Application of the Business Model Canvas to the study of industrial sector of Smart Textiles for Fashion focusing on the italian startup Cap_able.

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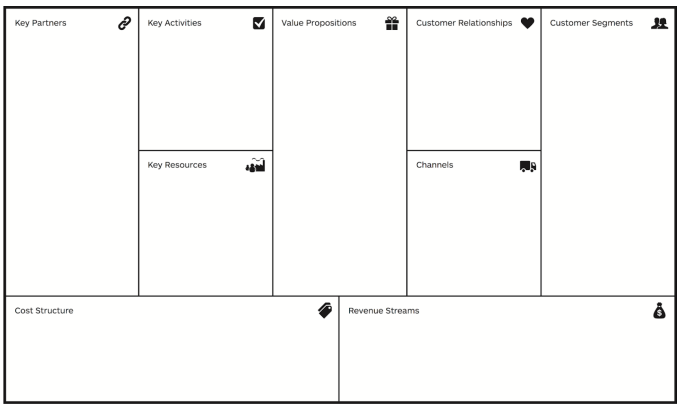

Figure 1: Business Model Canvas template[1]

Abstract

The present work applies the Business Model Canvas (BMC) to the industrial analysis of smart textiles for fashion, focusing on the Italian case of Cap_able. Cap_able is a fashion-tech startup that merges advanced technology into stylish garments with the goal of protecting personal privacy by disrupting facial recognition systems. The paper considers the nine basic building blocks of BMC applied to the specific case of this startup. The information for this study was collected from different sources, including: patents, articles, Ted talks, and an interview that the author of this paper managed to have with Cap_able CEO Rachele Didero. Results showcase smart textile capacity for functional and ethical added value to trigger a social debate around privacy protection in the digital era.

1 The theoretical framework

The Business Model Canvas (BMC) is a strategic management tool that provides a comprehensive framework for developing and visualizing a business model. It allows organizations to describe, design, challenge, invent, and pivot their business models. The BMC is divided into nine essential building blocks that cover the core aspects of a business:

- **Customer Segments** Defines the different groups of people or organizations an enterprise aims to reach and serve.
- **Value Propositions** Describes the bundle of products and services that create value for a specific customer segment.
- **Channels** Explains how a company communicates with and reaches its customer segments to deliver a value proposition.
- **Customer Relationships** Outlines the types of relationships a company establishes with specific customer segments.
- **Revenue Streams** Represents the cash a company generates from each customer segment (costs must be subtracted from revenues to create earnings).
- **Key Resources** Describes the most important assets required to make a business model work.
- **Key Activities** Explains the most important things a company must do to make its business model work.
- **Key Partnerships** Identifies the network of suppliers and partners that make the business model work.
- **Cost Structure** Describes all costs incurred to operate a business model.

The BMC was introduced by Alexander Osterwalder and Yves Pigneur in their book Business Model Generation (2010).[1] They designed the canvas to help businesses systematically understand, design, and differentiate their business models.

2 Smart Textiles in the Fashion Industry

Smart textiles, also known as electronic textiles (e-textiles) or smart fabrics, are materials that have been enhanced with technologies to provide added functionality beyond traditional textiles. These functionalities can range from monitoring physiological parameters to adapting to environmental changes and even providing user interactivity. The integration of electronic components such as sensors, actuators, and conductive fibers allows smart textiles to interact with their environment and users.[2]

2.1 Technologies

To enhance everyday pieces of clothing, technological advancements were needed. Flexible electronics and stretchable interconnections enhance wearability, while energy harvesting from body movements and solar cells provide power. Conductive inks and yarns create electronic circuits directly in textiles, and P-FCBs offer a soft alternative to rigid circuit boards.[?]

