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**Fashion System**  
**Design Processes and Organizational Models of**  
**the Contemporary Fashion Company**  
**Informed by Digital Technologies**

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## **Theoretical and Critical Assumptions in a Scientific/Design Context**

The research scope focuses on the state of contemporary fashion business models, specifically in an Italian context, as well as changing consumer culture. The purpose is to identify how value and supply chains, alongside digital technologies, have systematized new organizational models in the fashion industry.

As the digital revolution continues to sweep across the world, many industries are being forced to adjust their business policies. The digital revolution has been positive and very successful for many businesses, as well as it has forced others to catch up and change the systems. The advent of digital technologies and in particular the pervasiveness of social media not only affected communication systems and logics but also changed consumption behaviors and human interactions and expectations in the “analogic world”. The world seems to be moving quicker; people want more and they refuse to wait. They are becoming less patient, and more customers everyday are becoming less tolerant of traditional methods and systems. To survive with time, business executives and owners need to adapt to change. Innovation doesn't stop. Business owners that choose to live in denial and refuse to acclimate to new advances will have a difficult time keeping up in the rapidly growing competitive market. People don't need go through the pain and suffering of climbing the traditional company ladder to reach their place anymore. An original idea and few taps on a smart device, and any person can market their designs anywhere and to anyone. Once an idea is released on the internet its growth and range is unknown. An idea can flow across the world like an imaginary wave overnight, and have an impact on millions of people.

In many cases, business supply chains operate using a mix of traditional, and modern processes. However, to benefit greatest from digital technologies, businesses need to reinvent their supply chain strategy. A true digital supply chain fully capitalizes on connectivity, system integration and the countless collection of information from digital components. Connectivity extends a business's market reach, and mobiles, as well as other smart devices, have made people accessible from almost anywhere in the world at any time, reaching customers via digital innovations such as personal computers, smart phones and tablets consistently on different social media platforms. People want to stay connected, and socially up-to-date, and demand that commercial vendors meet their needs. Brands have thus improved their communication to the increased visibility provided by social media, and experimented with the use of other digital technologies. With the emergence of Generation Y that represent tech-savvy consumers and employees who rely heavily on social networks and mobile applications for their fashion purchases, the fashion industry is now shifting focus from which markets drive growth to which channels drive growth (L2 report).

Even if the fashion industry was late to recognize the transformational role that technologies would play in a company's success, we have seen that the combination of technologies with creativity and fashion design has undeniably advanced and yielded growth and competitive advantage (*The Brighton Fuse*). Evolving technologies affect shifts in design processes and is a momentous developing practice, making products and strategies dated with respect to

technology advancements. Maintaining regular and informed updates in advancements and its use in other industries is essential to foresee any potential adoption by the fashion industry. The fashion industry is evolving in a way to accommodate technological advances and Internet of Things into their production activities, management processes and marketing, and naturally to the end consumer too. Digital fashion is the successful intermarriage between classical tailoring and recent technological tools. To affect higher performance digital tools are used by designers to enhance their designs improving the value chain through effective management processes and cost reduction for consumers.

The present globally competitive industry delineated by diverse, complex supply chains, fragmented production activities, geographically dispersed actors, and unpredictable demand has created the need for companies, ranging from mass-market to luxury segments, to adapt their supply network configurations. This means the **location of production and sourcing** have become important elements in a firm's competitive strategy and are crucial to assure competitive advantage over other firms (Buckley and Ghauri, 2004). Other variables relevant to the perspective of supply chain implementation by digital technologies to be studied are quality standards for production, timing of delivery, assortment and variety of the offer.

Literature indicates clusters of fashion companies that have adopted alternative methods to configure their production and supply network configurations to compete in the global context. In the paper entitled "Supply chain strategy for companies in the luxury-fashion market" about aligning the supply chain towards the critical success factors, (Castelli, and Sianesi, 2015) documents that success in the luxury market not only depends on branding and marketing but also on the choices made along the supply chain. The goal for any fashion company is to align its product, brand, and production channels with customers' expectations and needs (Brun et al., 2008)

In "Production and supply network strategies within the fashion industry" (Macchion et al., 2015) statistical analyses and case studies led to the definition of three clusters that are based on production allocation- in the far east, Mediterranean basin, and Made in Italy.

