RESET – RESEARCH CENTERS OF EXCELLENCE IN THE TEXTILE SECTOR

GOOD PRACTICE HANDBOOK 3

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CONTENT

1. GENERAL INTRODUCTION

1.1 AIM OF THE RESET PROJECT

European textile and clothing sector is the most relevant economical source for the EU, accounting for 4% of the total added value of the manufacturing sector, with 173.000 companies and a turnover of 165 billion €. Its competitiveness is linked to increased investments in innovation and research both public and private which are key drivers for European companies to lead the market in the coming years. Due to its enormous environmental impact, sustainability and environment-friendly production it is emerging as a new driver of textile process and product innovation as well as technology development. The overall objective of the project is to generate a policy change in the implementation of regional policies and programmes of the Structural Funds related to the strengthening of research, technological development and innovation to assure the sustainability of the T&C sector in the partner regions. It will be achieved through policy learning and capacity building activities on public policies supporting innovative, green and sustainable T&C production and processes. The learning potential embedded in an **interregional exchange** will result in the **uptake of new Good Practices and projects by the partner regions** enabling to support excellence in R&D, to promote investments by enterprises, to develop innovative skills of T&C stakeholders, and in a deeper integration between research and innovation policies for the sector's sustainability. Sustainability driven research and innovation will concern primarily the production processes and product development and addresses **six key themes**:

// Recycling in textile and waste disposal
// Water consumption and energy saving, sustainable company organisations
// New sustainable chemistry, including reduction of chemical substances
// Smart textiles and new ways of production
// Eco-creativity, natural fibres, short value chains
// New materials and new applications

1.2 EXCHANGE OF EXPERIENCE VIA GOOD PRACTICE EXAMPLES

The policy learning process and the resulting improvement of policy capacity of partners and regions participating in the INTERREG Europe programme are based on collecting, analysing, disseminating and transferring Good Practices and policy experience (in economic, technological, social and environmental sectors), in order to transfer and implement Good Practices developed by other regions in one's own area. Good Practices are initiatives (e.g. methodologies, projects, processes and techniques) undertaken in one of the programme's thematic priorities. To be considered a Good Practice, an initiative has to fulfil the following conditions:

- to be relevant to the project's objectives
- to provide added value
- to be proved successful and to have tangible and measurable results in achieving a specific objective
- to have the potential to be transferred to a different geographic region, i.e. to be transferred and implemented without any significant adaptations and changes in other regional and/or economic contexts

Following the above mentioned key topics, six thematic seminars were planned within the RESET project (see table below). Each partner prepares a template in advance of the seminars where the

proposed thematic Good Practice is explained following a certain scheme. During the seminars, this Good Practice example is presented more in detail to a broad audience from industry and policy.

No.	Title	Venue	Date
1	Recycling in textile and waste disposal	Alcoy (ES)	October 2016
2	Water consumption and energy saving, sustainable company organizations	Vila Nova de Famalicão (PT)	January 2017
3	New sustainable chemistry, including reduction of chemical substances	Bucharest (RO)	April 2017
4	Smart textiles and new ways of production	Chemnitz (DE)	June 2017
5	Eco-creativity, natural fibres, short value chain	Lodz (PL)	October 2017
6	New materials and new applications	Huddersfield (GB)	January 2018

After each seminar, all Good Practice examples are assessed by the project partners together with their regional stakeholders. Hereby, the Good Practice evaluation criteria follow the RESET methodology. The most important evaluation criteria are:

Evaluation criteria	Description
Strategic relevance	long-term impact on the policy theme
Evidence of success	tangibility (concrete results/outputs measured through indicators), durability (potential to become a durable model) and visibility (communication and dissemination activities)
Added value	effectiveness (tangible achievements and results of the practice and the resulting benefits for the different stakeholders), innovativeness, efficiency, (amount of resources required for the implementation of the GP)
Transferability	the potential of the practice to be adapted to and adopted in different contexts and regions (replicability) and transregional or transnational collaboration

To simplify the assessment process, a template for an easy evaluation of the GPs was developed by the partners (see Figure 1). An assessment score from 1 (least relevant) to 5 (most relevant) was introduced and the template is sent out by STFI (Exchange of Experience Manager in RESET) after each Interregional Learning Event (ILE) to be completed by the partners. Each partner has to assess the GPs for each topic concerning the above mentioned criteria.

RESET Interreg Europe / European Union European Regional Development Fund	*Dear partners, please use the present questionnaire to evaluate each GP according to the RESET methodology.* *You can score the relevance of the GP for your region on a 1 - 5 scale:* *1 least relevant - 2 less relevant - 3 relevant - 4 very relevant - 5 most relevant*													
Policy Theme	**Title of Seminar**			**Name of project partner**										
	Title of the Good Practice	**Partner**	**Country**	**Municipality of Prato (IT)**	**NTT - Next Technology Tecnotessile (IT)**	**Lodzkie Region (PL)**	**CLUTEX - Cluster Technical Textiles (CZ)**	**AITEX - Textile Research Institute (ES)**	**TCoE - Textile Center of Excellence (GB)**	**STFI - Saxon Textile Research Institute (DE)**	**CITEVE - Technological Center for Textile and Clothing (PT)**	**INCDTP - National Research & Development Institute for Textiles and Leather (RO)**	**CETI - Centre of European Textile Innovation (FR)**	**Total Score for each GP (average)**
GP1														
GP2														
GP3														
GP4														
GP5														
GP6														
GP7														
GP8														
GP9														
GP10														
	Best GP examples (each partner)													

Figure 1: Good Practice evaluation template

A ranking of the scoring results has to be done and the two GP examples with the highest scoring will be presented in the **GOOD PRACTICE HANDBOOK**

2. GOOD PRACTICE 5 "ECO-CREATIVITY, NATURAL FIBRES, SHORT VALUE CHAINS"

THEMATIC INTRODUCTION

The key priorities of long-term industrial policy for the textiles and clothing sector are to increase investment leading to the growth of innovation and creativity potential and to increase the efficiency of enterprises in the sector. Eco-friendly textile goods and technologies that minimize power consumption, CO_2 emissions and the volume of waste generated at every manufacturing stage, are a priority for the textile and clothing sector, stimulating the development of modern technologies in European regions. This priority is implemented by gradually adopting measures focused on the implementation and modification of eco-friendly goods and technologies including:

- eco-creativity from concept design until implementation into industrial practice, which focuses on maintaining a balance between the innovation level of a product and technology, its price, competitiveness, and its impact on the surrounding ecosystem;
- maximizing the use of natural raw materials and their novel modifications, as well as eco-friendly technologies;
- comprehensive and careful evaluation of the time taken for a new product to be introduced to the market and the guidelines of its useful development after the warranty period.

2.1 SHORT INTRODUCTION OF 10 REGIONAL GOOD PRACTICE EXAMPLES ON "ECO-CREATIVITY, NATURAL FIBRES, SHORT VALUE CHAINS"

On 17th October 2017, the 5th Thematic Seminar of the RESET project took place in Lodz (PL) organized by RESET partner Lodzkie Region (see Figure 2). Project partners as well as several European experts presented a series of Good Practices and results of actions related to "Eco-creativity, natural fibres, short value chains" (see Figure 3).

Figure 2: Impressions of 5th Thematic Seminar in Lodz (PL)

Policy Theme 5: "Eco-creativity, natural fibres, short value chains"- coordination by Lodzkie Region (PL)			
	Title of the Good Practice	**Partner**	**Short Description**
GP1	**Okra Fibres: Properties and Possible Applications -** Dawid Stawski, Lodz University of Technology	Lodzkie Region (PL)	Natural materials are always important alternative for chemical products, because of its environmental friendly behaviour, like biodegradability and originating from renewable row materials. In this group of materials natural fibres play significant role. Typical natural fibres as cotton or wool are using in many applications, but they are quite expensive and there is limit of accessible sources. In this description we would like to present new type of natural fibres - obtained from okra plant. This is a group of stem fibres. The geographical origin of okra is different, with supporters of West African, Ethiopian, and South Asian origins. Generally okra is cultivated in tropical, subtropical and warm temperate regions around the world. Okra plant is valued for its edible green seed pods, and the steam is waste. Our idea was to use steam okra fibre as a reinforced material or natural component for different type of composites. During our common investigations we analysed fibres initially prepared at Pammukale University in Turkey. In Łódź we made mechanical investigations, FTIR spectroscopy, electron microscopic views, UV radiation stability tests and deep thermal analysis (in nitrogen and oxygen atmosphere).
GP2	**Lighter than light – Potential of blends from natural fibres and recycled carbon fibres for lightweight applications -** Bernd Gulich & Anna Große, Saxon Textile Research Institute	STFI (DE)	Natural fibre reinforced composites (NFRC) have been well-known in the production of moulded parts for the automotive industry for a long time. Currently, an increase in applying such material solutions can be noted. The described project aimed at the development of natural fibre reinforced composites produced from natural fibres of greater length by means of textile-technological methods and matrix materials also applied in fibre shape. Motivation of the project idea was to use the knowledge in plant fibre processing and carbon fibre recycling existing at STFI for the application of reclaimed carbon fibres in newly developed products at attractive price ranges. The focus of the project was on a significant weight reduction of fibre reinforced moulded parts for the automotive industry (such as pressed needle-punched nonwovens) while improving or at least keeping at the same time selected mechanical properties. The effect of partial substitution of natural fibres used as reinforcing material by reclaimed carbon fibres was investigated for textile basis materials (nonwovens) from blends of natural and thermoplastic matrix used so far. A technically and economically acceptable optimum to replace natural fibres by carbon fibres should be found exploiting the up to 13 times better specific E-modulus of carbon fibres and where weight reductions of up to 20% compared to currently used systems can be achieved.
GP3	**Digital Heritage -** Lorena Vidas & Besnik Mehmeti, Municipality of Prato	Prato (IT)	Over the last few decades, the economic crisis and de-industrialization which have affected the European textile sector have resulted in the loss of many textile archives. The failure of businesses and the consequent closure of their warehouses has caused the loss of hundreds of textile samples and designs. In order to avoid breaking the line of continuity which joins past and future

			textile production - a fundamental feature of European excellence in the fashion sector - it is necessary for industrial districts like Prato to protect its textile heritage. The loss of the textile heritage has been accentuated also by substantial lack of a culture of conservation in the textile industry. Even in those companies that have succeeded to maintain their historical archives, in most cases, these are poorly accessible and unexploited, ending up to represent an unproductive clutter rather than an economic resource. Today, when the distinguishing feature of the quality and prestige of the European textile and clothing industry vis-à-vis its international competitors stands also in its cultural and emotional value, the enhancement of the local textile heritage is paramount. In fact, this material – sample books and data sheets, in the case of textiles - is of great value. By preserving the manufacturing memory of the area and of individual companies, it contributes almost unconsciously to the preservation and transmission of the 'know-how' and the enormous wealth of tacit knowledge of a T&C district. Above all, when it is properly stored, catalogued and digitized, making it available for consultation both internally and third parties, it can represent a significant resource for designers.
GP4	**Eco-creation thanks to Design Thinking -** Thierry Leblan, Centre of European Textile Innovation (CETI)	CETI (FR)	The GP has been developed in CETI to help our customer and our staff to bring some solutions to various problems or to study an idea on different aspects. During these R&D works the GP was to begin the development by defining precisely the needs of the "customer" without taking account of the technological possibilities. The goal is to evolve from a classical design to a designed innovation taking into account various aspects of the innovation and the eco-conception will. This is done with the help of a special software which offers a method for this step.Then when the need is well defined, we can look for the best solution available on the market or to develop and the partnership to build. This method avoids to develop product which do not match with market and are designed just for the buzz which can be done with them.
GP5	**BleNaBIS (CORNET) – Complex utilization of natural (linseed flax waste) and biosynthetic (PA) fibres – step forward to the bioeconomy and textile resource sustainability -** Jan Marek, inotex	CLUTEX (CZ)	BleNaBis project aims to develop an innovative yarn from oil flax straw (a waste stream obtained during the harvesting of oil flax) and bio-based polyamide (BioPA). This innovative, blended yarn will enable the production of home textiles showing less environmental impact but are qualitatively and economically competitive with traditional product equivalents. This will be demonstrated within the BleNaBis project choosing the pile yarn material of a carpet as the application for the innovative blended yarn. This demonstration offers high potential for reducing greenhouse gas emissions since the production of conventional pile yarn causes 45 % of the Global Warming Potential (GWP) for the total carpet.
GP6	**WOOL4BUILD - Isolation material for eco-building based on natural wool -** Oscar Calvo, Textile Research Institute (AITEX)	AITEX (ES)	In the construction sector, where we can find different types of materials and technical solutions, there is an increasing demand for more environmentally friendly products that keep their natural properties. Beside the most common mineral insulation, there is a variety of natural and