3 Applications in the Fashion Industry

The fashion industry has embraced smart textiles for their potential to revolutionize how we think about clothing. Here are some key applications:

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Figure 2: Cap_able luxury clothing tricks surveillance systems[6]

Figure 3: Adversarial Fashion t-shirt

3.1 Health Monitoring

Wearable Health Monitors: Garments embedded with sensors can monitor vital signs such as heart rate, body temperature, and respiratory rate.[3]

Posture Correction: Some smart garments are designed to monitor and correct posture, helping to prevent long-term musculoskeletal issues.[3][4]

3.2 Sports and Fitness

Performance Tracking: Smart fabrics in athletic wear can measure metrics such as muscle activity, sweat levels, and body movement. This data helps athletes optimize their training and performance.[5]

Performance enhancement: Smart coatings can be used to reduce drag in sports such as cycling, sprinting, and swimming. Drag reduction is fundamental to enhance performance.[5]

3.3 Fashion and Aesthetics

Interactive Clothing: Designers use smart textiles to create garments that change color, light up, or even play music based on user interaction or environmental stimuli. This blend of fashion and technology creates a unique, dynamic aesthetic.[2]

Adaptive Fashion: Smart textiles can adjust their properties based on environmental conditions, such as temperature-regulating fabrics that keep the wearer comfortable in varying climates.[2]

3.4 Safety and Protection

Protective Gear: Smart textiles are used in creating protective clothing for military, firefighters, and industrial workers. These garments can monitor environmental conditions and the wearer's physiological state, providing critical data in hazardous environments.

Ampliating the concept of protective gears and smart textiles, it is worth mentioning the work of the Italian startup Cap_able, developing AI Clothing that exploits adversarial attacks to trick facial recognition surveillance systems.[6]

4 The case of Cap_able

Cap_able is an Italian fashion-tech startup that specializes in creating smart textiles designed to protect personal privacy. The company integrates advanced technology into fashionable pieces of clothing, making them capable of disrupting facial recognition software used by surveillance cameras.[7]

4.1 History of Cap_able

Cap_able was founded in 2022 by Rachele Didero during her PhD. at Politecnico di Milano.[7] The idea was born before, during Didero's master thesis[8] and was later transformed into a startup, cofounded with Federica Busani, current Business Developer. Cap_able was founded to address the increasing concern over privacy and the misuse of biometric data by surveillance technologies. The founders recognized the need for innovative solutions that could offer protection from invasive facial recognition systems while maintaining the aesthetic and functional aspects of fashion. By creating garments that incorporate adversarial patterns, Cap_able aims to empower individuals to protect their privacy and stimulate public discourse on the ethical implications of biometric surveillance.[6]

4.2 Technology

Cap_able's primary product line, the Manifesto Collection,[6] features garments embedded with adversarial patterns. These patterns are designed using AI algorithms[8] to mislead facial recognition systems(frt) based on Ultralytics-YOLO,[9] either causing them to fail to identify the wearer or misclassifying them. This approach not only provides privacy protection but also raises awareness about the misuse of biometric data and the importance of privacy in the digital age[10].[7] The technology behind adversarial patches is not new, and already in 2017 Google researches were publishing articles on the topic.[11]

