator Suit)[18] is being developed in the USA in a large-scale research project, including 56 companies, 16 government agencies, 13 universities, and 10 national laboratories. The suit is supposed to embed sensors for monitoring body temperature, heart rate, hydration, and body position. Additionally, heating and cooling functions for the temperature within the suit, bulletproof armor, 360-degree cameras with built-in night vision and a motorized exoskeleton supporting muscle activity are planned. The first prototypes are expected in the year 2018.

3.3. Communication and interaction

Unlike above-mentioned approaches to smart clothes, the developers of the company *Avery Dennison* focus less on connecting apparel to the wearer's body than on the communication of apparel with its environment[19]. By means of integrated transmitters like RFID chips, garments can be identified and contacted individually. A football jersey could then also be the ticket to a football match in a stadium and could enable a person who wears it to pre-order drinks or to activate exclusive content in the halftime. The project *NikeConnect* makes it possible to personalize a certain *Nike* jersey after the purchase. After the online registration via the NBA-jersey's tag, wearers receive access to exclusive highlights, playlists, products, and experiences from their favorite team. Another concept is the Limited Edition BRIGHT BMBR jacket[20] (see Figure 4), a collaborative project of New York design label *Rochambeau* and RFID chip supplier *Avery Dennison*. The chip integrated in the garment, grands access to special services like VIP-entrance to partner-locations or exclusive experiences, such as tastings and private guided tours to art galleries.

Figure 4. BRIGHT BMBR jacket
Source: https://brightbmbr.nyc/

Likewise, companies can store information about materials, handling, manufacturing, ownership, recycling or warranty directly in the garment, giving the customer additional and easy to access information about their clothing item. Furthermore, companies can offer additional products and services to customers wearing connected apparel. Smart Clothes can connect to apps in the surrounding environment and communicate with, for example, cash register systems[21]. Another application would be the wardrobe: All clothes inside can be stored regarding color, shape, and material to derive personal preferences. The digital wardrobe can then assist in the daily outfit choice and recommend matching items for purchase. This kind of clothes' communication with the environment is an interesting, yet feasible and cost-effective springboard for the fashion industry to advance into a digital and service-oriented future.

For *Google* and *Levi Strauss*, a logical next step is the direct interaction of wearer and apparel. Therefore, they have developed thin, touch-sensitive, and flexible threads made of conductive metal alloys, allowing direct control of another device, such as a smartphone. These threads can be combined with a variety of natural and synthetic fibers while retaining the weight and touch of a normal fabric. This results in interactive textiles that activate trigger commands on a smartphone by means of gestures on the material. For example, by wiping on the sleeves of the *Levi's Trucker Jacket*[22] it is possible to control a music playlist, start the navigation-system or receive calls on the smartphone.

[18] http://www.businessinsider.com/the-militarys-iron-man-suit-called-talos-will-arrive-in-2018-2015-10?IR=T
[19] http://rbis.averydennison.com/en/home/our-solutions/apparel-and-footwear-branding/introducing-janela-smart-product-platform.html
[20] https://brightbmbr.nyc/
[21] https://www.wareable.com/smart-clothing/lyle-scott-contactless-payment-jacket-1605
[22] https://atap.google.com/jacquard/

In essence, the vision of Smart Clothes that are connected with intelligent devices as part of the Internet of Things environment, indicate highly interesting scenarios.

4. Challenges and implications

4.1. Product requirements

In order to make intelligent clothes interesting for a larger part of the population and to fully exploit its market potential, the products have to meet several requirements.

People utilize clothes alongside their classical protective functions: to represent themselves to the world and to create, define, and communicate their intended identity (Joo Park, Young Kim, & Cardona Forney, 2006). In addition to "hard" factors such as price and function, the purchase decision for apparel is often based on "soft" factors such as strong positive emotions between customer, product and clothing brand (Hines & Margaret, 2007). Successful fashion-brands try to build up this emotional link by targeted marketing and branding, which is a critical factor for the buying decision of clothes in general.

It will be interesting to see how Smart Clothes will find their spot within the interplay of appealing, aesthetic product design of the garment, and integrated digital services and technical capabilities. Companies that want to convince customers mainly with technical innovations and focus on functionality instead of design or vice versa, might risk remaining niche suppliers.