For a robust business model, the aforementioned literature suggests that supply network configuration is dependent on company's critical success factors and that the links between competitive priorities and production, and supply network configuration within the fashion industry can be tied to production plants technological capabilities and craftsmanship (Cagliano et al. 2005). In addition, managerial capabilities can be characterized by traceability, and collaboration to enhance company control along the entire supply chain. Technology also plays a major role in decision making on production location, as traceability and communication require specific technological capabilities, such as Radio Frequency Identification (RFID) (Guercini and Runfola, 2009). Information and communication technologies can improve the relationship between companies and manufacturers as communication is inherent when outsourcing production. In the context of offshore production, traceability is a key capability to be undertaken as a result of anti-counterfeiting, verification of production steps (Cheng and Simmons, 1994), sharing information about products and processes through to the final consumer to achieve transparency also in terms of sustainable aspects and the use of

dangerous materials (Jones et al., 2004). Traceability is important to in the fact that it ensures the origin of production and processes to build competitive barriers, making entry to market nearly impossible for foreign competitors when referring to brands that base their competitive priority on being 'Made in Italy'.

In "Virtual Organization for supply chain integration" (Wang, and Chan, 2009) focuses on supply chain structures and indicates barriers of integrating toward the upstream and downstream supply chains and provides a mutual solution by building up the e-fashion global supply chains. Dispersed and dynamic supply chain changes are due to advances in information technology and phenomenal changes leading to reconfiguration. Globalization has led to an increase in outsourcing leading to supply chain changes, from serial to network. Mass customization requires a system with increased flexibility and responsiveness. Inter-organization networks or virtual organization, is the emerging organizational structure characterized by flexibility, fast responsiveness and efficiency where cooperation is vital. Each entity within the supply chain should be proficient in a specific task with core competences. A collection of core competences results in a synergistic effect, in turn increasing productivity and lowering transaction costs. Virtual organizations are dedicated to management activities that change dynamically to increase efficiency and effectiveness; and are feasible due to information technology advances, strategic alliance (cooperation and trust), and can include both players in the market side - market (demand) and manufacturing (supply).

Research acknowledged design, retail and marketing innovation through the implementation and utilization of digital technologies such as: big data, artificial intelligence, design software, 3D scanning, innovative textiles, nanofibers, biotechnology, wearable technology, virtual prototyping, digital fabrication, 3D printing, digital buying, virtual reality, augmented reality. These technologies are being fused with creative processes, resulting in social media engagement, co-creation, co-design, open design, personalization, mass customization, crowdsourcing, crowdfunding, and open source platforms.

Contemporary literature has been indicative of **three critical issues** that have developed as consequence of the digital inclusivity in creative processes of fashion and have and as such affected business practices in terms of supply network strategies.

During this first year, analysis underlined major research areas that can offer contribution to the building up of the theoretical background. The rise of digital media has affected **product design and consumption patterns**. Fashion creative processes activities such as trend research, design, materials, prototyping, manufacturing, communication, and distribution channels make use of different technologies that enhance the very processes, collaborative practices, and overall efficiency across the supply chain.

The second critical issue is the **unification of retail and communication through social media and ecommerce**.

The third is the **shift from product to consumer experiences to personal transformations and customization**.

## Research Field: Design Setting and Focus

The research can be substantially structured into two main levels of reading and focus. Firstly, **attention to the fashion supply chain setting**, with a **focus on creative processes** in order to **focalize on how digital technologies are affecting practices** and render cyclic the fashion system as information technology generates a domino effect and leads to changes in marketing and communication strategies. To understand the exact implementation into the product design and conception phase is key to highlight future study. Observation has been dedicated to grasp engagement strategies of brands through digital technologies with respect to consumer culture. Secondly, digital technologies have been examined for formalize a more specific **understanding of the current conditions and applications**.

### 1. Fashion System Evolution

From a design perspective, fashion's subsequent efforts to modernize their approach through a **digital experience results in two major consequences**.

Prior to the digital revolution, fashion's design activities were split into several parallel sectors. These separate processes allowed for only a select few to input their ideas into the company's marketing strategy. One major consequence of fashion's adoption of digital platforms is the **unification of communication and retail through social media and e-commerce**. These platforms have also had an unprecedented effect on the **role of consumers** in the process of a company's branding and **strategy**. Today, successful fashion companies encourage **engagement** through various social channel tools, such as direct messaging, hashtags, comments and likes, and extensively uses the data collected in their market strategies. This **disruption of the relationship between producer and end user** has then profoundly affected brands' retailing strategy thanks to e-commerce. This paradigm shift also **lead to a disruption of the industry's seasonality** and affected some brands to change the delivery dates of their store collections. Several concepts brought about by the digital revolution have incentivized start-up designers to enter the burgeoning fashion market, and others to explore possible applications of these technologies for market share capitalization or collaboration projects that include social media, digital fabrication, and the Internet of Things. The concept gaining momentum in the world of digital fashion is that of **'in-season relevancy'**, where rather than making ready-to-wear apparel available 6 months in advance, this approach varies its collection based on the current season, such that each new collection is readily and instantly available for consumers according to the current season. In order to successfully utilize this concept, brands would be required to delve into the social landscape of consumer interest through deep data analysis of past sales and initiate well-founded planning. Resolving the time between the presentation of a collection and its availability to markets has effectuated **organizational changes**, leading to, for few cases so far, the combination of men's and women's collection presentation during fashion week disrupting their design and production cycle.