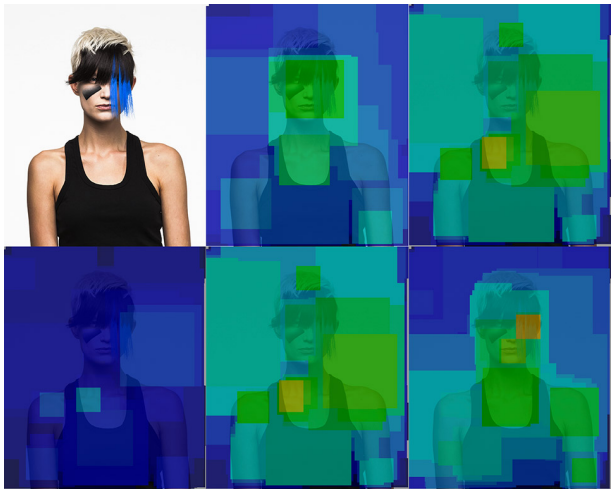

Figure 4: CV Dazzle makeups that fool Convolutional Neural Networks

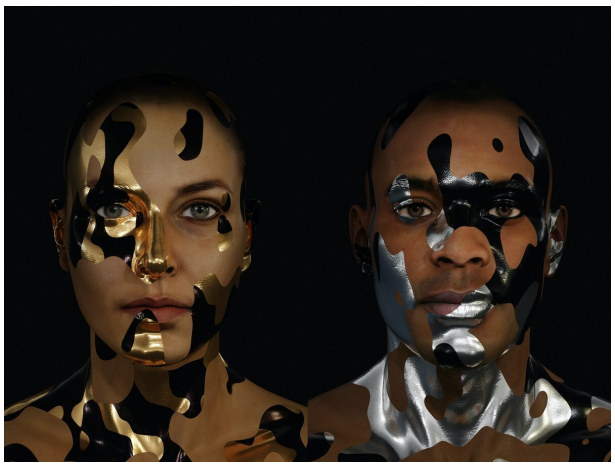

Figure 5: CV Dazzle updated makeup style for 2020's systems

5 Business Model Canvas for Cap_able

The author of this article managed to obtain an interview with the CEO Rachele Didero. The information obtained from the interview was used to construct the Business Model Canvas. In the following section the content if the interview will be separated by the author's personal analysis through the use of the citations.

Key Partners	• Tech collaborations with AI and privacy protection companies[12] • Partnerships with established fashion and design brands[12] • Collaborations with academic research institutions such as Politecnico di Milano[12] • Collaboration with non-profit organizations protecting human rights[12]
Key Activities	• Continuous research and development of new technologies and patterns[12] • Marketing and sales promotion through online and retail channels[12]
Key Resources	• Advanced AI technology for creating adversarial patterns[6 13] • Designers and Computer Scientists[12] • manufacturing facilities[6] • Intellectual property[8] and patents[13] to protect their business in the italian market.
Value Propositions	• Clothing designed to confuse facial recognition software[6] • Combination of advanced technology with stylish design[6] • Raising awareness about privacy and protection of biometric data[6 10]
Customer Relationships	• Building a community around privacy and fashion via social media and events[6 12] • Providing educational content and talks about privacy issues[6, 10 10]
Channels	• Selling products directly through their online store[6] • Collaborations with fashion retailers for distribution[6]

Customer Segments	• Privacy-conscious individuals concerned about biometric data and with strong ethic values[12] • Organizations whose members operate in high-risk environments that require personal data protection[13]
Cost Structure	• Significant investment in R&D for new technologies and patterns[12] • Costs associated with the production of high-quality smart textiles[6] • Expenses related to marketing and sales[6] • Expenses related to patent issuing[13]
Revenue Streams	• Revenue from the sale of smart textile garments[12] • Potential revenue from partnerships with other brands and human-rights organizations[12]

6 Competitors landscape

As we have already stated, Cap_able technology is an application of well-known technologies and research topics that have been available for years, this makes the competitive landscape more competitive. Startups and open-source projects focused on privacy protection and in particular tricking surveillance systems are growing in number. Here we list some of them.

- **URME Surveillance** is a non-profit privacy-conscious organization that produces realistic prosthetic silicon masks replicating the face of artist Leonardo Selvaggio.[14]
- **CV Dazzle** is an open-source project that creates makeups able to trick Convolutional Neural Networks (CNN)[15]
- **Adversarial Fashion** is a startup competing in the same market as Cap_able but focusing on commodity clothing rather than luxury[16]

According to CEO Rachele Didero, the added value of Cap_able with respect to the listed competitors resides mainly in the quality of their products, that are manufactured in Italy and whose materials are free from toxic chemicals.[7] Their advantage in Italy resides also in having patented their technology and maintainig their technological advancements thanks to collaborations with labs and research institutions in the field[13].[12]

7 Conclusions

Cap_able's integration of advanced technology into fashion to protect personal privacy exemplifies innovation in the smart textiles sector. The Business Model Canvas analysis reveals the startup's strategic focus on research, partnerships, and ethical marketing. Cap_able's success highlights the potential for smart textiles to revolutionize fashion by combining functionality with privacy protection, providing a valuable model for future developments in the industry.

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