

VIRTUAL GUIDE  
Learning unit 1  
Lesson 2

# Introduction to the smart textiles market



Innovative smart textiles & entrepreneurship

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## Introduction to the smart textiles market - Niche markets I

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## Content

Content	1
Abstract	2
1. Niche markets I	3
1.1. Healthcare	3
1.2. Sports and fitness	6
1.3. Personal and protective equipment	8
Conclusions	10
References	10

## Abstract

Smart textiles market is one of the most promising and emerging markets lately. Due to the technological revolution they are experiencing since few decades ago, the possibilities that a traditional textile product could offer in past have increased dramatically.

The combination of classical textiles' concept with several elements such as materials with particular properties, sensors, electrification, and internet are leading textiles to a new era.

This book will provide a necessary contextualisation necessary to understand the potential of smart textiles and which kind of relationship they have and they might have with the commercial market.

Then, it will provide some more deep information of specific markets and show examples about how they are evolving.

## 1. Niche markets I

So, once the general concepts regarding smart textiles have been exposed, as well as the process how they are done, and the variety of possibilities they can offer, the next step is to see how the market reacts and/or what kind of future we can expect from the smart textiles in this field.

Niche markets are those that are expected to succeed, according to potential consumers' or society needs. Let's say, in other words, potential successful (economically) markets.

Particularly, the Cambridge dictionary definition says about niche market it is "a small area of trade within the economy, often involving specialised products".

Smart textiles are a structural component of the wearable technology revolution, which is transforming how we interact with technology and each other. Wearable devices can be integrated into clothing, but also in jewellery, and other accessories, providing convenient access to information and services. Indeed, they are also part of the larger IoT revolution, which is connecting everyday objects to the internet and each other. These components can be used to collect and transmit data about their environment, enabling new forms of automation and control. Furthermore, in most of the cases, smart textiles are being developed using nanotechnology, which involves manipulating materials at the molecular and atomic level. Nanotechnology can enhance the properties of textiles, such as strength, flexibility, and conductivity.

Also, consumers are increasingly seeking out products that provide comfort and convenience in their daily lives. Smart textiles can deliver on both of these fronts, providing enhanced functionality without sacrificing comfort.

The fact is that the combination of smart applications on products developed with textiles can go much beyond fashion and/or general physical care and protection.

### 1.1. Healthcare

Smart textiles are increasingly being used also in medical applications, such as monitoring vital signs, providing drug delivery, and even wound healing. These textiles can help improve patient outcomes and reduce healthcare costs.

If we go deeper into the definition of the smart textiles within the health field and its performance, we find that

*Smart textiles for healthcare include textile sensors, actuators and wearable electronics systems embedded into textiles that enable registration and transmission of physiological data, and*

wireless communication between the wearer and the ‘operator’, for example, patient and medical personnel<sup>1</sup>.

Such systems ensure patients’ mobility, thereby providing a higher level of psycho-physiological comfort, especially when a long-term bio-monitoring is required (Kirstein, 2013, Catrysse, Pirote, 2007; Textilien und textile..., 2012; Cherenack, van Peterson, 2012; Chan, Esteve, 2012; Alemdar, Ersoy, 2010; Schwarz, van Langenhove, 2010).

Generally, applications of smart textiles for medicine and healthcare vary from the surgical applications of single yarns to complex wearable and axillary systems for personalised healthcare.

Up until now, research community sustain “There is no still classification smart textile for these applications, but initially those can be described referring to commonly distinguished groups in conventional medical textiles. Of course, due to new functions, several new categories must be highlighted. Those are textile drug-release systems, textiles with biometric performance and active textiles for therapy and wellness.”

An extracted table from Mečnik, V., Hoerr, M., Krievičs, I., & Schwarz, A. (2014) research shows briefly general applications for health of smart textiles.

Table1: Applications of smart textiles for medicine and healthcare

Application	In vitro	In vivo
Surgery	Bandages Wound-care	Sutures Soft-tissues Orthopaedic implants Cardiovascular implants
Hygiene	Uniform for medical personal Hospital textiles	-
Drug-release systems	Smart bandages and plasters	-
Bio-monitoring	Cardiovascular and haemodynamic activity Neural activity Muscle activity and kinematics Respiratory activity Thermoregulation	-
Therapy and wellness	Electrical stimulation therapy Physiotherapy Auxiliary systems Active thermoregulation systems	-

Furthermore, companies keep on innovating and developing products regarding the society needs that are proper examples of smart textiles niche markets.

<sup>1</sup> Mečnik, V., Hoerr, M., Krievičs, I., & Schwarz, A. (2014). Smart textiles for healthcare: applications and technologies. *Rural Environment, Education, Personality*, 7, 150-161.