			sustainable materials attempting to claim their space in the world market. These organic materials have very interesting technical features but are harshly penalized by having to compete with materials manufactured on a large scale. The aim of WOOL4BUILD project has been to develop a sustainable product for buildings insulation based on the wool wastes produced in the tannery industry, with improved performance in the acoustic and thermal insulation values. WOOL4BUILD products provide a number of environmental advantages, such as reductions in the consumption of non-renewable resources and less building waste, making them the ideal materials for sustainable construction and environmentally friendly buildings.
GP7	**The World's only Natural FR System -** Craig Lawrance, Textile Centre of Excellence (TCoE) Huddersfield	TCoE (GB)	The use of chemicals to create a Fire Retardant fabric is commonplace and as such creates a practice that has a lasting effect on the environment. Due to continually changing regulations and legislation, new chemistries must be found to replace those that have been deemed no longer suitable, and banned. These new chemistries are still in their infancies and are not as efficient as those they are replacing, and potentially still harmful to the Environment. Camira fabrics have for a long time looked at ethical and environmentally friendly ways of producing Textile Fabrics and reducing their carbon footprint. Camira have a long history in creating Upholstery and Contract Fabrics which must meet many different internationally recognised fire and flammability Standards and also look at using renewable sources for their fibres, mostly naturally occurring, and recycling as much as possible to create a closed loop manufacturing process.
GP8	**Romanian Angora Mohair Fibres: from acclimatized Angora goats to final textile products -** Lilioara Surdu - National Research & Development Institute for Textiles and Leather (INCDTP)	INCDTP (RO)	In Romania, the manufacturing of natural fibers was a tradition, our country being a traditional producer for hemp-flax and also wool. Regarding the wool fibers, Romania was a traditional producer, Merino wool fibers (20-23 microns) being recognized for manufacturing knitted fabrics with superior features. After 1989, the number of sheep gradually decreased. Due to uncontrolled crossbreeding the quality of wool fibers was negatively affected. Currently, it is found that in the predominant race, Turcana, the fiber characteristics have changed: increased diameter: 30-35 microns, the degree of whiteness has decreased. Basically, the reality is that the Romanian textile industry is dependent on the imports of raw material, natural and chemical fibers. In this context, at INCDTP we consider that it is our duty to promote the revival of production of natural fibers and fabrics made of natural fibers. Despite this expansion of the production and processing of chemical fibers with extremely diversified and sophisticated characteristics, the specific properties of natural fibers and especially those of animal hairs could not be equalized. The use of these precious raw materials, the so-called noble fibers or "luxury hair fibers" overcame the barriers of "luxury" products, becoming a characteristic of the textile product market in the last years. In Romania, Angora goats were brought under the form of donations, in order to reinvigorate Romanian livestock farms. INCDTP initiated in collaboration with the FERM PROD ltd company from Braila county (area favourable in terms of environmental conditions and climate) an acclimatization project in Romania of a nucleus of Angora goats.
GP9	**CORK-A-TEX YARN: Eco-Creativity in Home Textiles with Cork** - Albertino Oliveira, SEDACOR	CITEVE (PT)	Cork is a natural, recyclable, reusable and environmentally friendly product, presenting itself as a solution of value and differentiation in markets such as architecture, fashion and furniture, being the target of increasing demand in the global market. In recent years cork has inspired designers, artists, stylists, architects and other professionals that believe in eco-design and sustainability, and that have become interested in natural materials. Cork-a-Tex project aimed at the development of high performance products incorporating simultaneously the properties of textile substrates in terms of comfort, touch and aspect, and additionally incorporate cork's functional gains such as lightness, thermal insulation, anti-dust properties, water- proofing, etc. Simultaneously it was intended to promote the eco-friendly concept and contribute to the

			increase the sustainability of products through a renewable resource - the cork. The main motivations are: to re-use cork waste from cork stoppers and other applications for a new textile solution, to develop and scale-up textile yarns incorporation cork through chemical bonding, that can be transformed into textile structures, while maintaining the characteristics of the textiles and the added value of cork, stimulate and promote the eco-design and "made in Portugal" product concept, create goods and services with higher added value, with a strong export component.
GP10	**Plissettatura Rosalba: handcraft and textile art mixed with product innovation -** Enrico Venturini, Next Technology Tecnotessile	NTT (IT)	In a reality like the one of subcontractors, getting acquainted within the commissioners is a necessity, especially in such a specific field as pleating. To stand out from the other companies in the industry, Plissettatura Rosalba decided to focus on the communication and the need to hit the potential customer by showcasing company skills, by the production of samples and the investment in innovative materials and techniques. Investing in natural raw materials, combined with the use of recycled materials within production, and the attention to fashion trends has enabled a large and varied portfolio of products able to attract new customers, both nationally and internationally, from small to big branding companies.The main stakeholders of this GP are new customers and companies, and the industrial territory where the company is located. The company represents one good example of subcontractors of the area, as it is part of the production process and contributes to the realization of added value to textile products manufactured in Prato and marketed worldwide.

Summary and notes of the Brokerage event

After the presentation of the regional GP examples, a Brokerage event and B2B meetings took place. GPs were discussed among the partners and participants. The main issues of this are listed below.

This report present the key points retrieved from the discussions between the stakeholders and the audience of the seminar. It was compiled by Lodzkie Region with the contributions from the stakeholders that presented the Good Practices of eco-creativity, natural fibres and short value chains.

GP 1: Lodzkie Region

Craig Lawrance from TcoE: During the discussion main assumptions and results of the good practices "Okra Fibres" and "The World's only Natural FR System" were discussed. Questions about the details of technological processes were answered.

GP 2: Saxon Textile Research Institute (STFI)

Thierry Leblan from CETI

Question from **CETI** on STFI´s new equipment and machinery in the field of carbon fibre recycling and nonwoven production

A: In 2017 **STFI** has opened a new Center for Textile Lightweight Engineering with following technologies for processing carbon fibre waste into nonwovens in a semi-industrial standard:

•Cut- und Tearing technologies to transfer dry textile waste of high-performance materials (especially made of carbon fibres) into applicable fibre layouts for further textile processing

•Carding technologies for processing of high performance fibres into mechanically bonded nonwovens, realized by using carding machine, cross-lapper, needle loom and/or stitch-bonding machine (working width 100 cm)

•Random web technology for processing of high performance fibres into mechanically bonded nonwovens, realized by using airlay random carding machine, needle loom and/or stitch-bonding machine (working width 100 cm)

Jan Marek from INOTEX Ltd

Question from **INOTEX** if linseed fibres can be mixed with carbon fibres, to test if very light structures for composite production can be achieved (accordingly to the presented GP from STFI)

A: It depends on the length of the linseed fibres and their quality after conventional harvesting methods and retting. It would be a starting point to test if **STFI** can produce nonwovens from the linseed fibres **INOTEX** already has in stock. **INOTEX** will check if they can send 10-20 kg of their fibres to **STFI** for pre-trials.

Oscar Calvo from AITEX

Question from **AITEX** how the nonwoven structures presented in **STFI**´s GP are impregnated with resin.

A: STFI explains that PP fibres are mixed with hemp and recycled carbon fibres, processed to nonwovens and then are pressed under high temperature to the composite structures; hence PP fibres are acting as matrix material in the composite, there is no need of further resin application

Question from **STFI** if the wool manufacturer is situated near Alcoy.

A: No, the majority of the wool manufacturers are situated in the north of Spain, the wool that was used in the project is a waste material from leather production, that is also the reason why it is in such a clean condition
Q: What is the amount of the wool fibres?
A: 1000 tons/a

Craig Lawrence from Textile Center of Excellence (TCoE)
Q: TCoE asked which natural fibres can be processed at **STFI**.
A: All kind of natural fibres are processable, e.g. hemp, flax, jute, banana, …
Q: Was it problematic to bond the webs with needle punching since carbon fibres where used
A: There is a little breaking of the fibres but no major problems. The nonwovens are "only " the intermediate step to achieve the composite structure.
Q: Are there problems with the application of the material in cars since carbon fibres are conductive. Is there the possibility of electrical interference?
A: No there are problems with the application. The parts are also covered by upholstery material.

STFI is interested in the effect why mixtures from wool and hemp fibres do not burn, but the materials on their own do. **TCoE** explains that this relates to all bast fibres, e.g. nettle, hemp, jute, etc. The wool is a natural flame retardant material on its own but not strong enough regarding long time flame retardency. The bast fibres enhance this effect. The best effects are achieved with mixtures of 60% wool and 40% bast fibres. The main application field of the products from company CAMIRA are materials used for e.g. seat covers for hotels, hospitals, public areas, etc.

Paulo Cadeia from CITEVE
CITEVE reports on own project where hemp fibres are used for yarn production, problem is the fibre length.
Q: Is there also hemp production in Germany?
A: There is but the majority is situated in CZ and BE. Retting is a problem in Germany due to climate conditions, but a special harvesting method was developed where the plant is cut in 3 different heights to avoid fibre damage.

GP 3: Municipality of Prato

Oscar Calvo from AITEX
Q: Can the heritage manager software be used privately by companies and can it be customized?
A: The software will be available online in the next weeks on CreativeWear web site (https://creativewear.interreg-med.eu/index.php?id=6922). Each company, or a museum can install it on its private server and use it for archiving of textile products. In addition, it can be used to upload the current collections, as a portfolio to show to clients or exhibit during the commercial events and fairs. It is an open platform, and it can be customized by the users on the basis of their needs. The graphics, technical sheets can be changed. The companies can decide to share all or part of their collections with their clients or new possible customers.
Q: Is it possible to get some training for users of the software?

A: The operational guidelines are being developed at the moment, and it is foreseen to organize a training seminar for companies by March 2018. It will be streamed online and video recordings put on the web as tutorials.

Doina Toma from INCDTP

Q: The heritage manager could be very interesting for museums cataloguing our traditional costumes and clothing. Is the software suitable for costumes archiving, or is it only made for textiles cataloguing?

A: The software is an open source platform, it can be customised for all kinds of archives. At the moment the technical sheets are made for textile samples archives, but they can be changed and adapted.

Q: We could also involve design students to work on creative reinterpretation of the traditional costumes. How can the heritage manager be of use in that and how the companies can benefit from this?

A: The heritage manager software can be used by students and/or professional designers to choose from different archives the most interesting costumes and make their own collection. This can save a lot of time for them, as they won't visit all museums and consult all the archives. The designers can develop projects together with clothing companies, interested in the production of new collections inspired by traditional costumes.

Thierry Leblan from CETI

Q: The La Piscine Museum in Roubaix has a big permanent collection of textile samples from local textile companies but they didn't digitise their archives. It could be an interesting good practice for the musem, is it possible to make a connection between the prato textile Museum and La Piscine and work on a common project on digital heritage?

A: Yes, we can send you all the material and get in contact with them in order to develop a project idea putting into connection several European textile museum and design schools. This work could be interesting for textile and clothing companies looking for new ideas and inspiration for their productions.

Good practice WOOL4BUILD presented by AITEX

Q: Is the insulation building product developed within the Wool4Build project already available on the market?

A: No, but it obtained the certification from Spanish authorities to enter the market and several companies are looking into it and considering the production.

Q: Is the insulation material made 100% from the wool?

A: No, it has up to 15% of polyester thermafiber, needed for blending of the material.

Q: In Prato we have a company that is leading the market in production of eco-sustainable building material, Manufattura Maiano. They are using wool production waste. Is the Wool4Build using the same material for this product?

A: No, we used in this project the wool tannery wastes, not processed for further textile production.

Q: What tests have been performed for this material?

A: Different tests have been performed in order to confirm the properties of the material: thermal performance of building material and products; geosyntetics – wide-width tensile test; reaction to

fire; resistance to alkaline liquids; short&long term water absorption;
acoustic absorption and flow resistance; insect resistance classification.

GP 4: CETI

Textile Centre of Excellence (TCoE) Huddersfield - Craig Lawrance
Craig Lawrence presented us a lecture about bast fibers (hemp, jute and nettle) which are used to be blend with wool in order to make yarn. We have a discussion with him about the process to make a yarn with nettle and the flame retardant functionality.
The nettle is growing without inputs and is then cut. The nettle is then ready for decortication (separation of fibers from straws as scutching for flax) and will then be cut at the same length as wool to be spinning.
Of course this plant is abundant in Europe and could become again a source of fibers as it was in the past centuries.
We know that wool has flame retardant properties. Thanks to this presentation we have seen that a blend of wool and bast fibers (in the demonstration it was hemp) had better flame retardant properties than wool alone. The char which is formed during the combustion of the fabrics made with a blend of hemp and wool resists a longer time to the one made from wool fibers. This prevents the foam behind the fabrics to burn and feed the fire.
We found this conference very enthusiastic because it opens some ways to develop a local production of natural fibers with interesting properties. This could be the subject of a structuring collaborative research project.

CORK-A-TEX YARN/SECADOR and CITEVE
During the discussion we obtained more details about this project. The cork presents different properties: low density, acoustic and thermal insulation, fire retardant (until 400°c).
We have been very interesting by the idea to coat the cotton yarn with a cork paste which gives it a new aspects and new properties. The granulometry of the cork in the coating past is 0.5 mm. The yarn can be dyed.
At this time, the cork past is coated on a cotton yarn. No trial has been made to extrude the cork past to make a filament directly.