It is to be observed whether the widespread and successful adoption of Smart Clothes for both private and commercial applications, in contrast to "normal" clothing, will depend on the quality of additional digital services. When it comes to this balanced interplay of fashion design and technological characteristics, the unobtrusive integration and usability of technology still is a major challenge for companies. Particularly, dependable power supply, storage, and charging imposes difficulties (McCann & Bryson, 2009). Yet, several actors show creative approaches to these problems like using the sun's energy[23] or textile-based batteries[24].

In summary, the future of intelligent clothing is not just about combining fashion and technological capabilities, like measuring a person's biometrics and behavior or displaying the product's environmental impact. Rather, it is about combining respective capabilities in a meaningful way to create something valuable for the customer in a holistic way. The real winners in the Smart Clothes market will be those products that manage, on the one side, to generate value by technical and digital characteristics. On the other side, products need to be designed in an aesthetically pleasing and easy to use way, also focusing on establishing strong emotional relationships with consumers.

4.2. Business model

Like all industries that face the opportunities and risks of the digitalization, the fashion industry should reconsider whether the value of their products for the customer will continue to arise in the same way as today. Inspired by current developments and possibilities described above (Zott, Amit, & Massa, 2011), new ways of creating value in the fashion industry are discussed hereafter.

The public and academic discussion about business models increased due to new developments, such as the emergence of platform-based services like *Spotify* in the music industry (e.g. Wagner et al., 2015). The term business model has been well established for a long time and generally describes how value is generated in a company (Voigt , Buliga, & Michl, 2017). Although there exists no universally accepted definition of the term, the underlying understanding refers to the system of interdependent activities carried out by a company and its partners, as well as the mechanisms that link these activities to generate value (Zott et al., 2011). Nowadays, the digitalization is forcing companies to reconsider central elements of their existing business models, including the value proposition, value chain, or revenue model.

Consumers have steadily challenged the value proposition of companies. Whereas in the past, producers dictated the supply, today's markets are increasingly influenced by individualized consumer demands. On the one hand, technological changes have turned consumers into well-connected and well-informed actors. Moreover, consumers exchange information via social networks or messaging services. On the other side, new players such as *Google*, *Uber*, or *Amazon* are successfully mixing up traditional markets with innovative digital services and offerings. All this is accompanied by a change in customer expectations: higher quality, individualized products, prompt delivery and comprehensive pre- and post-purchase services, free shipping, and regular updates (Johnson et al., 2008). In a nutshell, the digital age gives consumers more power than ever before and demands a critical reconsideration of the value proposition (Johnson et al., 2008). The consumer is moving towards the center of all value creation processes, accompanied by organizational and methodological changes.

These changes in the value proposition entail a shift of organizational power structures, since, for example, the IT departments are becoming increasingly relevant and long-established processes no longer function as they used to do. Start-ups often have the advantage that their organizations' design and business model are "born digital" and therefore changes in their structures or supply chain are less demanding than for established companies (Chesbrough, 2007). The latter will find it much more difficult to adapt their value chains, as this requires a profound rethinking of the corporate culture and structure. Agile project management, horizontal and vertical cross-departmental cooperation, multiple collaborations with third-party vendors, and a trial and error

[23] http://www.dailymail.co.uk/sciencetech/article-3823205/Now-S-call-power-dressing-Smart-clothes-use-solar-energy-charge-devices.html
[24] http://www.financialexpress.com/lifestyle/science/new-fabric-based-battery-to-power-smart-clothes/965798/

culture are just a few of the necessary aspects for a successful digital value chain and organizational structure (Gilbert, 2005; Hon, Bloom, & Crant, 2014).

As the digitalization and interconnection of products enables companies to realign and scale their way of monetizing on offerings, reconsidering the revenue model ultimately follows (Johnson et al., 2008). Shifting costs to third-party providers, platform and subscription models, pay-per-use and consumption-based billing or freemium models show prominent and promising use cases in different aspects.