Another major consequence of fashion's digital revolution is its impact on **creativity, product design and conception**. Product design is no longer limited to creativity, form and function as customers seek **personal transformation** rather than **products** and **experiences** alone, digital technologies offer a possibility of additional added value. Product customization, downloadable fashion, and open design and crowdsourced input are some of the strategies enabling co-creation and resulting in broader **engagement** by the global community. **Open design** is strongly gaining appreciation in the fashion industry as evidenced by the development of new production policies. Most recently, select cases have promoted an open innovation approach to creative processes; allowing consumers to assert their fashion preferences is indicative of a shift towards the mass customization of on-demand production that provides consumers with options and designs to fit their tastes and needs.

Few case studies have highlighted engagement achieved in regards to how collections are conceived and the degree to which customers have become stakeholders and co-creators of the product. The first objective has been to define the **methods and tools** select companies have **adopted to promote the integration of digital tools into the design processes to further stimulate engagement with established brands and in new digital-fashion supply chains**. Secondly, describe the **degree of integration achieved** through these tools and company innovations prompted by user generated fashion.

A first categorization of cases can be synthesized as follows, considering different level of consumer engagement:

1. Crowdsourcing content and platform based brand **Away to Mars** is a co-created fashion brand that draws its trend research from people all over the world who can upload their inspirational images, as well as designs. This has put this brand relatively ahead of the curve as they have been able to predict the trendiest color of the next season, prior to Pantone even announcing it, simply by analyzing all the contributions. This case strongly represents the notion of bringing possible end users closer to the design phase of the product. With its dependency on crowdsourcing, a stronger product may be marketed as consumers would be interested in supporting a brand that is not entirely dictated by a single creative director that typically imposes their imagination on the entire collections. Rather, Away to Mars's strategy reinforces the concept of innovation by the people for the people.
2. A brand based online with no brick and mortar stores, neither any inventory, and a completely local production strategy use industrial knitting machines to produce unique, customizable clothes that are made-to-order. **Unmade** is a knitwear brand based in London that allows users to manipulate the knitted patterns and modify them according to personal taste via their website. Customization and personalization are techniques brands use in order to bring the end user closer to their product. The input of the end user into their personalized knit wear may imply that they might wear it more frequently - unlike fast fashion products that have less wear and tear. Their quote says it best. "We



hold no stock — nothing exists until you place your order and the production process begins.”

**Rebecca Minkoff** has built a tech fueled fashion line that redefines wearable tech and retail experiences as people still want to try things on, rather than shop online. Bracelets that charge your phone, dresses with 3d print and a boutique that changes the way people shop. With a tech first initiative, and with a different mentality that gives them an x-factor. In a partnership with Ebay that built the technology, customers can browse through the collection on interactive mirrors. Customers can order a drink, select garments and order them to their dressing room so clients don't have to leave the dressing room half naked to get a different size. Once the items are in the dressing room, the RFID tags make them pop up into the screen. In return, a valuable data record of everything her customers like and what they're pairing it with. Looking at the data but still innovating, figuring out what the next thing is that the customer doesn't know what they want. This case shows the impact of retailing innovation and consumer data collection on creative processes.

## 2. Digital Technologies

Digital technologies have an impact on fashion's creative processes, there are more applications when technology is introduced, bridging the gap between form and function and performance and aesthetics. There is a convergence of design and technology in the wake of the fourth industrial evolution – cyber physical systems. The market needs technology, the market is pushing to change paradigms, and competitors drive innovation.

Issues in design processes and organizational issues can be resolved by asking the right questions, rephrasing and refocusing them and in the case of fashion, technology functions can be applied into the different phases of the product lifecycle management (trend research, design, merchandising, sourcing, prototyping, manufacturing, buying, distribution, retail, communication).

-Big data and artificial intelligence are being used in trend research phases by analyzing all the sales data (retail and e-commerce) as well as social media posts which will affect the collection merchandising plan and designs.

-In the design phase a variety of design software facilitates processes, reducing drawing effort, allowing quick and reliable assessment of designs, concept validation, design review, and experience design such as usability, and ergonomic validation. 3D scanning software can also be used in the design phase to create clothing with a perfect fit tailored and personalized for the end user. This highly affects the design phase as the design tools are now different, therefore impacting the supply chain.