INOTEX
INOTEX explained us what was BIOTEX: Road Map made by EURATEX dealing with bio based activity (Bio-agent, bio based material, natural fibers, biotechnologies). Some textile companies and agricultural actors are part of BIOTEX projects.
CETI would like to have more information about BIOTEX and which are the projects in preparation within this interest group.

GP 5: INOTEX Ltd.

CETI
Discussion with the Thierry Leblan about the web-based system of the design the innovation. The system is not free, but the base function of the system it is possible to test.
Regarding the Blenabis project presented by Mr. Marek from INOTEX company: Thierry Leblan and Jan Marek discussed about circular economy, the position of European technology platform for

textile on the circular economy and content of SIRA (Strategic research agenda of ETP for textile) regarding the circular economy. Mr. Marek explain the content of the Blenabis project, that is focused on the use of oilseed flax in textile industry. They also discussed the possible cooperation.

STFI

Discussion of Mr. Marek and colleagues from STFI: the discussion was about the possibility of modification of project/processes presented by STFI for using of the fibres from oilseed flax in the composites with the recycled carbon fibres.

GP 6: AITEX

National Research & Development Institute for Textiles and Leather (INCDTP)

The Romanian Textile & Leather Institute was interested in the Wool4build product (textile-based building material based on wool wastes) and its manufacturing process.

AITEX explained which is the main origin of the waste used in the GP and the possibilities to use it.

CITEVE/SEDACOR

A discussion about the industrial stage of the product was carried out. **CITEVE** and **SEDACOR** explained that the yarn is currently in a pre-industrial stage and partnership is trying to increase the capacity of production.

Further industrial exploitation of the product could be considered under 2 different ways to be explored by the company:

- Licensing.
- Selling

In addition, both sides (**CITEVE/SEDACOR** and **AITEX**) talked about the possibilities to dye and/or finish the yarn and fabrics manufactured with it. It could be potentially dyed or finished, but testing would be required. For further cooperation projects in this way (e.g. SUDOE) Spanish partners could participate for validation and launching of new products based in this yarn (nonwoven manufacturers, garment manufacturers, etc.):

Municipality of PRATO

About the GP presented by **AITEX**, **Municipality of Prato** explained that some companies in Prato are manufacturing these kind of panels (e.g. Manifattura Maiano SpA). To manufacture these kind of panels similar to Wool4build product sheared wool is used, that is not suitable to be transformed into fabrics and yarns. It's a waste coming from wool companies; in the case of Wool4build the waste comes from the same company that processes natural leather (skin) from sheeps: it isn't a wool company.

About GP3 presented by Prato, the partner explained that the main purpose of this GP (archive of samples and digitalization) is to provide new tools for designers and creators:

- Marketing purposes.
- Story-telling concept.
- Inspiration for further collections and designers.

- Avoid them to move to the physic place where the samples are located (museums, companies, etc.) and provide this info via a digital media.

STFI

A short discussion was performed between **STFI** and **AITEX** about the technologies and materials for manufacturing nonwovens and composites.

Centre of European Textile Innovation (TCoE)

A discussion about the possibilities to use the yarn was open. Craig informed that this natural-based FR yarn is available in the market and licensing isn't required for using it.

Suppliers, possibilities of blending, etc. is a kind of technical info that's available at the website of the entity in charge of the development of the product.

GP 7: Centre of European Textile Innovation (TCoE)

CETI, STFI & NTT

A question was asked regarding fibre length requirements. I explained that the bast fibres would need to be cut to match the length of the wool so as to execute a compatible blend.

The next question was in regards to growing of the bast fibres. I explained that in the UK, the Industrial Hemp plant is grown under a licence from the UK Government, and uses the plant with minimal THCs, thereby having no benefit to those seeking psychoactive effects, and that nettles could be grown on any land providing the potential for additional income for land owners.

I was asked what process the fibres needed to be put through in order to convert to a yarn. I explained that the system used is the woollen system, whereby the fibres are blended, carded through a traditional woollen system card and a slubbing is produced. This slubbing is then ring spun into a yarn. The process is a dry one.

I was then asked whether higher levels of bast fibre could be used other than the 60/40 or 75/25 wool/bast mix. I explained that it was predominantly the wool that is inherently Fire Retardant and that the Bast Fibre enhances the char that is produced by the wool. If there is less wool used than bast then the Fire Retardant properties are reduced.

AITEX

Oscar asked the same questions as above, however he additionally asked whether the process was patented. The answer is no, there is no patent on the process or Good Practice.

Oscar then asked whether the Company would sell the yarn direct. I advised him that he would need to contact the manufacturer direct and ask the question of them as I am not sure. However the Good Practice could be carried out in any country utilising current machinery.

He then asked with regards to success of the Good Practice. I explained that the Company had successfully rolled out the GP and that they were in the process of replacing current fabric ranges with ranges containing wool/bast blends.

GP 8: National Research & Development Institute for Textiles and Leather (INCDTP)

Craig Lawrance (TCoE)

A question was asked: why we purchase pure Angora males to preserve the specific characteristics of the breed from Turkey. Lilioara mentioned that, for us, it is more facile to purchase pure Angora males from this country.

Also, Craig wanted to know if the physical-mechanical characteristics for mohair fibers have been evaluated after many generations. Lilioara explained that the comparative study was carried out for the fibres coming from adult goats (Young goat 1 year of age). In the future INCDTP will be planning to perform such kind of study.

Paulo Cadeia (CITEVE) and Albertino Oliveira (SEDACOR)- GP 8: CORK-A-TEX YARN: Eco-creativity in Home Textile with cork

INCDTP issue of interest in the presented GP from CITEVE was: the manufacturing process of the textile yarns coated with cork additives; the behavior of fabrics made in washing processes and the types of processes used for obtaining the fabrics from this yarn.

Albertino and Paulo provided us more information about the process for the production of cork yarns. Also, Albertino presented the results obtained so far in the washing tests carried out for the fabrics made. In terms of knitting of cork yarns: still not tested, but in the near future, SEDACOR will be planning to carry out these tests.

Oscar Calvo (AITEX) – GP6 – WOOL4BUILD – Isolation material for eco-building based on natural wool

The question from INCDTP in the presented GP from AITEX was about the manufacturing process of the insulating Wool4build product.

Oscar gave us technical details regarding the steps of the technological process of mechanical and chemical processing (carding process, moth and insect finishes, FR finishes) carried out to obtain the wool4build product. Oscar explained what are the possibilities and benefits of using this product for building insulation.

Lorena Vidas & Besnik Mehmeti (Municipality of Prato) – GP 3: Digital Heritage

As regards our concern for the re-evaluation of the local cultural heritage and the promotion of traditional motifs specific to each region in the fashion collection at both national and international level, INCDTP wanted to know more about the transferability conditions of the presented GP from Municipality of Prato to other regions.

Besnik and Lorena provided us more information about the database software developed by CreativeWear Project and about the new “heritage based” business model developed.

<u>GP 9: SEDACOR Company</u>

Oscar from AITEX

Q: It was asked if the yarn is already available in the market because it could be possible that some home textiles Spanish companies could be interested to include this material in them products.

A: The results are just coming out from an R&D project. At this moment, the partnership is preparing the first industrial production by integrated the concept in the industry. Next year (2018) the product it will be available under 2 possibilities: i) to produce all the yarn and selling; ii) to give to exploitation under licence.

Q: The solution obtained under the project, particularly the cork waste, could be very interesting to make some trials with nonwovens technologies and probably it could be transferred to Valencia region to be applied in this type of industry with different solutions than obtained under the actual project.

A: answered that the partnership is open for sure to make some trials/tests

Leonardo from NTT

Q: Asked to **SEDACOR** if it is possible to explain more in detail the process and also asked if it is possible to make some trials with other fibres (natural or not).

A: SEDACOR explain more in detail the process of cork yarn, cotton based and answer that indeed it could be possible to make trials with other fibers. Indeed, the idea of the next step, after industrialization of this version with cotton, is to make some trials with other natural fibres.

Doina from INCDTP

Q: It was asked about if **SEDACOR** already made some tests about washing and if the yarn lost some proprieties

A: SEDACOR answer that the partnership did that tests and indeed there is some loss of cork but it is very few percentage. With new trials in a new yarn machine that was buy specifically for this, the partnership will start to make some new washing tests.

Q: It was asked if the partnership did some tests/trials knitting, using this cork yarn.

A: SEDACOR answered that not but it will start before the end of 2017

Thierry from CETI

Q: CETI informed **SEDACOR** that has a non-woven air-lade equipment and they are interested to make some samples mixing cork samples to get possible very interesting products and

A: SEDACOR told that they are open for that.

Q: It was asked what is the dimension of cork granules?

A: SEDACOR answered that the granules of cork waste are very thin between 0 – to 0,5 mm

Q: CETI also asked if any tests were made in extrusion?

A: SEDACOR told yes but only for cork stopped. The machine design specifically for the cork industry and not a

Q: It was asked if in the loom and in the process of weaving, there exist any loss of cork.

A: Yes, little but the project is still improving to reduce the maximum of cork lost in the process.

GP 10: Next Technology Tecnotessile

Meeting n. 1 with: Albertino Oliveira from **Sedacor** and Paulo Cadeia from **CITEVE** – Good Practise "CORK-A-TEX YARN: Ecocreativity in Home Textile with Cork".

The most important questions were related to:

- The technical process for the production of the yarn
- The fibers that can be used for the yarns (natural or not)
- The kind of products made by **Sedacor**.

Albertino Oliveira explained in details the process for the production of cork yarns based on cotton.

Mr. Oliveira clarified also that the yarn can be realised also with other fibres (instead of cotton) and in the next future, **Sedacor** will try to develop the yarn with natural and synthetic fibres.

Mr Oliveira explained also that **Sedacor** still not produces protective clothing based on cork.

Possible follow up: organisation of a meeting with yarn producer in order to evaluate costs, and feasibility of the use of the cork yarn in the textile and clothing companies based in Prato area.

Meeting n. 2 with: Craig Lawrance from **Textile Center of Excellence (TCoE)** – Good Practise "The World's only Natural FR system".

The most important questions were about:

- The process to produce the yarn
- The presence on the market of the new fabric

Mr. Lawrance explained the process to produce the yarn with bast fibres; these fibers have to be cut to match the wool length in order to use the traditional carded wool system. The yarn composition is mainly with wool. The new fabric (wool+blast) is flame retardant and Camira Fabrics is replacing current fabrics ranges with this new one for contract sector.

Meeting n. 3 with: Oscar Calvo from **AITEX** – Good Practise "WOOL4BUILD – Isolation material for eco-building based on natural wool".
The most important questions were about:

- The composition of the non woven material
- The origin of the wool wastes

Mr. Calvo explained that the material is based on wool wastes blended with polyester (circa 10/20%); the polyester is necessary to make the mat more compact and solid. These characteristics are essential considering that this mat will be used as insulation material for building. The waste wool come from tannery companies which are involved in the leather production sector; the possibility to use these waste represents for these companies a new business opportunity and also a good action in terms of environmental advantages.

2.2 ANALYSIS AND EVALUATION OF GOOD PRACTICE EXAMPLES ON "ECO-CREATIVITY, NATURAL FIBRES, SHORT VALUE CHAINS"

Following the evaluation methodology, the assessment template was sent to all partners for

GP	Title	Partner	Total score
7	The World's only Natural Fire Resistant (FR) System	TCoE (GB)	39
2	Lighter than light – Potential of blends from natural fibres and recycled carbon fibres for lightweight applications	STFI (DE)	36
6	WOOL4BUILD - Isolation material for eco-building based on natural wool	AITEX (ES)	34
9	CORK-A-TEX YARN: Eco-Creativity in Home Textiles with Cork	CITEVE (PT)	33
3	Digital Heritage	Prato (IT)	30
5	BleNaBIS (CORNET) – Complex utilization of natural (linseed flax waste) and biosynthetic (PA) fibres	CLUTEX (CZ)	29
1	Okra Fibres: Properties and Possible Applications	Lodzkie Region (PL)	29
10	Plissettatura Rosalba: handcraft and textile art mixed with product innovation	NTT (IT)	27
8	Romanian Angora Mohair Fibres: from acclimatized Angora goats to final textile products	INCDTP (RO)	26
4	Eco-creation thanks to Design Thinking	CETI (FR)	23

completion. After getting back the templates, the scoring results were calculated and a scoring table created (see Figure 4).

Figure 4: Scoring table of GP examples on "Eco-creativity, natural fibres, short value chains"

2.3 DETAILED DESCRIPTION OF THE TWO GOOD PRACTICES WITH HIGHEST SCORING

Following the scoring table (see Figure 4), the GP examples presented by project partner TCoE on "The World's only Natural FR System" and STFI on "Lighter than light – Potential of blends from natural fibres and recycled carbon fibres for lightweight applications" were selected by the partners to be the most relevant GPs. Detailed description of both examples follow below.