First one, is the smart face-mask was developed by ARPE company due to the COVID19 pandemics needs and resulted to be an important path for the investigation and smart textiles contribution on the health field. In this case the mask is endorsed with those required electronics and sensor systems to be able to monitor humidity and temperature within the mask and face area in real time, advise when a disinfection is needed, and provide an automatic disinfection process by raising the mask temperature higher than 70°C within 3 minutes. All this data, to be monitored by an app.



Image 4: ARPE Smart-mask<sup>2</sup>

Another prototype, this time, designed by CP. Aluart company is the SMART-WORKWEAR prototype. It provides an active monitoring system embedded on the first-layer of a comfortable garment that integrates a set of flexible sensors to assess the physiological strain index (PSI) connected with integrated wearable, washable, flexible conductor and with a raw data processing and visualisation system for demonstration purposes.

This protective equipment tackles harsh conditions needs, such as high temperature or moisture environments outdoor and industrial workers face, and which can accrue risks for workers causing fatigue or even heat strokes that can lead to accidents on duty. Heat exhaustion causes a significant economic loss of labour in sick days and in health care costs.

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<sup>2</sup> <https://arpe.es/en/blogs/blog/arpe-smart-mask>



Image 5: Smart textile prototype for personal protection by C.P. ALUART<sup>3</sup>

## 1.2. Sports and fitness

Smart textiles applied to sports recently opened an interesting niche market. Particularly to all those sports which implicate some risky moments or a continuous risk. Smart textiles can be applied as a protective factor and, at the same time, provide the person and/or its team of relevant data either for the person's safety or for their performance improvement<sup>4</sup>.

Some examples to be shown in this line are the following.

On one side, we can find a classical motorbike jacket concept, but endorsed with some extra protective elements plus an integrated air-back system that deploys in reaction with a potential collision of the driver. Indeed, this system is able to react to an external cinetical input and activate the system. For this reason, as mentioned previously, reliability plays a direct role in regards to safety.

In this case, the product has been developed by a company called Dainese.

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<sup>3</sup> <https://cpaluart.com/en/ppc-clothes/>

<sup>4</sup> Mohammadi, R. A., Shirazi, M., Moaref, R., Jamalpour, S., Tamsilian, Y., & Kiasat, A. (2022). Protective smart textiles for sportswear. In *Protective Textiles from Natural Resources* (pp. 317-345). Woodhead Publishing.





Image 6: Dainese Smart Jacket<sup>5</sup>

And then, we can find the “SMART-HORSE-RIDING” breakthrough. It consists of a smart half pad for the dressage (an equestrian discipline) market. The novel product integrates flexible electronics through printed conductive yarns and pressure sensors within a half pad (blanket positioned under the horse saddle). The different pressure points generated by the rider position on the horse are visualised through a custom app developed during the prototype stage.