-Physical prototyping for product testing was once time consuming and costly, but with virtual prototyping design activities are accelerated, errors minimized, simulating how a product looks and works and gaining insight into product performance and manufacturing, thus positively

affecting the supply chain. A virtual prototype is an anticipation of a product that simulates shape and function which does not yet exist in reality, but appears and behaves as if it were real. Virtual prototyping, or functional modeling, is being used by several other industrial sectors such as automotive, aerospace, nautical, industrial design, home appliances, plant engineering services. For example, in automotive design, integrity testing, crash simulation, and performance evaluation are some ways virtual prototyping is being used to improve the development of machinery. For fashion, this applies to accurate fabric to garment, and garment design in real time with the right fit.

-In sourcing phase, there is a range of innovative textiles – developing technologies such as integrated soft circuits, fiber optics, biotechnology, nanotech, thermochromatic inks, wearable haptics, sensors, and actuators are raising questions about the need for tech in design, and the answer is that the questions are changing. As wearable tech demand increases, the market will need to supply and this will affect production strategies.

-3D printing is one of the most important technological means to develop new products and prototypes, and garments then to be realized by using technical and sustainable textiles. Iris Van Herpen is a pioneer, and has skillfully adopted 3D printing on a luxury scale. Composites allow more freedom of production, subtractive manufacturing vs additive manufacturing when talking about 3D printing. Digital fabrication is escalating such as machine knitting and electrospinning, and laser cutting. For example, a start-up called Electroloom allowed anyone to design and create ready-to-wear garments, from a personalized 3D geometry, without the need for seams; offering the comfort of being able to do everything, from design to finished product, from home. One of the objectives of Electroloom was to reduce the amount of energy necessary for the production of a garment. Unlike traditional methods, cutting and sewing were not involved, but the fabric was generated from zero, through the technique of electrospinning, a method that converts a special liquid nanofiber solution, sprayed and deposited on the plate model. The plate is driven by an electromagnetic field inside the printer by a process very similar to the techniques used in laboratories to produce organic tissue. The brand worked with a mixture of polyester and cotton and tested on silk. Users only need to possess some basic CAD (Computer-Aided Design) skills to design their own models, and Electroloom did the rest. Once removed from the mold, the flexible material can be draped, pleated and reworked in a way similar to traditional fabrics. Display and tracking technologies are important in managing all these processes.

-Digital buying facilitates manual processes and is more time efficient and minimizes error.

-Virtual reality and augmented reality can serve in retail and E-commerce to experience products with some examples in fashion such as Dior eyes, Topshop, Holition (war paint, mani match). Interactive virtual prototypes (IVP) can create multisensory interaction (vision, touch, sound, and smell) but applications in fashion are inexistent so far. When technology becomes more accessible, the fashion industry jumps on the opportunity to experiment, such as is the case with 3D scanning, virtual reality and augmented reality, though, as these technologies are not mature enough to be integrated and scaled - as well as the fact that the human race is not fully prepared to embrace them yet.

## General and Specific Objectives

Overall, the research aims to identify the design driven opportunities that foster the integration of traditional and digital fashion supply chains, placing emphasis on product development, the management of processes, and differing approaches to markets. Several objectives have been determined as instrumental to the research scope. These include:

1. defining the tools that promote integration,
2. codifying company's organizational models that have adopted the new digital-fashion supply chain,
3. and defining the level of integration and innovation of the two (traditional and digital) supply chains eventually enhancing the value chain of the industry.

The first year of research concentrated on defining the framework and identifying the boundaries within which to develop the research. Building and updating the theoretical background with respect to various disciplines has been performed to achieve a global and comprehensive overview about:

- Technology in industry as an interdisciplinary element.
- Focus on re-structuring of fashion business models that existed before the digital revolution as well as those who have laid their foundations on digital culture.
- Changing consumer culture and implications for markets and businesses. How do existing consumer needs differ from new needs created by the digital revolution? How can brands tap into the future needs of the fashion market?

## Methodology

In order to get a deeper understanding of the critical issues surrounding the research topic, **qualitative and quantitative approaches** have been selected in order to investigate the aim and objectives of this study. Information has been collected to formulate stronger grounds to recognize technologies embedded in both creative and non-creative fashion processes. The methodology consists of several strategies in order to congregate necessary data. The work presented is divided into **three stages of data collection**:

1. Initially, to broaden the knowledge on digital technologies and their applications in and out of the fashion industry, I looked at non-structured sources as immediate coverage of new products and applications of developing technologies is best found in sources alternative to scholarly journals. A wide range of secondary resources such as online sources, blogs, influencers, and brands have been selected in correlation with the aims and objectives of the study, have been observed and analyzed qualitatively in order to attain a universal scope. The state of the art of digital technologies is underway, as the field is broad and is present in a variety of industries such as medical, automobile and product design. This was necessary to understand the possible applications of developing technologies to fashion, as well as to discover more about newer technologies that have not yet reached the market as potential tenders.