1. The World's only Natural FR System (TCoE/GB)

Short description:
Abstract:
camira The use of chemicals to create a Fire Retardant fabric is commonplace and as such creates a practice that has a lasting effect on the Environment. Due to continually changing Regulations and Legislation, new chemistries must be found to replace those that have been deemed no longer suitable, and banned. These new chemistries are still in their infancies and are not as efficient as those they are replacing, and potentially still harmful to the Environment. Camira fabrics have for a long time looked at ethical and environmentally friendly ways of producing Textile Fabrics and reducing their carbon footprint. Camira have a long history in creating Upholstery and Contract Fabrics which must meet many different internationally recognised Fire and flammability Standards and also look at using renewable sources for their fibres, mostly naturally occurring, and recycling as much as possible to create a closed loop manufacturing process. The Good Practice utilises the long held knowledge that Wool is a very good Fire Retardant fibre and by blending it with fibres such as Hemp, Jute or Nettle Fibres, the resultant yarn or fabric enhances the properties of each fibre and creates a FR fabric which is greater in efficiency than if the fibres were used individually rather than as a blend. The fabrics have been fully tested to recognised ISO, EN, BS Standards and pass all the relevant test procedures to ensure their safety.
Resources needed:
The initial funding amounted to £350,000 granted by DEFRA, matched in kind by Camira Fabrics and necessitated the growing of Industrial Hemp or Nettles as a commercial crop by Farmers to ensure a sustainable source of fibre.
Evidence of success (results achieved):
The GP has allowed Camira to replace some of their fabric ranges with fabrics produced from these new yarns. Camira is an exporter of many fabrics and sales of these fabrics amounted to 150,000m in 2016 and are on course to achieve sales of 250,000m in 2017. Camira are looking at other fabrics in their ranges which can be replaced with these new fabrics as interest in sustainable natural products increases.
Difficulties encountered/lessons learnt:
Don't start with an idea for an end product for a fixed date. Work in stages as Camira have had to learn what makes the best blend, how to spin it, how to dye it, grow it and harvest it. Price/Performance/Aesthetics must be born in mind when creating products. Good partnerships with Growers/Farmers have to be cultivated.
Potential for learning or transfer:

Industrial Hemp, Nettles, Jute etc. all are all capable of being grown in the Northern Hemisphere in most regions. They are a crop which will require little or no Chemical Pesticide to eliminate pests or weeds as there are no natural predators. The crops will also grow so quickly that weeds and unwanted vegetation cannot compete for light therefore will not grow and strangle/affect the growth of the crop. Harvesting/Retting/Scutching etc. is already practised in various northern regions and so can easily be applied to these new crops. The GP also shows that by utilising these crops with certain keratin based protein natural fibres we can heavily reduce the amount of chemicals in use for FR where possible and product dependent. Potentially could create another source of income for local farmers/growers which could also assist in crop rotation.

Detailed description:

The continuing use of Hydro-Carbons for coating a textile product to ensure it meets stringent Legislations and Regulations in regards to performance criteria is well-known to have a harmful and damaging effect on the natural environment. The impact on eco systems in parts of the world has been devastating and it will take years, if not decades, for this to begin to reverse if at all possible. Industry needs to play a key part in reducing toxicity to the environment, whilst maintaining all safety aspects and concerns and meeting international safety guidelines. Camira teamed up with De Montfort University, Leicester, to develop an industry first fabric made from wool and nettle fibre made from the common stinging nettle. The project encompassed research into nettle cultivation on UK farmland. This involved all methods from harvesting and fibre extraction all the way through blending, spinning, weaving and dyeing. Nettles grow rapidly and grow easily on land unfit for arable crops. Nettle cultivation also encourages bio-diversity, providing a natural habitat for birds and insects. Hemp is grown as a crop under licence from the UK Government Home Office. The plant used, Cannabis Sativa, contains only minute amounts of the psychoactive substance THC. For every hectare of land 45kg of seed is sown, producing 6 tonnes of hemp straw which produces 1 tonne of hemp fibre. After harvesting the leaves decompose and act as a natural fertilizer for the following year. Jute is recycled mechanically back into fibre form from the discarded hessian which makes up the cocoa and coffee bean sacks around the world, so there is no shortage of supply. The bast fibres are blended with pure new wool and processed through a traditional woolen system to make into a yarn. The yarns are then processed normally and woven into a fabric. Wool is chosen as its smart abilities are well documented. When subjected to fire it is difficult to ignite and forms a char against flaming. This ability is enhanced further still when blended with bast fibres. The fabrics have been tested to BS7176 Medium Hazard which is the main UK Flammability Standard for contract fabrics used for commercial interiors and public spaces e.g. Public Buildings, Hotel Bedrooms, Restaurants, Places of Public Entertainment, Hospitals and Hostels. The test carried out to BS7176 is the Crib 5 process. For a flammability pass to be recorded, all flaming must cease within 10 minutes and the foam underneath the fabric cannot be burnt through its full thickness.

Stakeholders involved:

Initially, the Good Practice was developed by Camira Fabrics but the GP can be utilised anywhere in the world as it is not a patented technology and can be carried out using existing machinery and practices.

Analysis of the Good Practive:

Relevance of the Good Practice to the policy theme:

The Policy Theme of Eco-Creativity, Natural Fibres and Short Value Chains is the perfect vehicle for this Good Practice. The use of Wool and Bast Fibres make the products eco-friendly, whilst manufacturing costs of spinning and weaving stay the same, the bast fibres are extracted by Dew Retting which is a natural process letting nature destroy the pectins holding the fibres together, thereby minimizing power consumption and reducing significantly the amount of CO2 emitted into the atmosphere. Waste produced from the growing and harvesting process is either used as animal bedding and then as fertilizer or is immediately ploughed back into the soil to provide nutrients for the next crop.From concept design to manufacture, these products show an industrial balance in creativity, eliminating harmful chemical use but giving the same level of protection as before. There is a greatly reduced impact on the environment and local eco-systems but the product remains price

competitive. The fabrics take the best that nature can give in terms of functionality of the product, and in the case of Camira Fabrics, the warranty period to the consumer is stated at 10 years thereby providing insurance as to its suitability.

Evidence of success (tangibility, durability, visibility):

Success factors

The GP has allowed Camira to replace some of their fabric ranges with fabrics produced from these new yarns. Camira is an exporter of many fabrics and sales of these fabrics amounted to 150,000m in 2016 and are on course to achieve sales of 250,000m in 2017. Camira are looking at other fabrics in their ranges which can be replaced with these new fabrics as interest in sustainable natural products increases.

Difficulties encountered and lessons learnt from the practice

Don't start with an idea for an end product for a fixed date. Work in stages as Camira have had to learn what makes the best blend, how to spin it, how to dye it, grow it and harvest it. Price/Performance/Aesthetics must be born in mind when creating products. Good partnerships with Growers/Farmers have to be cultivated.

Remarks on the durability of the GP results and impacts

The fact that the textile fabrics are supplied with a 10 year warranty shows their durability. The crops can be grown on many types of land, need no insecticides or weed control, provide new opportunities for farmers/landowners to create new crops, increase turnover, provide employment and use no chemicals to create a FR barrier.

Possible leverage effect

Whilst the GP shows viability when mixing wool and bast fibres for contract furnishings, how may the idea work with other types of fibres? Camira Fabrics are to be admired for their ethos of recycling, reducing their carbon footprint to 0%, and only utilising ethically sourced renewable sources. This should be the benchmark of as many manufacturing techniques as possible.

Added-value of the practice in terms of innovativeness, effectiveness and efficiency:

At regional and transregional levels, this use of fibres can be utilized anywhere within the EU and the rest of the world where the ability to grow bast fibres exists. Wool is a product found in most areas of the world. By the utilization of this process, the Textile Industry of Europe can become greener, create new markets, employment and opportunities and create partnerships at any level with different sectors of industry.This is a totally innovative practice, which shows an effective use of nature's resources without the need for harmful manufactured chemistries. The effectiveness of the product is proven to recognized standards and would probably be more efficient across the whole fabric length/width as the fibres occur throughout the product whereas by the use of chemistry, there may be areas not covered by the required Hydrocarbons necessitating extra processing costs and time reducing efficiencies and competitiveness.

Remarks on feasibility and transferability of the GP to other regional/local contexts:

The ability to source the relevant ingredients for the making of the yarns/fabrics. There are very few regions in the EU that could not take up these innovative ideas and utilize them for the good of the regions. The manufacturing industries would have no need for the need to acquire new technology as it can all be processed n existing technology making this extremely practical and available now. Funding or research may be needed at regional level to learn and overcome any potential barriers, as Camira Fabrics did, but these barriers/problems are not unsurmountable.

Contact:

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Organisation: Camira Fabrics
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2. Lighter than light – Potential of blends from natural fibres and recycled carbon fibres for lightweight applications (STFI/DE)

Short description:

Abstract:

Natural fibre reinforced composites (NFRC) have been well-known in the production of moulded parts for the automotive industry for a long time. Currently, an increase in applying such material solutions can be noted.
The described project aimed at the development of natural fibre reinforced composites produced from natural fibres of greater length by means of textile-technological methods and matrix materials also applied in fibre shape. Motivation of the project idea was to use the knowledge in plant fibre processing and carbon fibre recycling existing at STFI for the application of reclaimed carbon fibres in newly developed products at attractive price ranges. The focus of the project was on a significant weight reduction of fibre reinforced moulded parts for the automotive industry (such as pressed needle-punched nonwovens) while improving or at least keeping at the same time selected mechanical properties. The effect of partial substitution of natural fibres used as reinforcing material by reclaimed carbon fibres was investigated for textile basis materials (nonwovens) from blends of natural and thermoplastic matrix used so far. A technically and economically acceptable optimum to replace natural fibres by carbon fibres should be found exploiting the up to 13 times better specific E-modulus of carbon fibres and where weight reductions of up to 20% compared to currently used systems can be achieved. Objective of the project was furthermore, to achieve a homogeneous blend of the fibre materials despite their different properties and processing behaviour to ensure an easy processing.

Resources needed:

Besides the availability of the needed fibre materials (natural fibres, thermoplastic fibres and recycled carbon fibres), the most challenging issue is to invest in the technical equipment where blends of natural and reclaimed carbon fibres can be processed in a proper way. To build up a recycling and processing concept for carbon fibre materials will always require investment for machinery and equipment. For the upgrading of already existing machinery approximately 0.5 to 1.0 mn € are necessary, a complete new construction with all needed machinery components will be total in ca. 5.0 mn €. On the other hand there is a cost benefit when recycled carbon fibres are used. The price per kg of “new” carbon fibres for industrial applications such as automotive industry or machine engineering amounts to 16-20 € (higher price compared to other fibres, for instance cotton, is due to more value inherent), whereas pyrolysed carbon fibres are 12 €/kg, and dry waste from production without resin and after preparation are 6 €/kg.

Evidence of success (results achieved):

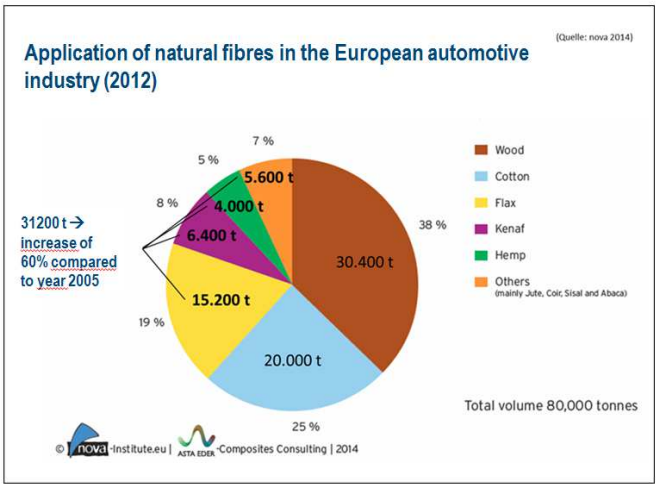
The main success factors can be seen is on the one hand the application of natural fibres (such as hemp) which is a regrowing material and therefore having a good availability throughout Europe. On the other hand high-quality recycling material (carbon fibres) is used leading to cost reduction compared to the use of “new” carbon fibre material. The carbon waste material is brought back into the production process which can safe material costs. Thus, sustainability aspects are covered by the used material components. Furthermore, the development of new products for the application in the automotive industry is boosted.

Potential for learning or transfer:

From a technological point of view, the described Good Practice is transferable to other regions provided the availability of the requested investment for machinery as well as of a sufficient quantity of natural fibres and carbon fibre waste to be recycled.