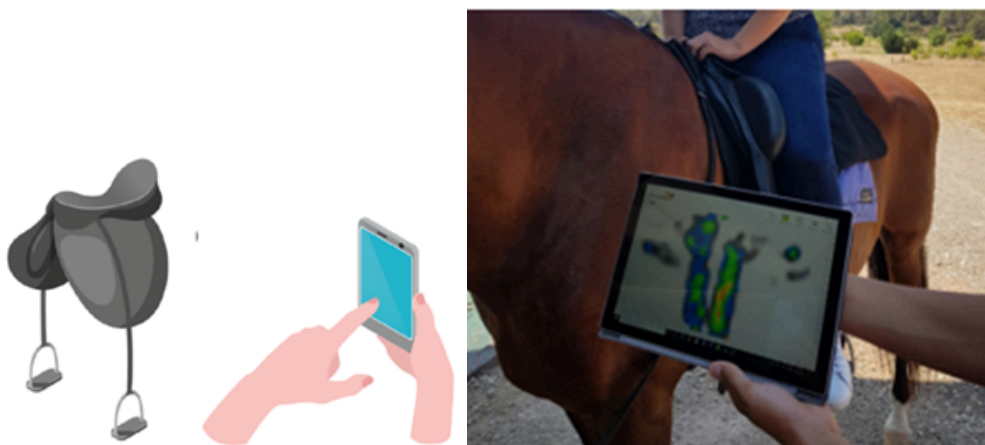


Image 7: Smart-horse riding prototype by POLISILK<sup>6</sup>

<sup>5</sup>[https://www.dainese.com/es/es/dainese/smart-jacket.html?utm\\_medium=ppc&utm\\_campaign=ES+-+Brand+Motorbike+2018&utm\\_source=adwords&utm\\_term=%2Bdainese%20%2Bsmart%20%2Bjacket&hsa\\_grp=100913370713&hsa\\_ad=427772361820&hsa\\_cam=792983677&hsa\\_acc=7513287879&hsa\\_ver=3&hsa\\_src=g&hsa\\_kw=%2Bdainese%20%2Bsmart%20%2Bjacket&hsa\\_mt=b&hsa\\_a\\_net=adwords&hsa\\_tgt=kwd-844408391260&gclid=CjwKCAjw3POhBhBQEiwAqTCuBuzRE2\\_BlCHpMuSnfR\\_Fws4pkcGsh0nKq6LFHqg6NICVXkWhFSIRxoCWnwQAvD\\_BwE](https://www.dainese.com/es/es/dainese/smart-jacket.html?utm_medium=ppc&utm_campaign=ES+-+Brand+Motorbike+2018&utm_source=adwords&utm_term=%2Bdainese%20%2Bsmart%20%2Bjacket&hsa_grp=100913370713&hsa_ad=427772361820&hsa_cam=792983677&hsa_acc=7513287879&hsa_ver=3&hsa_src=g&hsa_kw=%2Bdainese%20%2Bsmart%20%2Bjacket&hsa_mt=b&hsa_a_net=adwords&hsa_tgt=kwd-844408391260&gclid=CjwKCAjw3POhBhBQEiwAqTCuBuzRE2_BlCHpMuSnfR_Fws4pkcGsh0nKq6LFHqg6NICVXkWhFSIRxoCWnwQAvD_BwE)

<sup>6</sup> <https://www.polisilk.com/products>

### 1.3. Personal and protective equipment

Personal Protective Equipment (PPE) is also a sector in increase due to the smart textiles capabilities. Up until now, *three main trends have been identified for product development: users' needs, global systems, and environmental conditions.*

These electronic wearables can protect human beings thanks to their physiological reactions (temperature, humidity, electricity, pressure, chemicals, solar or any other variable) and transmit data and relevant indicators to monitor the person's health within a wide variety of external conditions.

This is thanks to the sensors, which, of course, need to be well installed to become safe and also need to be reliable as long as any possible malfunctionality may lead to a fatal or serious injury.

For instance, *thermal comfort can also be improved with phase change materials that can provide additional heat or coolness as the need arises or the application of smart materials in PPE concerns shear thickening fluids that solidify and become shock absorbers when impacted at high rate<sup>7</sup>.*

Also, another important element to provide by a smart-textile-made PPE is the capacity to communicate. As long as the wearable is endorsed with electronic devices and, much more than probably is connected to some virtual network, it is thinkable to endorse the equipment with an emergency call system (which could even send to the external services with detailed geographic location, vital constants, images, etc., for example).

Beyond that, some specific examples to figure out how all this knowledge, technology and textiles become real useful products are collected below.

The first one is about firefighters, a dangerous task that needs to be efficiently prevented from multiple and considerable risks at the same time. Any solution proposed to ease the firefighter's job is welcome. And in this sense, GoodPRO company developed a smart indumentary which helps the person who is wearing it not only to deal with obvious temperature adversities but also to prevent accidents. This is achieved because of the sensors installed within the fabrics. They count with active lightning integrated so the person keep both hands usable, emergency call, real-time location, temperature measurement apart from the other staff to take into account to ensure flexibility, comfort and safety.

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<sup>7</sup> Dolez, P. I., & Mlynarek, J. (2016). Smart materials for personal protective equipment: Tendencies and recent developments. *Smart textiles and their applications*, 497-517.



Image 8: SmartPRO suit for firefighters by GoodPRO<sup>8</sup>

Also, other conditions can module the indumentary, depending on the needs, the risks and the conditions in which the person is exposed. For instance, and on the other extreme, we find labour tasks on very low temperature, and also in very low visibility. In that terms, warmth and lightning become essential to protect the user:



Image 9: High visibility clothing with integrated lighting system (left); cold storage equipment by Sioen<sup>9</sup>

SIOEN company develops professional protective equipment for multiple kinds of conditions. Above, different kinds of equipment are shown.

<sup>8</sup> <https://en.goodpro.cz/>

<sup>9</sup> <https://sioen-ppc.com/en>

## Conclusions

In conclusion, smart textiles have a bright future ahead. Ongoing technological revolutions lead to new applications, which at the same time lead to new and emerging niche markets. And the more versatile these innovations are, the more niche markets will appear and consolidate. Smart textiles are poised to transform a wide range of industries and applications.

These smart textiles' new applications and possibilities have been endorsed with, generally thanks to electronic devices and sensors that can revolutionise the concept of a classical textile product we have had until nowadays, but also specific properties achieved thanks to materials' ones or chemicals.

- The elaboration of smart textiles involve several sectors (electronic+textile+services) and does not forget sustainability aspects.
- Smart textiles need to be wearable comfortably and safety talking. Otherwise, their new applications remain useless.
- Smart textile niche markets can -and do- offer improvements and revolutions in multiple sectors.

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### Partnership



#### Project coordinator

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AEI Tèxtils - Agrupació d'Empreses Innovadores Tèxtils

[www.textils.cat](http://www.textils.cat)



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