GUIDE FOR SMART PRACTICES TO SUPPORT INNOVATION IN SMART TEXTILES

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GUIDE FOR SMART PRACTICES TO SUPPORT INNOVATION IN SMART TEXTILES

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Abstract: *Smart Textiles for STEM training (Science, Technology, Engineering and Math's).is an Erasmus+ project aiming to bridge Textile Companies with the Education sector via Smart Textiles Innovation and Training. Industries have been surveyed to analyze the needs for new jobs and skills in Smart textiles, contributing to improve the links with VET Schools training and closing the gap between industry and education. During the project a number of smart textiles examples and prototypes are worked to be transferred to Schools and used by students and teachers, aiming to foster STEM training. This paper presents the results of the survey applied to selected textile companies on Technical and Smart Textiles, based on data collected from 63 textile enterprises in Romania, Belgium, Slovenia, Portugal and Czech Republic. The survey identifies existing opportunities for producing smart textiles in enterprises and forecasting expected occupations and work profiles for young trainees. The guide for smart practices presents the results of this survey and aims to transfer smart practices from enterprises to Vocational Education and Training (VET) schools and young students. Providing real life prototypes and multi-disciplinary working activities on smart textiles will make textile occupations more attractive to young students, and will improve knowledge, skills and employability of VET students in STEM related fields.*

Key words: *Technical textiles, Smart textiles skills, Prototypes, STEM training, VET schools*

1. INTRODUCTION

A smart textile system has basically five functions: sensors, actuators, data processing, energy supply and communication. The progress in the smart textile domain was possible due to simultaneous development of several technological domains: synthetic fibers, textile technology, electronics and information technology.
The guide for smart practices in the textile sector aims to identify the skills needed in enterprises in order to prepare a Course adequate to the expected needs. Smart Textiles for STEM training (Science, Technology, Engineering and Math's) is an Erasmus+ project. Nicknamed SKILLS4SMARTEX the initiative aims to bridge Textile Companies with the Education sector via Smart Textiles Innovation and Training.
Sixty-three companies have been surveyed contributing to improve the links with VET Schools training and closing the gap between industry and education. During the project a number of Smart Textiles examples and prototypes are worked to be transferred to Schools and used by students and teachers, aiming to foster STEM training.

This paper presents the results of the survey, based on data collected from enterprises in Romania, Belgium, Slovenia, Portugal and Czech Republic. The research includes also seventeen smart textiles products that represent success stories from industry that are sources of inspiration to professionals and educators.
The innovation experiences and collected stories will be transferred to VET Schools, in order to prepare students to the jobs of the future. The idea is to anticipate job profiles and prepare the students with the appropriate skills.
Smart textiles products industrially produced in Europe can be used by teachers locally during the students learning process at School, they and their teachers will be invited to visit the respective enterprises and to learn more about the most modern and innovative textile enterprises in their region. Having good examples to work with, teachers and students can have more practical learning experiences, with a multilevel and project based learning of the STEM (Science, Technology, Engineering and Mathematics) subjects, in order to get skills that prepare them to the world-of-work in smart & technical textile field. Providing real life prototypes and multi-disciplinary working activities on smart textiles will make textile occupations more attractive to young students, and will improve knowledge, skills and employability of VET students in STEM related fields.

2. RESEARCH METHODOLOGY

The research was tailored according to Bardach's methodology which focuses on a smart and interesting idea in a given practice that deserves attention [1]. This type of study characterizes basic and general aspects, as well as the links between them and are thus called "smart practices" research. A methodology of Best Practice Research (BPR) has been developed, based on a questionnaire survey, which was commonly prepared by the project's partners and included aspects related to:

- Analyzing the interest and capacity of textile enterprises to perform smart and technical textiles.
- Finding the profile and the number of the workplaces needed by the textile industry.
- Identifying the availability of textile enterprises to organize one-day visits with VET students or practical training.
- Transferring the guide towards important stakeholders, such as: VET schools, professional associations, enterprises, regional educational agencies.

The questionnaire includes a total of 33 questions, some are Multiple Answering Questions where the respondent can choose between a rose of alternatives, other questions are using a Likert scale, with selectable values from 0 to 5. For common understanding of terms in what concerns technical and smart textiles, the example of a t-shirt was provided to respondents:
Level 0 = basic standard t-shirt
Level 1 = functional t-shirt with thermal properties or antibacterial functions
Level 2 = t-shirt with passive smart properties e.g. Phase Change Materials (PCM), colour change
Level 3 = t-shirt with attached components (sensors – heart rate, temperature…)
Level 4 = t-shirt with embedded components (communication sensors like GPS)
The research was based on high-value added smart textile products from industries in the partner's countries to understand the current development and the innovation in the textile sector. The data gathered from the survey will be used to identify the sources sites, namely the textile enterprises providing profiles for high value-added workplaces for young trainees.