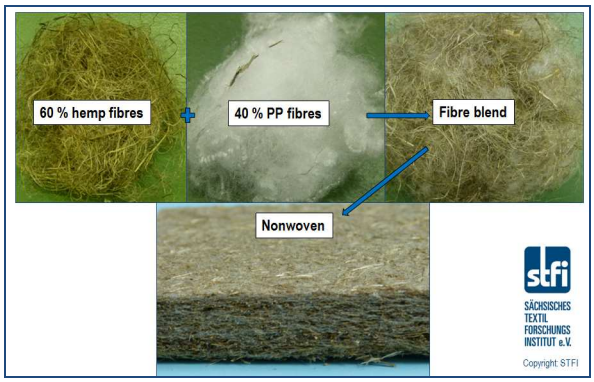
Detailed description:

Motivation of the project idea was to use the knowledge in plant fibre processing and carbon fibre recycling existing at STFI for the application of reclaimed carbon fibres in newly developed products at attractive price ranges. The focus of the project was on a significant weight reduction of fibre reinforced moulded parts for the automotive industry (such as pressed needle-punched nonwovens) while improving or at least keeping at the same time selected mechanical properties. The effect of partial substitution of natural fibres used as reinforcing material by reclaimed carbon fibres was investigated for textile basis materials (nonwovens) from blends of natural and thermoplastic matrix used so far. A technically and economically acceptable optimum to replace natural fibres by carbon fibres should be found exploiting the up to 13 times better specific E-modulus of carbon fibres and where weight reductions of up to 20% compared to currently used systems can be achieved. Objective of the project was furthermore, to achieve a homogeneous blend of the fibre materials despite their different properties and processing behaviour to ensure an easy processing.



Advantages of composites from natural fibres used in the automotive industry:

- Low density, 10 to 30 % weight reduction
- Good mechanical and acoustic properties
- Good processability
- Good behaviour in case of accidents (high stability, no splintering)
- Better ecological balance (production, driving)
- Processability analogue to GMT (glass mat thermoplastic) process and assembly without (glass)dust formation



Objective of the project:

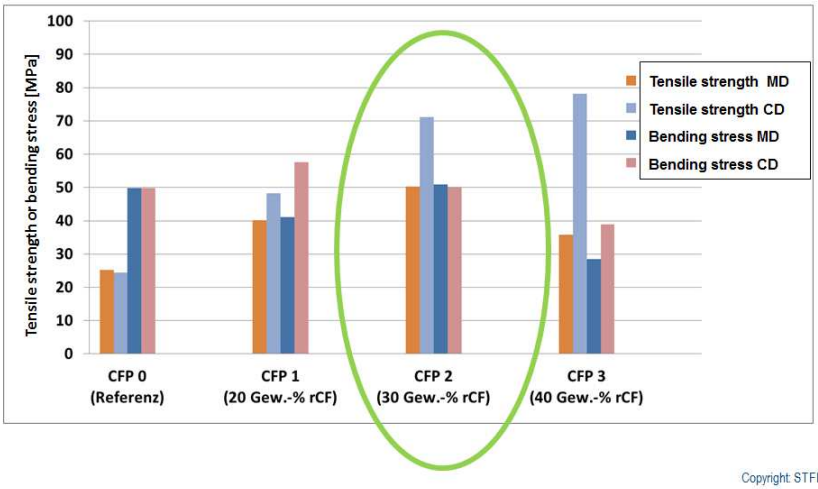
Exploitation of the potential for lightweight construction of moulded parts based on needle-punched nonwovens made from natural fibres (NF)-polypropylene (PP)-blends through partial substitution of natural fibres by reclaimed carbon fibres (rCF)

Initial situation:

- Natural fibres (NF) replaced the textile glass fibres in car interior
- Reduction of mass per unit area from 2200 g/m² down to 1800…1600 g/m²
- Usual blends are 50% NF / 50% PP or 60% NF / 40% PP

First step:

- Stepwise substitution of hemp fibres by reclaimed carbon fibres (rCF)
- Share of PP remains constant (40 %)
- Basic mass per unit area 1.600 g/m²



Second step:

- Stepwise reduction of the mass per unit area at constant blending ratio based on pre-trials
- Finding the economically acceptable optimum to replace natural fibres by carbon fibres by keeping the mechanical properties comparable to pure NFRP

Figure: Carbon fibre recycling and processing machinery/plant

Technological parameters of the carbon fibre plant:

- Working width: 0.6 m – 1.0 m
- Mass per unit area: 40 g/m² - 1500 g/m²
- Processable raw materials:
- Up to 100 % carbon fibres
- Blends with glass fibres, natural fibres and aramid fibres as well as thermoplastic fibre material (e.g. PP, PA, PPS…)

The market for automotive textiles is still the most important market for nonwoven fabrics made from mixtures of glass fibres or natural fibres as reinforcing fibres with polypropylene fibres as thermoplastic matrix fibres and therefore also for the newly developed material solutions.
In addition, a great potential is also expected in fields of application that are not currently in the focus. Examples include the market segments of public transport, mechanical engineering, furniture and architecture/construction. The use of these materials is always based on the concept of lightweight construction as a tool for resource efficiency and sustainability.
While CFRP structures (almost always based on filaments) are not uncommon in premium segments of vehicle construction today, these plastics are not suitable for large-scale production applications due to their high costs. Advantages from the partial use of the recycled carbon fibres indicated in the project arise on the one hand through the desired improved mass-performance ratio with only moderate cost increase and on the other hand in comparison to the absolute carbon fibre use (as fibre or as filament) in noticeable cost reduction and sufficient fibre availability. In Germany, 8 companies produce needle-punched nonwovens as basic material for fibre-reinforced plastics. The fibres used as reinforcing materials are mainly flax, hemp, kenaf, polyester and textile glass. As a matrix fibre almost exclusively polypropylene is used. These nonwovens are further processed as semi-finished products by a thermoplastic process (door panels, hat racks, wheel arch trays, underfloor coverings). The demonstrator component selected in the project, an automotive interior door panel, is a typical representative of the envisaged application spectrum.

The substitution of 50 % of hemp fibres by reclaimed carbon fibres allows a weight reduction of up to 50 % at same or better mechanical properties.

Stakeholders involved:

Benefits from the recycling of CFRP will have recycling companies and nonwoven producers in the field of preparation and processing of such waste materials as well as all sectors where such materials can be applied for the production of lightweight and durable composite parts such as automotive industry, lightweight engineering sector, aerospace, defence as well as wind energy sector and offshore fields. Furthermore, textile machinery producers will be involved.

Legal framework:

The recycling of carbon fibres is strongly influenced by legal regulations. Landfill of such materials is not allowed and disposal regulated by the German Closed Substance Cycle and Waste Management Act as well as the landfill regulation and further European guidelines. Landfill is therefore no recycling alternative, especially for CFRP. Legislation related to the topic is included in:

- **The European Waste Framework Directive (2008/98/EC)** sets the basic concepts and definitions related to waste management and develops a “polluter pays”- principle known as

extended producer responsibility. It requires EU Member States to apply the waste management hierarchy: prevention, re-use, recycling, recovery, and disposal.

- **German Closed Substance Cycle and Waste Management Act (KrW-AbfG) valid since 1996**
  It is the central federal law of the German legislation on waste. Purpose of the law is to promote the recycling economy to conserve natural resources and ensure the protection of people and the environment in the production and management of waste and in particular for recycling and promote other recycling of waste.

Trends in legislation tend more and more to increase producer responsibility and recycling rates as well as to reduce availability of landfill. The European Union Circular Economy Package and proposed changes to the Waste Framework Directive will limit municipal waste to landfill to 10% by 2030 but it is not clear yet how this will affect industrially derived and construction waste other than packaging (75% must be recycled by 2030).Further legislation to be taken into consideration is more of technical and safety nature when carbon fibres are processed. Very important is the personal protection (wearing protective suits) on the one hand to avoid health risks for the workers when getting in contact with the fibres/dust and on the other hand to prevent the transfer of carbon fibres into other facilities when leaving the working area (protection of technical plants against short circuits).

Analysis of the Good Practive:

Relevance of the Good Practice to the policy theme:

The key priorities of long-term industrial policy for the textiles and clothing sector are to increase investment leading to the growth of innovation and creativity potential and to increase the efficiency of enterprises in the sector. With the presented Good Practice in the field of lightweight construction, fibre reinforced plastics and composites addressed companies are enabled to improve their product range and further strengthen their sustainable approach. Eco-friendly textile goods and technologies that minimize power consumption, CO_2 emissions and the volume of waste generated at every manufacturing stage, are a priority for the textile and clothing sector, stimulating the development of modern technologies in European regions. The GP contributes to these priorities with strategies to recycle and reuse materials like carbon fibres that are produced under high energy and material consumption in new production chains by simultaneously saving of raw materials. It was also taken into account to maintain a balance between the innovation level of a product and technology, its price, competitiveness, and its impact on the environment.

Evidence of success (tangibility, durability, visibility):

GPs tangibility:

The results obtained provide a scientific step towards the development of new textile products in the field of lightweight construction and sustainable composites. They also contribute to a successful acquisition of future R & D projects. This is expected to increase the reputation of the STFI e.V. as a research and testing institute as well as a consultancy service provider. National and international cooperation on industrial level including transfer of knowledge and know-how is one of STFI's main concerns. The innovative character of the developed technology could bring thus benefits to other partners or regions. From a technological point of view, the described Good Practice is transferable to other regions provided that the requested investment for machinery is available.

Success factors

- Development of new products (lightweight construction parts, new natural fibre reinforced composites)
- Development of a process with high economic efficiency (material savings) and high performance materials as result
- Economical and high-quality material through reuse of recycled carbon and natural fibres
- High formability together with sufficient strength → new sustainable nonwovens fabrics made of mixtures from carbon and natural fibres can be used well as semi-finished products for the manufacturing fibre reinforced plastic (FRP) structures

Difficulties encountered and lessons learnt from the practice

Main challenge is to introduce the newly developed products into the market. Furthermore, the procurement of carbon fibre waste which can be recycled (waste volumes, provenance, how to maintain a consistent supply of waste) has to be ensured. Logistic systems/concepts on regional level to collect, record and sort the waste materials has to be established. To find the investment (investors or funding programmes) for required costs for machinery and equipment could also be challenging.

Remarks on the durability of the GP results and impacts

The GP addresses several currently very important and actual topics, e.g. production of sustainable materials and products, reusing valuable expensive materials as carbon fibres in new production cycles, finding application fields for natural fibres, etc. Therefore the results have an direct impact on the addressed topic "eco-creativity, natural fibres & short value chains" and are of highly interest for industrial partners in the specific application fields.

Added-value of the practice in terms of innovativeness, effectiveness and efficiency:

Good Practice value added at regional and transregional (EU) levels (relevance to organizations beyond RESET partnership)

- Gaining expertise in a specialized technological field
- Establishing innovative technologies and new products
- Meeting the requirements of customers, solving their problems with the innovative product
- Transferability of Good Practices to other regions
- Improvement and adaption of machinery and equipment for worldwide application
- Gaining cost-effective materials (compared to "new" materials) with high functionalities
- Saving of material (reduced material consumption reaching the same material parameters as conventional materials)

Remarks on feasibility and transferability of the GP to other regional/local contexts:

- Investments for establishing machinery systems and equipment (up-scaling of already existing plants)
- Procurement of raw materials; acquise of customers and establishment of a customer network
- Finding markets of sufficient size to provide carbon fibre nonwovens for further processing
- Training, education and know-how transfer by specialists and experts

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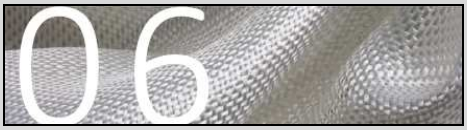
3. GOOD PRACTICE 6 "NEW MATERIALS AND NEW APPLICATIONS"



THEMATIC INTRODUCTION

Innovative textile companies operating in the field of new materials and applications are developing a range of groundbreaking, hi-tech textile solutions with a range of useful new properties. New

materials are being developed with an incredible range of functionalities, capable of containing explosions, protecting firefighters, providing anti-bacterial protection, maintaining the structural

integrity of built structures and providing high performing filtration and containment. Such developments not only improve the competitiveness of the companies involved, but also

deliversignificant environmental benefits. Both traditional and technical textiles are increasingly being used for new applications across a range of sectors. An example is the development of 3D weaving for the manufacture of components for the automotive and aerospace industries. This technology allows the production of components with the strength and rigidity of steel and the weight of aluminium. Emission targets for 2020 have made weight and strength priorities for many other sectors including heavy truck, rail, defence and the renewable energy industries. There will be other examples of leading edge new materials and applications being developed in the partners' regions and the RESET project will identify these good practices and identify options for embedding support for them in regional Action Plans.

3.1 SHORT INTRODUCTION OF 10 REGIONAL GOOD PRACTICE EXAMPLES ON "NEW MATERIALS AND NEW APPLICATIONS"

On 31st of January 2018, the 6th Thematic Seminar of the RESET project took place in Huddersfield (GB) organized by RESET partner Textile Center of Excellence (TCoE). Project partners as well as European experts presented a series of Good Practices and results of actions related to the topic new materials and their applications carried out in the main textile manufacturing regions of the EU.