Companies constantly have to adapt to change, but while these transitions used to take years or even decades, automated information processing shrinks the time span for these processes and requires ever faster and more agile adaptions. The digital age thus drastically accelerates the necessary learning and adaptation phases. In order to develop a successful digital business model in the long term, companies must therefore develop and cultivate their ability to learn, be creative and adapt fast (Chadwick & Raver, 2015; Meinel et al., 2018). In other words, established companies need to change their organizational culture in a way that it better adapts to the new challenges of the digital era. One cornerstone for this could be the implementation of "new work" office spaces, following the example of tech companies, such as *Google*, *Facebook* or *Dropbox*. Research has shown that the physical work environment has a great influence on employee behavior, including creative performance (for a review, see Meinel et al. (2017)).

The changes resulting from the digitalization have affected many traditional industrial sectors for several years and have yielded interesting business models. In the fashion industry, this trend is evident in new internet-based distribution channels and platform providers. For many year, however, a large part of the product range has only changed regarding design, material, or color combinations. Now is the opportunity for companies to rethink their products and business models to disruptively change the traditional fashion industry.

Fashion companies may reconsider several aspects of their activities. For example, it is questionable whether the one-off purchase of a garment remains the most promising revenue model. If the value for the customer comes from a service, companies could, for example, offer products free of charge in combination with an associated ecosystem of services (e.g. nutritional advice or fitness and lifestyle coaching). The customer pays for the service and is equipped with an intelligent item of clothing. A service provider such as *Weight Watchers* could provide customers with a Smart Shirt that measures physical activity and offers personalized nutritional and training plans. Thus, revenues could be generated over the entire life cycle of the product and could be expanded and adjusted. This type of service model – one could call it "Clothes-as-a-Service (CaaS)" – would not only help to subsidize the device, but would also foster a long-term relationship and communication between the customer and the brand.

Moreover, businesses need to understand consumers' expectations towards Smart Clothes. It will not be enough to develop technologically advanced or aesthetically pleasing products that generate quantified data. Companies will need to combine compelling experiences and services with tasteful designs and digital business models to build and maintain an emotional connection with their customers.

4.3. Technical issues

Smart Clothes with technological enhancements are mostly comprised of intelligent textiles (Smart Textiles), i.e. materials that have additional capabilities in comparison to normal textiles. The material base such as cotton, polyester or Kevlar, often contains electrically conductive fibers and is combined with electronic components such as microprocessors or miniaturized textile-based sensors and actuators. Those react to certain physical or environmental conditions, collect and send data and can perform certain actions. Integrated textile solar cells, fluorescent and electroluminescent elements, flexible buttons and haptic feedback systems are available. Companies such as *Toray*, *Panasonic*, *Covestro*, *DuPont*, *Toyobo* and numerous start-ups already supply the necessary materials. Biomimetic, i.e. the imitation of natural materials such as spider threads or leather in the laboratory, will continue to drive this field forward.

Sensor technology has developed rapidly in recent years due to an increasing demand for connected items that require smaller, more precise multidimensional sensors. The most important and driving sensor developments and technological advances include miniaturization, drastic reductions in production costs and increased reliability. However, more and better sensors also cause an increased amount of generated data and, due to transfer and processing, an increased power consumption. Energy-efficient technical components and a reliable power supply are decisive factors for successful products. Approaches towards energy storage challenges include thermogenerators, i.e. the conversion of body movement into electricity, textile solar cells or inductive charging possibilities in conjunction with woven and flexible batteries such as fiber super capacitors. By using transmission technologies, such as GSM, Bluetooth, NFC or RFID, the data is transferred to reception systems. A major technical challenge, not only for Smart Clothes, but also for interconnected device infrastructures in general, is the heterogeneity of data, protocols and platforms, a lack of standards and security aspects, which is why these problems should be discussed holistically.

5. Conclusion

The main objective of this paper was to provide a comprehensive overview of emerging possibilities and challenges of clothes that are characterized by technical and digital capabilities. Discussions and further research about the learnings and implications from respective developments should follow this introduction. This paper showed how advanced sensory technology, innovative components, and new ways of communication enable new product offerings with currently unknown capabilities in the fashion industry. To meet resulting requirements of the future Smart Clothes market, companies should reconsider their business models

in respect to their value proposition, value chain and revenue model. The decisive success of Smart Clothes is still several years far off. However, it is already worthwhile reflecting on the requirements, challenges, and opportunities of this promising market.

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