3. SURVEY DATA RESULTS

3.1 Results of the questionnaire

The survey was conducted between January and April 2019 and produced a state-of-the-art report on Technical and Smart Textiles in 5 European countries, based on data collected from 63 selected

Textile enterprises in Belgium (10), Czech Republic (10), Portugal (12), Romania (21) and Slovenia (10).
Data collected during the research revealed that 63% of the companies are from Clothing/fashion and from Technical Textiles and invest at least 4% of their budget in innovation. Most of the companies prefer younger managers and engineers. This is particularly relevant in Portugal and Belgium, where about 90% of the companies prefer people under 40 years old.
Concerning innovation, all areas of innovation are mentioned, but technology and design are the top-rated answers. Data Capture is especially relevant for Belgium companies, in line with the evolution of smart textiles for health and sport that require large amounts of data to be analyzed. All areas concerned with technical textiles are relevant, with emphasis on technical textiles for clothing applications (Clothtech, 16%), technical protective fabrics (Protech, 13%), textiles for sports (Sportech, 11%), automotive textiles, including railways, ships, aircraft and spacecraft (Mobiltech, 11%), medical and hygienic textiles (Medtech, 10%).
It should be emphasized that more than half of the companies have still either no involvement or involvement only in first generation smart textiles. In terms of first generation (functional smart textiles) there is an emphasis on water and stain resistant, as well as conductive thermic / electric. Concerning second generation (passive smart textiles reacting to the environment), emphasis is on thermal aspects (thermally regulated, heat involving and heat fabric and storage). Colour change fabrics have been highly rated in Slovenia and in Portugal. For third generation (smart textiles with attached or embedded components) emphasis is on temperature regulating. Activity and heart beat reading are given significant importance in Belgium and Slovenia, in line with the focus on Sportech and Medtech. Interactive wear and sport jackets are the emphasis for fourth generation smart textiles (ultra-smart textiles, much more advanced, combining sensors, actuators, and communication, help anticipating needs of the wearer).

3.2 Industry success stories

The guide includes survey results resulting from the seventeen in-depth interviews with most innovative enterprises. Case studies include several areas of smart textiles, involving namely conductive textiles for several applications (optical effects / LED, shielding, measurement of vital life functions), increased thermal comfort, thermal insulation, stockings with gradual compression, etc. As an example, figure 1 presents the product LEDinTEX: a light technology that allows the use of LEDs within the curtains with Jaquard design.

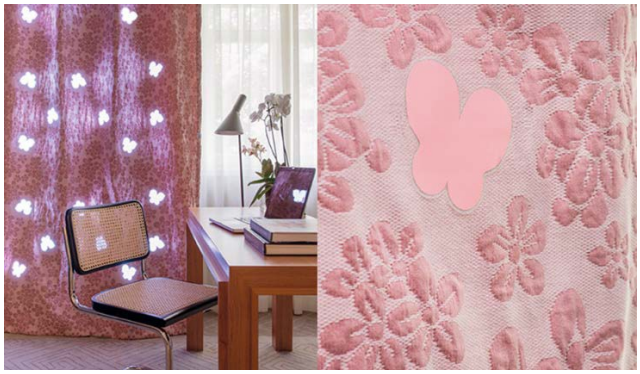

Fig. 1. *LEDinTEX (Texteis Penedo, Portugal)*

Two very interesting products developed in Slovenia are:

- a T-shirt with GPS that measures vital life functions and temperature, intended for firefighters, soldiers and policemen in the event of a life threatening.
- a kinesiological assistant, where the sensors in clothes can monitor adequacy of sport training to achieve an increase in condition and muscle mass, respectively. Adequacy is monitored in the phone application. It is intended for professional sportsman and recreational sportsman.

The smart products that have been surveyed represent opportunities and are the basis for forecasting expected occupations and work profiles. They will be used in the training actions within the SKILLS4SMARTEX project.

4. TRANSFER INNOVATIVE IDEAS TO EDUCATION ORGANIZATIONS

The main aim of the Smart textiles for STEM training project is to develop transfer of innovation strategies from research providers towards textile enterprises & VET schools. The main strategy is to link students with textile professions and with companies via existing industrial smart textiles products that are being produced in their respective regions.
The students within technical education acquire basic disciplines, such as mathematics, physics, technical drawing, chemistry, biology, mechanics, but the horizon of the end applications and usefulness of such basic disciplines is often not touchable. In correlation with these facts, the Skills4Smartex project is centered on improving knowledge, skills and employability of VET students in the STEM related fields, by providing the adequate examples from industry and the adequate training instruments to students to understand multidisciplinary working.
The state of the art in the textile sector, together with the Industry success stories on Smart Textiles products allow VET Schools, their teachers and students to analyse a with range of examples from industry that can be inspiring for the work within a STEM practice in the classroom. Visiting the companies and getting the chance to develop real word prototypes will foster the development of skills and can be an attractive way to shorten the distance between students, VET Schools and the job profiles needed in the industry in each textile region involved in the project.
It is expected that thanks to project dissemination the results can be further transferred to other textile regions in Europe.

5. CONCLUSIONS

The guide for smart practices is the supporting raw material for the development of the project e-learning course on smart textiles for textile professionals. Main aim is to offer learning content in advanced textile fields and innovative solutions, especially smart textiles, for the textile enterprises, represented by these professionals.
Smart textiles are nowadays used for various application fields within clothing, home textiles and technical textiles applications and have overcome the barrier of classical products. Examples collected from textile companies in Belgium, Czech Republic, Portugal, Romania and Slovenia include sports, medicine, buildings and defense-military applications. They combine textile technologies with electronics, chemistry, physics, and informatics and they represent a multidisciplinary domain.
The quality of Vocational Education and Training (VET) in technical fields at European level means competitiveness leverage in the international context and more interconnection between the ecosystem created by Industry, Research organizations and Professional Schools. European VET schools have a good performance and a strong tradition, however, the key competences and STEM multidisciplinary learning capacities have to be increased. The speed-up of technological development is an opportunity for the young VET students, while the development of the textile industry needs new job profiles including well prepared specialists in multidisciplinary fields.
The European Textile labor market needs appropriate skilled professional workers, in order to compete on the global markets and this Guide intends to be a contribution to it.

REFERENCES

[1] Blaga, M. at.al (2019). Smart education for smart textiles, Autex2019, 19th World Textile Conference on Textiles and Crossroads, Ghent, Belgium.