Figure 5: Impressions of 6th Thematic Seminar in Huddersfield (GB)

Policy Theme 6: New materials and new applications			
	Title of the Good Practice	**Partner**	**Short Description**
GP1	**Graphene – The World's only 2D Material -** Craig Lawrance, Textile Center of Excellence (TCoE)	TCoE (GB)	New applications and materials are being developed by Companies, Research Centres and Universities to overcome many restrictions and make improvements in many areas of industry especially medical, construction, aerospace and automotive for creating lighter, stronger and more flexible substrates. Many of these new products/procedures are patented, controlled or exploited by their developers alone. In the case of Graphene, this cannot be patented as it is a natural carbon product and as such is available for any organisation to develop ideas and materials from. Graphene is a natural substance and a single layer is only 1 atom thick. It can be made several layers thick according to requirements. Graphene is an excellent conductor, extremely light and is up to 200 times stronger than steel. It can be dissolved in a liquid which allows it to be used in ink to create a printed electrical circuit for example. At the other end of the scale it can be used for Protective Personal Equipment as it could help to improve the flame resistance of the fabrics it is coated onto as well as reduce the heat penetration and also reduce the gases passing through the textile substrate. There is always the demand to reduce the impact on the Environment of man made chemicals, reduce reliance on the petro-chemical industry for products and find new ways of doing things.
GP2	**New professional antibacterial and self-cleaning insect screening** - Andrea Tagliavini, Tessitura Industriale Europea	Prato (IT)	A mosquito net offers protection against mosquitos, flies, and other insects, and thus against the diseases they may carry. To be effective the mesh of a mosquito net must be fine enough to exclude such insects without reducing visibility or airflow to unacceptable levels. For these characteristics, some nets on the market are quite fragile and not easy to clean. This is not the case of SUNOX net, in fact, one of the feature of the SUNOX net is that it is antibacterial and self-cleaning; it means that the lifetime of this net is longer and the product itself is safer than the other products on the market. After an analysis of these characteristics, along with specific market studies, TIE have decided to invest in this new product obtaining significant results.The development of this product required the support of the research center Next Technology Tecnotessile that have worked closely with the company technicians. This good practice involves: Social and ethical issues concerning the health of people; Research centers that can support the development of new ideas and new applications.
GP3	**Hospital Service Textiles - new tools employing bio and smart aiming at dematerialization and Circular Economy** - Jan Marek, INOTEX Ltd	CLUTEX (CZ)	Hospital service textiles (HST) represent one of rising textile market commodity, typical high volumes in daily use of hospital care and related institutions became part of health care, comfort and safety products with rising societal impact consequently with ageing of population. Often being categorized as PPE they are chosen by public tenders. Resulting from it combination of high quality and rising demand for functionality and comfort by extended durability (service life) require a complex innovation solutions including the whole chain of producers-users (nursery, medical staff and patients) x maintenance (laundry services – more often the shared/leasing system based) and

			supporting (more and more to the integrated ICT tending) actors. Actually – the disproportion between the lowest possible purchasing price (in case of public tenders) and requested parameters initiated a joint innovation action to solve these problems. Long term joint activity of (2) textile development centers – large Prague and regional hospitals and laundry services opened space for a systematic approach - from optimized fabric constructions, finishing (functionalization) to the daily use in real conditions and industrial laundry testing. Future need of dematerialization and circular economy practices did got a new dimension to this long term study. Results document that replacement of purchasing price criteria with cost pr one cycle of use can help to find new way to the added value market.
GP4	**Protection against piracy – Counterfeitproof thread** - Marco Barteld, Saxon Textile Research Institute (STFI)	STFI (DE)	As a result of product and brand piracy, small and medium-sized textile companies are increasingly experiencing a decline in turnover, a loss of image and extensive verification procedures for complaints or product liability. The reliable differentiation between originals and counterfeits is therefore extremely important for textile manufacturers to ensure their marketability. By the integration of technical product protection for textile precursors and semi-finished products, it is also possible to offer new products or open up a completely new branch of industry by adapting the applicable recognition technologies. To fight product and brand piracy in the textile value chain, not reproducible markings in the field of yarns are the key to a complete, safe detection of counterfeits. The production of a marked thread processed with the usual material properties has been successful. Coded micro-colour particles fixed on the thread surface ensure that a textile product is always uniquely identified by this new special yarn and, thus, can neither be copied nor manipulated. The development results will primarily support textile companies wishing to take measures to combat product and brand piracy. In the future, sewing threads with integrated marking particles can be identified depending on customer-specific safety levels or used against product counterfeiting. A distribution of the special threads is initially planned via the project partner Alterfil Nähfaden GmbH.
GP5	**Use of algae wastes to develop nonwovens and composite materials** - Oscar Calvo, Textile Research Institute (AITEX)	AITEX (ES)	Algae and seaweed accumulations on beaches and along coasts (mainly Mediterranean but also from other EU zones) are an environmental nuisance; this biomass emits unpleasant odours, promotes mosquitos and their rotting contribute to increase the high mortality in shellfish beds as they turn into rubbish. City Councils of the coastal areas are required to remove them if they want to remain their touristic conditions and their Blue Flag Beach category. It is important to remark that sand is also removed when algae residues are collected so, year by year the beach goes back and must be regenerated applying new sand. For this reason, currently the most widely adopted practice is to leave the algae residues in the coasts in winter and collect them in summer when tourists make massive use of the coastal areas. Generally, this actuation takes place within the Integrated Management System where all the marine accumulations are managed as urban solid wastes and are deposited in a landfill and/or incinerated.This GP (developed through the LIFE SEAMATTER

			project) intends to solve the environmental problem of the vegetal, algae and seaweed accumulation in the coastal while validating the best collection and transport management method for these natural wastes. This particular kind of natural residues will find application in non-woven textile industry as materials derived from marine biomass will become sustainable textile reinforcements suitable to be implemented in composite industries, specifically as acoustic panels in buildings.
GP6	**Aegis, a lightweight and flexible textile shield for construction -** Roberto Fenzi, FF Lenzi Egisto	NTT (IT)	Lenzi Egisto FF is based in Prato and it is a very important company for the production of technical textile. Its activity began in 1898 and can count on a very long history in the textile world. This GP is the result of the long experience of Lenzi Egisto FF in the world of technical textile. In particular, in 2002, in cooperation with a division of the Italian Army, Lenzi developed the innovative NYCO fabric for combat suits, nowadays used not only by the Italian Army, but by many States both in Europe and Extra Europe. This fabric is characterized by many properties, such as: tensile strength, tear and abrasion resistance, quick drying. In 2003 Lenzi Egisto has invented and developed a textile perforation resistant insert for safety and military footwear to replace old and uncomfortable steel plates. Thanks to its great comfort, ergonomic and larger protected surface, this material has been a total revolution in Safety Footwear market Worldwide, where is now employed by the majority of Safety Footwear.On this basis, Lenzi decided to exploit these characteristics to develop an innovative fabric to be used in the construction sector. The result is the fabric AEGIS which is a textile barrier created to contain components of secondary construction, which has properties of high tenacity, elasticity and flexibility. These features give to these fabric excellent properties for ensure buildings and ceilings, reducing physical damages to people.
GP7	**Advanced ballistic materials and products** - Marcin Struszczyk, Institute of Security Technologies MORATEX in Lodz	Lodzkie Region (PL)	Several new, textiles and composite materials based on the fibres are annually introduced to improve ballistic armour performance. There is a rising demand for these textiles materials and other multilayer material systems providing maximum ballistic protection with minimal mass. Over the years, fibrous matrix composites have found increasing use in armour protection systems for improving the efficiency of light to medium armour. The application of the textiles in ballistic protection is limited by required and documented resistance to the environmental factors (humidity, temperature gradient, biological factors, etc.), prolonged lifetime of the final products and the ergonomics. The developed technologies and resulted ballistic protections are applicable for: end users of the ballistic protections (services acting in security area and the military forces as well as companies responsible for securing persons and sensitive goods); manufacturers of the ballistic protections who are responsible for implementation of modern solutions into industrial practice; scientific institution as a user of the new generated knowledge for the commercial utilization.
GP8	**ACCLITEXSYS - ACCLImatisation TEXtile SYStem** - Gilda Santos, Technological Centre for the Textile	CITEVE (PT)	ACCLITEXSYS aimed to study the conceptual development and evaluation of different technological approaches for the stabilization of the soldier's body temperature. The main goal was to study the feasibility of a new acclimatisation textile system, regarding active and passive technologies that can

	and Clothing Industries of Portugal (CITEVE)		act as a temperature regulator by monitoring and responding to the soldier's body needs, considering different environment conditions.The active thermal regulation system was studied considering a fast and efficient thermal reversible solution (hot/cold). For that it was studied the feasibility of using based textile Peltier elements, air or liquid channels, forced air like micro fans or pumps. The system requires wearable electronic devices for data acquisition (temperature body sensors), monitoring and a power supply unit.The passive thermal regulation system was studied regarding the potential of spacer fabrics, deploying 3D structured fabric technologies. The main motivations are: to develop light weight space fabrics able to improve human body thermal regulation; to use a technical textile that can have multifunction's like compressibility, flexibility, air channels, moisture management, thermal resistance, in order to have one textile suitable for hot and cold climates.
GP9	**Odour reduction thanks to textile fabrics** – Thierry Leblan, European Centre of Innovative Textiles (CETI)	CETI (FR)	The background of this GP is to understand what is the origin of this phenomenon and how we can struggle against odors thanks to textiles. The first part presents the different interactions between skin and textiles, the interactions between textile, bacteria and odorous substances. Then the characteristics of odor release or retention is shown to be dependent of the nature of the fiber (synthetic, cellulosic or keratin). Then the impact of washing on the odor elimination is presented. The second part explains how the odor of textiles is tested through mainly human olfactory evaluation. The third part introduce the different processes to eliminate odours in textiles: sensory deodorization, chemical or biochemical deodorization, entrapment deodorization.
GP10	**New uses of advanced technical textiles in the aeronautical products** - Adrian Salistean, National Research & Development Institute for Textiles and Leather (INCDTP)	INCDTP (RO)	The good practice addresses to the development of an integrated management system for designing, analyzing, manufacturing and conformity assessment of paragliders, parachutes products and autonomous platforms using these.Technical textiles are increasingly being used for new applications in aeronautic product due to their multiple technical and performance characteristics like high breaking and tensile strength compared to a very low weight. High performance technologies have contributed to the creation of textiles with air permeability at very strict and well-controlled intervals, as well as a high UV resistance.The hi-tech textile solutions with a range of useful new properties have allowed the development of ultra-light flying devices from the first devices only for pleasure flight with special performances for sports competitions or actions in which the presence of man is avoided (NBC detection). The problem that good practice solves is that of labor productivity, given that the size of the manufacturing batch of these types of products is small, due to the diversification of performance and demand characteristics.

Figure 6: Overview of GP examples on "New materials and new applications"

Summary and notes of the Brokerage event

This summary presents the key points retrieved from the brokerage event between the stakeholders and the audience of the seminar. It was compiled by TCoE with the contributions from the stakeholders presented the GPs on new materials and their applications.

1. CETI (FR)

TCOE (GB): Graphene has very specific properties:

- It is ultra-light yet immensely tough.
- It is 200 times stronger than steel, but it is incredibly flexible.
- It is the thinnest material possible as well as being transparent.
- It is a superb conductor and can act as a perfect barrier - not even helium can pass through it.

Question to Craig LAWRANCE was to know if there are already applications of graphene in textile nowadays and more precisely if it was possible to insert graphene particles in filaments during melt spinning process.

In fact, although some persons would like to do so, nowadays there is no applications of graphene in the textile field. The main reason is that it takes so much time to obtain graphene that it is very expensive and not affordable for textile applications.

AITEX (ES): Oscar CALVO has presented us the **Use of algae wastes to develop nonwovens and composite materials.**The nonwovens are made thanks to the wetlaid process. My question was to know if it would be possible to use other nonwovens processes with this raw materials.If we wanted to use drylaid process with longer fibers (40 to 60 mm), the geometrical properties (length, section) of the algae are very different. So the homogenous blend of fibers and algae would be very difficult to obtain.We could try the airlaid for short fibers by cleaning, drying and milling of the algae in a first step and then mixed the algae with short thermofusible fibers (coPET) for calandering or use a chemical binder to consolidate the web.This development is very interesting because it could be part of a solution to the problem of invasion of Brittany beaches by algae.Oscar informed me also that they were involved in a project to develop natural dye-stuff from sea resources.