Qualitative analysis of brands', from diverse fashion sectors, adoption of digital technology, such as through social media, has shed light on the rapid transformation of their communication strategies. This proves that the effect of digital technology on communication has a direct correlation to other business processes such as marketing. The trajectory of transformation is thanks to software updates on diverse platforms, such as the implementation of stories on Instagram, leading major brands to develop and plan content more meticulously – for example video coverage during fashion week of backstage events to runway – in a shorter time frame. This qualitative approach through digital platforms has led to the discovery of several new fashion companies, by their online communication, that were founded after the digital revolution and more recently in the past few years which have diverse business models, production strategies and retail approaches. This proved useful to **gather possible cases** to be considered for future study. In order to identify criteria for the categorization of case studies quantitative data is further needed as support.

2. Simultaneous to all the non-structured sources and digital observation, literature review about the state of art of the fashion system and supply chain has been performed delving deeper into **product creation and development**. Scholarly journals focused on the contemporary types of demand, the new modes of consumption, user experience, product creation, and the different models of innovation have been also included. Literature study provided insight on the state of the fashion industry, with a focus on the **Italian context**. **Empirical** evidence on organizational characteristics and strategies of firms were analyzed based on a data set of SME's, and brands, or fashion industry giants. These brands were then **clustered** based on production location, furthering the knowledge on **supply chain** management. Other literature focused on the specific digital technologies used in fashion supply chain management.

Following the research, the findings of the primary research have been evaluated, and interpreted into a matrix in order to facilitate the development of conclusions. Data analysis and visualization is necessary in order to design a draft of a supply chain informed by digital tools to provide the variables needed to determine criteria for case studies.

1. Social media monitoring tools are set in place and have so far gathered two seasons of fashion week engagement. This 'Social Sensing' is being performed by a collective of researchers; the Fashion in Process research team along with DEIB Politecnico. This collaboration allows the gathering of up to date and meaningful insights, this tool will be implemented each season during Milano Fashion Week in order to quantify benefits of digital communication strategies adopted by numerous firms. The sample size includes Italian brands, in and out of the official fashion week calendar.

## Future Actions

- To deepen the research of specific digital technologies characteristics and innovations as tools identified with respect to other sectors technological adoption and their effect on the fashion supply chain and specific design phases.
- Case studies organization and mapping to lend a wider perspective of the main players changing the game, clustering them by the ways in which they strive to do so, and synthesize and define the emerging paradigm and by comparing to international competition/best practices. Acute consideration of company clusters would stipulate the characteristics of a hybrid traditional-digital supply chain based on innovation and levels of integration.
- Changing consumer culture is paramount to study to determine shifts in the supply chain and design practices.
- As this research is not focused on a single market segment, but on diverse fashion sectors and from fast-fashion to luxury, specific case studies must be performed. A company that has yet to embrace digital fully into their strategies is suitable to analyze and compare with a competitor that has implemented digital more than the standard. The critical analysis of the literature will be challenged by conducting in-depth interviews with professionals and industry experts providing criteria to select case studies.
- Companies that were born prior to the digital revolution will be analyzed in order to understand levels of technological adoption in practices. Two other companies will be studied, determining factors include, firstly born after the digital revolution, secondly they must fully embrace digital advancements with respect to their critical success factors. Additional research will be conducted in order to quantify the benefits of design thinking, marketing and digitization on product creation, and to quantitatively measure its impacts on the different organizational levels of companies. Eventually, the strategies will be chosen to define new possible organizational models and tools that enable the integration of fashion and design thinking with digital know-how.
- Ultimately, the evaluation of the possibility to perform a design oriented research which will be project and collaboration based.

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### **Didactical Activities**

-Metaprogetto (Fall 15/16 Semester, Fall 16/17 Semester):

- Teaching Assistant
- Development of Interactive Research Tool used for Individual Assessment (Pinterest)
- Merchandising Workshop

### **Research Activities**

-Il Nuovo Vocabolario della Moda Italiana

- Content Generation: Catalogue Text Editing
- Exhibition Production

-Social Media Monitoring of Milan Fashion Week, Fashion in Process and DEIB Politecnico (Social Sensing)

-Participation to Conference "Wearabil\_IT" Bologna