NTT (IT) Andrea Tagliavini presented **New professional antibacterial and self-cleaning insect screening**. The application of this auxiliary is presently made by spraying on the fabric before entering the tentering dryer. The question was about the feasibility to insert the product in the fiber during melt spinning of a bicomponent fiber. No trials have been made and there is a risk to have some adhesive problems at the interface between the polymer and the Product. To go ahead, we were advised to contact Mr Leonardo MARCHETTI (leonardo.marchetti@tecnotex.it)

2. INCDTP (RO)

a) Marco Barteld (STFI/DE)

Marco wanted to know about the testing procedures in the presented GP. Adrian replied that the numerical results for the system simulations were confronted with real test data that we had available. He also stated that when this data weren't available new tests were employed to validate the virtual results and that the confidence levels of simulated data with physical data were above 95% accuracy for all air flow and mechanical loads simulations.

b) Thierry Leblan (CETI/FR)

Thierry wanted to know what materials we use in our prototype manufacturing. Adrian replied that we mainly use imported raw materials like: parachute cloth from USA (Paragear) and/or France (Porcher Marine), parachute lines from USA (Paragear) and/or France (Cousin Trestec) and webbing from USA (Paragear) and/or Romania (Pasmatex Timisoara).

c) Oscar Calvo (AITEX/ES) – GP5: Use of algae wastes to develop nonwovens and composite materials
Interest from INCDTP in the presented GP from AITEX was: manufacturing process of the nonwovens product using *Posidonia* collected from the Valencian coast. Oscar gave us technical details regarding the methods for obtaining non-woven material using wet-laid technology. He also mentioned that AITEX possesses its own in-house pilot plant for manufacturing nonwovens using the wet-laid process. The solution provide by this GP could be adopted in the revalorization of algae and seaweed wastes from the Romanian Black Sea coast.

d) Marco Barteld (STFI/DE) – GP4: Protection against piracy – Counterfeitproof thread
Marco provided us more information about the coded micro color particles and the process used to latch these particles on the thread surface. He also let us knows that the particles raw material is polymer based and that is produced by another company from Germany. Adrian wanted to know if the process can be used to encode the marking thread of the webbing commonly used in the textile systems with critical applications in aeronautics and the answer was positive. The process is none degrading and can be applied to any yarn.

3. STFI (DE)

	Contacts STFI	Country	Comments
1	Centre of European Textile Innovation (CETI) Thierry Le Blan	FR	Question from STFI on CETI ´s new equipment and machinery in the field of textile recycling. A new technical centre will be opened up in September 2018 at CETI`s premises (funded by EFRD). Main focus will be the mechanical recycling. New machinery for that and also for sorting will be established. The waste comes from public collectors. STFI is interested in visiting the new centre to identify possible synergies of cooperation.
2	Lodzkie Region/Moratex Marcin Struszczyk	PL	STFI and MORATEX discussed about new project ideas in the framework of HORIZON 2020 as well as other funding schemes like CORNET, IRA SME or ESA tenders. Marcin will check which funding schemes would be feasible for MORATEX and give feedback to STFI. Furthermore, he is interested in visiting STFI and its technical equipment. Further arrangements are planned.
3	Textile Center of Excellence (TCoE) Craig Lawrence	GB	Referring the GP presented by TCoE, the discussion was about how graphene could be applied on textiles and which material effects and surface functionalisation could be reached. Referring the GP presented by STFI, the question was what happens to the particles when they are washed out. Investigation on this is still under progress. Furthermore, Craig explained another example for product marking by means of plant DNA.
4	CITEVE Paulo Cadeia Gilda Santos	PT	Question from STFI was on the structure of the spacer fabric presented by Gilda in the Portuguese GP and how the moisture can be regulated. Gilda gave explanations on the single layers, how the fabric structure was produced and where it can be applied. Gilda and Paulo asked concerning the GP about the counterfeitproof thread which was presented by STFI a. They asked for information on

	Contacts STFI	Country	Comments
			the washability, the amount of particles needed to guarantee protection, the prize of particles as well as the processability of the sewing thread in the ready making process.
5	Comune di Prato/FF Lenzi Egisto Robert Fenzi	IT	STFI has had an EU-project titled "POLYTECT" (in FP6) which focused also on the topic of reinforcing structural elements. A discussion on the different technical solutions took place.
6	INCDTP Doina Toma Adrian Salistean	RO	Starting with the presentation on technical textiles in aeronautical products, questions about INCDTP's own test methods were discussed. There are no special official regulations or guidelines in Romania. In the case of new applications, a database provided for this purpose is accessed. Information on external access can be requested directly.
7	MTIX LTD Pravin Mistry	GB	MTIX is interested in changing the surface or chemical composition of surfaces, especially by using laser technology or innovative finishing technologies. STFI's equipment for laser processing was explained.
8	CLUTEX/INOTEX Milos Beran/ Jan Marek	CZ	It was asked how the idea of marking sewing threads with micro-colour-particles was born. It would be also interesting to see how end consumers can recognize whether a textile is counterfeit and how reliable the unambiguous recognition by means of colour-code layers is. In addition, it was discussed whether automatic identification or automatic comparison with a central database would be possible and helpful. In this respect, technical approaches are already under research in the follow-up project "Textile label of the future".
	Further contacts		
9	University of Huddersfield Parik Goswami Mike Chadwick	GB	Information about STFI were given, especially of interest are R&D activties in nonwovens and textile lightweight engineering. The possibility of joint European projects within HORIZON2020 was discussed. Further arrangements are planned.
10	Nonwovens Network Chris Wilkinson	GB	Information about STFI were given, especially of interest is the R&D work in nonwovens. Further arrangements are planned.
11	Here2Grow Henry Brew	GB	The mutual interest in innovative product development was expressed.

4. TCoE (GB)

Adam Hainsworth (UK) asked questions with regards to the use of Graphene with staple yarns, especially wool fibres, applications where it could potentially be used. It was asked if the Graphene could take the form of sheets and be used as a laminate or infill into a garment, and probably most important the cost of the substance. Thierry Leban (CETI) enquired as the possibility of using Graphene in the wet laying process for non-wovens as well as enquiries around the cost of Graphene and the current, as yet, lack of applications for the use of Graphene. STFI enquired as to the potential use of Graphene as an ink based substance and whether it could be used to print onto any substrate as the presentation mentioned the printing of Graphene only to cotton. Christine Wilkinson (UK) enquired as to the potential uses of Graphene and discussions took place with regards to enabling SMEs to utilize Graphene, whether by collaboration with others or individually and the barriers that may need to be overcome. Christine also formally invited me to deliver the Graphene Presentation to the UK Non-Woven Network Annual Seminar.

3.2 ANALYSIS AND EVALUATION OF GOOD PRACTICE EXAMPLES ON "NEW MATERIALS AND NEW APPLICATIONS"

Following the evaluation methodology, the assessment template was sent to all partners for completion. After getting back the templates, the scoring results were calculated and a scoring table created (see Figure 7).

GP	Title	Partner	Total score
5	Use of algae wastes to develop nonwovens and composite materials	AITEX (ES)	40
6	Aegis, a lightweight and flexible textile shield for construction	NTT (IT)	40
8	ACCLITEXSYS - ACCLImatisation TEXtile SYStem: New Materials and New Applications for Defence	CITEVE (PT)	36
2	New professional antibacterial and self-cleaning insect screening	Prato (IT)	31
4	Protection against piracy – Counterfeitproof thread	STFI (DE)	27
3	Hospital Service Textiles - new tools employing bio and smart aiming at dematerialization and Circular Economy	CLUTEX (CZ)	26
1	Graphene – The World's only 2D Material	TCoE (GB)	26
7	Advanced ballistic materials and products	Lodzkie Region (PL)	25
9	Odour reduction thanks to textile fabrics	CETI (FR)	22
10	New uses of advanced technical textiles in the aeronautical products	INCDTP (RO)	22

Figure 7: Scoring table of GP examples on "New materials and new applications"

3.3 DETAILED DESCRIPTION OF THE TWO GOOD PRACTICES WITH HIGHEST SCORING

Following the scoring table (see Figure 7), the GP examples presented by project partner AITEX on "Use of algae wastes to develop nonwovens and composite materials" and NTT on "Aegis, a lightweight and flexible textile shield for construction" were selected by the partners to be the most interesting GPs. Detailed description of both examples follow below.

1. Use of algae wastes to develop nonwovens and composite materials (AITEX/ES)

Short description:
Abstract:
seamatter Algae and seaweed accumulations on beaches and along coasts (mainly Mediterranean but also from other EU zones) are an environmental nuisance; this biomass emits unpleasant odours, promotes mosquitos and their rotting contribute to increase the high mortality in shellfish beds as they turn into rubbish. City Councils of the coastal areas are required to remove them if they want to remain their touristic conditions and their Blue Flag Beach category. It is important to remark that sand is also removed when algae residues are collected so, year by year the beach goes back and must be regenerated applying new sand. For this reason, currently the most widely adopted practice is to leave the algae residues in the coasts in winter and collect them in summer when tourists make massive use of the coastal areas. Generally, this actuation takes place within the Integrated Management System where all the marine accumulations are managed as urban solid wastes and are deposited in a landfill and/or incinerated. This GP (developed through the LIFE SEAMATTER project) intends to solve the environmental problem of the vegetal, algae and seaweed accumulation in the coastal while validating the best collection and transport management method for these natural wastes. This particular kind of natural residues will find application in non-woven textile industry as materials derived from marine biomass will become sustainable textile reinforcements suitable to be implemented in composite industries, specifically as acoustic panels in buildings.
Resources needed:
Resources needed are referred to an infrastructure (machinery, vehicles, planning, etc.) required for collecting, treating and revalorizing of algae waste through a nonwoven manufacturing process. In the GP, textile machinery for nonwoven production is wet-laid. Other processes and machinery are referred to production of composite materials. Human resources (only for research and development of algae-based nonwovens and composites): textile engineers, mechanical/material engineers, industrial designers.
Evidence of success (results achieved):
SEAMATTER demonstrated that non-woven textile structures made from coastal vegetal wastes can be used as composites reinforcement in noise isolation acoustic panels and other composite structures. Wet-laid technology has been selected as the most optimum technology to transform the algae wastes in nonwovens to be used as reinforced structure. Fibrous and particulate materials can be easily applied in wet-laid process to develop nonwoven structures. These wastes have to meet some technical requirements (length, size, density, etc.) that have already been successfully studied; confirming the possibility of using these wastes as raw materials to form non-woven reinforcement. So, it is understood the positive impact of SEAMATTER project in terms of give value and recycling of the algae wastes accumulated and also it will have an environmental impact because these wastes will not have to be disposed but reused. In addition, the possibility of using this algae and seaweed residues in textile nonwoven industry with applications in building noise isolation opens a new

environmental attractive option, to design new green composites as an alternative to the conventional synthetic ones.

Potential for learning or transfer:

Key success factors for transferring are:

- Possibility of give value not only to the Posidonia Oceanica wastes but also other types of algae-based wastes.
- Acoustic isolation panels to be applied in the building sector can be obtained.
- The nonwovens developed are easily applicable also as reinforcement for obtaining composite materials.
- Public and private entities can be involved, in order to look for benefits that directly impact on the society.
- Specialization of technicians who develop products for new markets/applications. Increasing of knowledge of technicians.
- A full strategy to implement the GP is required, including some funds for implementation, machinery and auxiliary installation devices.
- Technologies to develop new products are well-known
- Specialization and re-conversion of traditional textile companies that are currently producing nonwovens or isolation

Detailed description:

The mounds of seaweed and seagrass found on beaches, known as beach-cast wrack or wrack beds, are the result of a natural process whereby these plants detach from the rocky or sandy substrates on which they have grown and are then washed ashore. Beach-cast wrack is a natural phenomenon that is usually caused by large waves and storms on the coast, which generally have a beneficial effect on the health of seaweed and marine plant populations. Wrack beds act as natural barriers against coastal erosion, form embryonic dunes, provide organic matter and nutrients to the native flora and represent a source of food for many invertebrates which in turn provide food for seabirds, insects and juvenile fish, etc. At present, beach-cast seaweed and marine plants may either be harvested, usually for industrial purposes (production of agar, carrageenan and alginates, feed for Haliotis farming, fertilisers, insulators, etc.) and agricultural uses, or simply removed, generally in response to the demands of tourism and recreational activities. The putrefaction processes associated with the decomposition of these large mounds of beach-cast organic matter can adversely affect recreational use of the area as well as possessing an unattractive appearance and an unpleasant smell. The complaints received from tourists and beach users, who are unaware of the ecological and environmental importance of beach-cast wrack, prompt the local authorities responsible for keeping the beaches clean to remove and transport wrack beds to landfill sites. However, the sudden and massive nature of wrack deposition on beaches poses serious problems as regards planning the cleaning operations required for its elimination. In addition, removal exacerbates the existing environmental problems associated with overloaded landfill sites at which no protocol or system for the disposal of low-impact wrack beds has yet been established. Nor does there exist to date a single specific system for removing beach-cast wrack or a historical record which would facilitate the development of a plan for harvesting and using this waste. Moreover, existing removal systems could present a serious threat to beaches, since they can alter coastal sediment dynamics and natural processes. This problem is not restricted to massive-touristic areas (e.g. Mediterranean coasts) and it can also be found in the North of Europe. How to manage (and take profit from) vegetal wastes coming from seas is a major problem of some EU countries. A strong collaboration between public and private entities should be required for the implementation of this GP, in order to coordinate collection of algae wastes, their classification and processing, transport to the textile company, cleaning, nonwoven manufacturing and further development of composites based on the fiberized algae wastes. Technical skills of human resources (research and development of algae-based nonwovens and composites) will be required for textile engineers,

mechanical/material engineers, industrial designers… in order to know how to manage and process this new 'raw material' coming from algae wastes.
The development of this GP (based on the methodology and results of SEAMATTER project) is detailed as follows:

- First stage to study the current situation of the management of algae and seaweed deposition wastes from the coast (municipalities and companies in charge of the management of the coastal wastes).
- Optimization of the method of management of the seaweed deposition wastes. Collection from Valencian coasts (located in El Campello, Alicante).
- Definition, selection and characterization of the properties of coastal vegetal wastes to obtain nonwovens.
- Wet-laid application to obtain nonwovens that act as reinforcement structures in composites.
- Processing of composites through different technologies with the obtained nonwoven

Stakeholders involved:

Public and private entities: AITEX (Textile Research Institute); IEL (Fundación de la Comunitat Valenciana Instituto de Ecología Litoral), Perugia University (Università degli Studi di Perugia Dipartimento di Ingegneria Civile ed Ambientale) and TEVAL (Asociación de Empresarios Textiles de la Comunidad Valenciana). For industrialization purposes some textile companies and composite manufacturing companies could be involved.

Legal framework:

This GP should be fitted to EU legislation:
- Directive 91/156/EEC of 18 March 1991, amending Directive 75/442/EEC on waste.
- Council directive 1999/31/EC of 26 April 1999 on the landfill of waste.
- Biological treatment of biodegradable waste. European Commission. Working Paper. 2001.
And some specific national legislation for each country (e.g. in Spain: Law 10/1998, of 21 April, on waste; Royal Decree 1481/2001, of 27 December, regulating the disposal of waste by landfill).

Analysis of the Good Practive:

Relevance of the Good Practice to the policy theme:

This GP is released by AITEX as an example of alternative and green 'fiberized raw material' for the development of new nonwovens and composite materials. Common materials for these purposes are based on synthetics (glass fiber, polypropylene, polyester, aramides, etc.). This GP could be replicated/implemented at EU level, as involvement of public + private partners is required and problems on coasts coming from algae wastes are so common around Europe. The GP is linked to the policy theme in terms of new materials and their applications, and new technologies to develop nonwovens.

Evidence of success (tangibility, durability, visibility):

GPs tangibility

4 different types of demonstrators were obtained after the end of SEAMATTER project: a wall covering end-product based on a nonwoven structure, a tile (composite material with fibers coming from algae wastes acting as a reinforcement material), a decorative rafter (composite material) and a moulding-manufactured end product. Development of these demonstrators also shows the feasibility of collection, cleaning, cut and other operations to take profit from algae wastes.

Success factors

The wet-laid non-wovens have been used as reinforcement in thermoplastic and thermo-stable composites assessing their applicability in the following composite manufacturing processes: thermos-compression moulding, resin infusion (VARTM) and manual laminating (HAND LAY-UP and VACUUM BAG). We have developed a high variety of composite materials in the context of this project. Through the correct execution of the SEAMATTER Project we demonstrate the possibility of give value to the Posidonia Oceanica wastes obtaining technique acoustic isolation panels to be applied in the building sector. The non-wovens developed through the wet-laid technology from

coastal vegetal wastes are easily applicable as reinforcement for obtaining of composites through different technologies, offering good properties of acoustic isolation. Furthermore, when a good fire behavior is needed, it is possible to incorporate technical fibres with high thermal properties in the textile reinforcement process using wet-laid technology apart from fire retardant resins in the thermo-stable composites manufacturing process.

Difficulties encountered and lessons learnt from the practice

Main difficulties encountered are in relation with the classification and distribution size of the wastes (different materials can be found on the algae waste: sand, stones, plastics, etc.). In addition, algae wastes must be cut and fiberized in order to be processed by the wet-laid technology. In final products, of flame retardancy performance is required, then special fibers or chemical products must be mixed with the algae-based nonwoven.Other difficulties are linked with the profitability of the waste, as is compulsory to identify a textile company (nonwoven manufacturer) with the technical capacity of processing this special type of waste.

Remarks on the durability of the GP results and impacts

Work performed in SEAMATTER shows the possibilities to use algae wastes as a new material for composite applications based on textile reinforcement. As the problem with the generation of algae wastes on coasts is cyclical (mainly on winters due to storms and bad weather), the durability of the GP can be considered as high, as the methodology for collection, processing, processing… these wastes could be implemented whenever you want. In addition, this is not a local problem (and also not restricted to one type of algae, like Posidonia) and the implementation could be done in many locations, at national or even EU level.

Possible leverage effect to trigger further improvements in policies and know-how

New policies focused on promotion, development and/or implantation of new methodologies for collecting wastes could be launched. In addition, new technologies for traditional manufacturing sectors, and strengthening of technological capacities of textile companies could be achieved.

Added-value of the practice in terms of innovativeness, effectiveness and efficiency:

Good Practice value added at regional and transregional (EU) levels (relevance to organizations beyond RESET partnership)

Benefit of this GP in terms of regional and EU level is the potential replicability and the innovation level of the methodologies and processes/products developed. In addition, the final goal of the GP in terms of sustainability, environmental benefits and development of new eco-products is highly relevant for public/tourism, industry and end-users. Entities beyond RESET partnership could also find some benefits from this GP. Strength collaboration between industrial/private entities, public bodies and even research/academic partners could be promoted.

Remarks on feasibility and transferability of the GP to other regional/local contexts:

- Conditions for transferring the GP to other regions/countries should consider several issues:
- Enough volume of wastes for collecting them and further processing (for taking profit of them). Entity in charge of the collection should have an adequate infrastructure for it (vehicles, working force, etc.).
- A right cleaning, classification and fiberizing process should be applied on algae wastes in order to transform them in a valuable ‘raw material’ for the further development of nonwovens and composites.
- Installations and facilities to develop nonwoven products based on the wet-laid technique requires a significant investment. Other technologies could be envisaged for this purpose but background about them is not available.
- Technical skills and training of the people involved are required, in order to operate the machines properly and to know the relation between processing parameters and structure/ morphology of the products.
- Know-how and industrial property of the specific products to be taken into account.
- Possibility of give value not only to the Posidonia Oceanica wastes but also other types of algae-based wastes.
- Public and private entities can be involved, in order to look for benefits that directly impact on

the society. A full strategy to implement the GP is required, including some funds for implementation, machinery and auxiliary installation devices.
Further information:
General information of the good practice and the SEAMATTER project is available at website: http://www.seamatter.com/ Specific information about projects launched by the partnerships: AITEX projects http://www.aitex.es/innovacionydesarrollo/ ; IEL (Instituto de Ecología Litoral) http://www.ecologialitoral.com/ Perugia University (Università degli Studi di Perugia Dipartimento di Ingegneria Civile ed Ambientale) http://www.ing1.unipg.it/ ATEVAL (Asociación de Empresarios Textiles de la Comunidad Valenciana). http://www.atevalinforma.com/
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2. Aegis, a lightweight and flexible textile shield for construction (NTT/IT)

Short description:
Abstract:
Lenzi Egisto FF is based in Prato and it is a very important company for the production of technical textile. Its activity began in 1898 and can count on a very long history in the textile world. This GP is the result of the long experience of Lenzi Egisto FF in the world of technical textile. In particular, in 2002, in cooperation with a division of the Italian Army, Lenzi developed the innovative NYCO fabric for combat suits, nowadays used not only by the Italian Army, but by many States both in Europe and Extra Europe. This fabric is characterized by many properties, such as: tensile strength, tear and abrasion resistance, quick drying. In 2003, Lenzi Egisto has invented and developed a textile perforation resistant insert for safety and military footwear to replace old and uncomfortable steel plates. Thanks to its great comfort, ergonomic and larger protected surface, this material has been a total revolution in Safety Footwear market Worldwide, where is now employed by the majority of Safety Footwear.On this basis, Lenzi decided to exploit these characteristics to develop an innovative fabric to be used in the construction sector. The result is the fabric AEGIS which is a textile barrier created to contain components of secondary construction, which has properties of high tenacity, elasticity and flexibility. These features give to these fabric excellent properties for ensure buildings and ceilings, reducing physical damages to people.
Resources needed:
This good practice was developed by internal company resources and expertise. Also the equipment for the development of the fabric were internal; part of the testing and analysis were conducted in cooperation with specialised laboratories and research centres located in Prato and in Europe. The company has implemented good practices through self-financing, not having any funding at local or European level.
Evidence of success (results achieved):
The success of AEGIS is proven by the multiple possible applications of the product. Examples are: • Lightweight and elastic containment of external infill panels and solution to avoid falling

(both on existing buildings as well as for new buildings)
- Effective protection against ceiling falls and sinking
- Containing walls and cornices
- Construction of external lanes and cycle paths
- Elastic reinforcement of plasters

These results are demonstrated by both laboratories test and industrial applications of AEGIS.
AEGIS is an example of the attitude of LENZI to work on innovative products, solutions and materials; thanks to these efforts, Lenzi is able to be competitive in the technical textile world.

Difficulties encountered/ lessons learnt

Main difficult encountered has been the setting of an appropriate protection for the Polyester threads when the material is expected to be used inside plasters. Cement, lime they all have an high basic content which tends to affect Polyester fiber and degrade it during the time. Styrene Butadiene resins (SBR) have shown to provide a valid protection, and therefore a proper impregnation of SBR has shown to be the solution to overcome this difficulty.

Potential for learning or transfer:

Lenzi Egisto represents a perfect example of a company that invest a lot in research and innovation. In technical textile world, there are several sectors whit very specific needs that can be accomplished only through continuous and specific research activities. In its long history Lenzi has followed this approach reaching the market with winning products in different sectors (shoes, construction, fashion, protective clothing etc.). The successes keys are attention to the new needs, studying of new technologies, valorisation of skills of internal human resources, deep cooperation with research centres.

Detailed description:

The general raising of awareness of the relevance of prevention for avoiding accidents and damages in case of earthquakes and similar events is one of the outstanding trends of the last years. Consumers and public institutions have understood the benefits provided by a product that can limit the damages for people and buildings due to unpredictable events. This good practice involves:social and ethical issues concerning the safety of people and buildings, research centers that can support the development of new ideas and new applications.AEGIS is an innovative fabrics that works as a textile barrier to contain components of secondary construction. It can be applied to the partition walls and fixed to the structure at the same time: the panels thus secured to the structure are prevented from tipping and rolling out and, in the event that their breakage, any projection of their parts and fragments into the surrounding space is blocked and they are held back by the coating fabric itself. The fabric is characterized by flexibility, elasticity , lightweight, extremely easy to apply (no specialized work force is needed) and is able to contain and absorb impacts, fractures and structural failures. AEGIS textile reinforcements are available in two main types:

<u>High Tenacity Polyester WITH Stainless steel threads:</u>
HERMES , Leno weave structure 2 cm x 2 cm
ATHENA , a one by one weave of 1 cm x 1 cm
<u>High Tenacity Polyester WITHOUT steel:</u>
EFESTO, a closer weave of 0,4 x 0,4 cm
Versions with steel wire have preferential use inside plaster in cementitized mortar, since the steel, bonding to the cement, originates an effective armed plaster.

The versions without steel wire have a preferential use for the application on the outer of plaster, as in the case of use suspended ceilings (in this case with flame retardant treatment).

The versions without steel wire is also used when applied directly to the outer of plaster, fixed to the structural part of it, to stay face view, as in the case of use coated to the ceilings (in this case with flame retardant treatment).

Stakeholders involved:

The main stakeholders involved can be: fiber and yarn producers, testing laboratory, producers of textile fabrics, producers of technical textiles, research centers, construction companies.

Analysis of the Good Practive:

Relevance of the Good Practice to the policy theme:

This Good Practice is a perfect example for the policy theme “New materials and new applications” because AEGIS is product which summed up historical experience and innovative ideas. Both traditional and technical textile, new materials and technology are parts of this GP.

Evidence of success (tangibility, durability, visibility):
GPs tangibility: results and impacts on the partner's policy The success of the GP is evident from the interest showed by several important customers; this positive results have convinced the company to continue to invest in this products in order to find new possible application and new markets. **Success factors** The product can guarantee the following advantages: the application of the fabric is: easy, fast and cheap; it does not need usage of highly specialized labour; great safety of the man fact; it allows walls and ceiling to breath; minimum plaster usage; no significant increase of weight on structures; it can be used with any basic plasters and mortars, either cement or lime based; no alteration of structural behaviours; great versatility of use for all non structural part **Difficulties encountered and lessons learnt from the practice** When used directly fixed on the ceiling to leave it face view, the exterior aspect, with the mechanical fixing in evidence , is not always accepted. In these cases, a proper solution to mask them can be needed. **Remarks on the durability of the GP results and impacts** This project is having a positive impact on market share of Lenzi Egisto FF which are promoting the product remarking all its innovative properties. Lenzi confirmed that several construction companies have shown interest in the technological innovation of AEGIS. The market impact should guarantee good durability for this practice which will probably be followed by new investigations.
Added-value of the practice in terms of innovativeness, effectiveness and efficiency
Good Practice value added at regional and transregional (EU) levels (relevance to organizations beyond RESET partnership) Lenzi Egisto FF is a very innovative company and, in the field of technical textile, represents a reference point in Europe. The AEGIS fabric is only one examples of the typologies of products realized by this company; it can have several applications that can be also studied, analyzed and exploited by the partners of RESET project.
Remarks on feasibility and transferability of the GP to other regional/local contexts:
Conditions and requirements of GPs transferability: High density of technical textile companies in a given territory
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