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## SMART TEXTILES TO PROMOTE MULTIDISCIPLINARY STEM TRAINING

DOI: 10.35530/TT.2019.38

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**Abstract:** *Smart textiles consist of multi-disciplinary knowledge. Disciplines such as physics, mathematics, material science or electric is needed in order to be able to design and manufacture a smart textiles product. This is why knowledge in smart textiles may be used to showcase high school and university students in basic years of preparation some applications of technical disciplines they are learning.*

*The Erasmus+ project "Smart textiles for STEM training – Skills4Smartex" is a strategic partnership project for Vocational Education and Training aiming to promote additional knowledge and skills for trainees in technical fields, for a broader understanding of interconnections and application of STEM, via smart textiles. Skills4Smartex is an ongoing project within the period Oct. 2018-Sept. 2020, with a partnership of six research providers in textiles [www.skills4smartex.eu](http://www.skills4smartex.eu).*

*The project has three intellectual outputs: the Guide for smart practices (O1), the Course in smart textiles (O2) and the Dedicated e-learning Instrument (O3). The Guide for smart practices consists in the analysis of a survey with 63 textile companies on partnership level and interviews with 18 companies. Main aim of O1 is to transfer from source site to target sites technical and smart textile best practices and the profile of workforce needed for the future textile industry. The needs analysis achieved within O1 will serve to conceive the Course for smart textiles with 42 modules (O2), to be accessed via the Dedicated e-learning Instrument (O3). All outputs are available with free access on the e-learning platform: [www.adva2tex.eu/portal](http://www.adva2tex.eu/portal).*

**Key words:** *vocational education and training, mathematics, physics, material science, electric, interconnections.*

### 1. INTRODUCTION

Vocational trainees and students in basic stage of higher education learn a series of theoretical disciplines and they are eager to get the touch of practice, to understand final applications of their knowledge. STEM stands for Science, Technology, Engineering and Mathematics and often, education in these fields requires interconnection of theory and practice. Multi-disciplinarily is a modern way to tackle new research domains and students have to learn how to apply various disciplines. For all these challenges, the project Skills4Smartex offers a solution via applications of smart textiles.

Smart textiles combine knowledge in material science, mathematics and physics as well as electrotechnics. Smart textile prototypes are an excellent way to showcase final applications of multi-disciplinary domains.

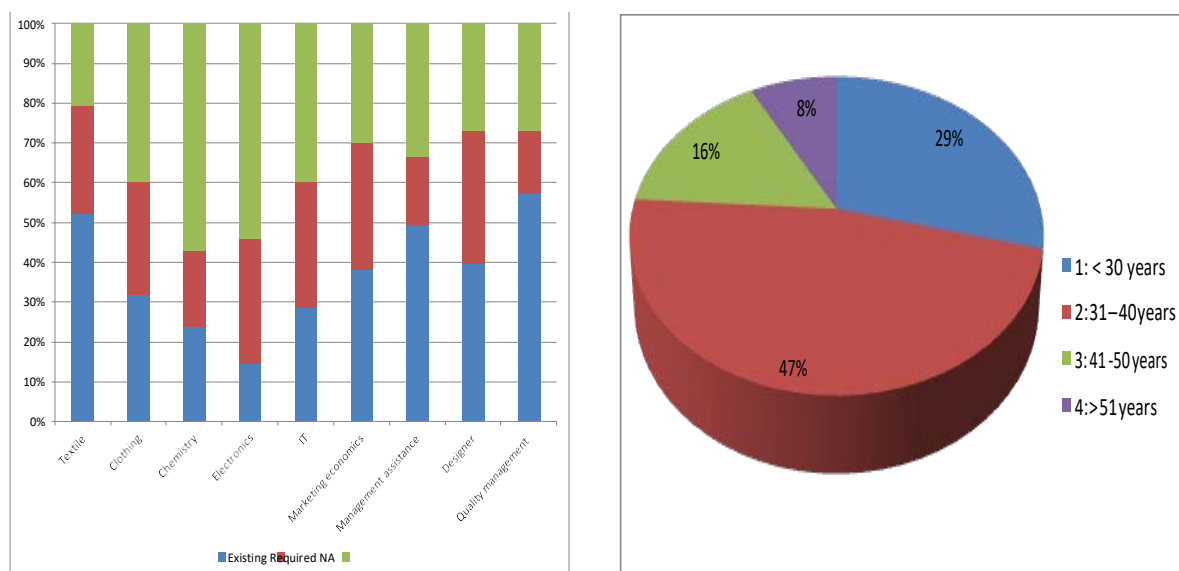
Erasmus+ Skills4Smartex “Smart textiles for STEM training” is a strategic partnership project in the field of Vocational Education and Training, for the period Oct. 2018-Sept. 2020.



Skills4Smartex includes a partnership of six research providers in textiles: INCDTP-Bucharest coordinates a prestigious consortium: TechMinho-University of Minho, Ghent University, University of Maribor, Technical University Iasi and the Textile Testing Institute – Brno. The project website has the URL address [www.skills4smartex.eu](http://www.skills4smartex.eu).

## 2. RESULTS OF THE SURVEY

Output 1 of Skills4Smartex achieved to identify the needs of workforce within smart and technical textiles, by means of a questionnaire based survey, with 34 questions. The elaborated questionnaire was sent to a number of 63 textile companies on consortium level, from countries like Belgium, Czech Republic, Portugal, Romania and Slovenia. The results of the survey are summarized within figures 1-3.

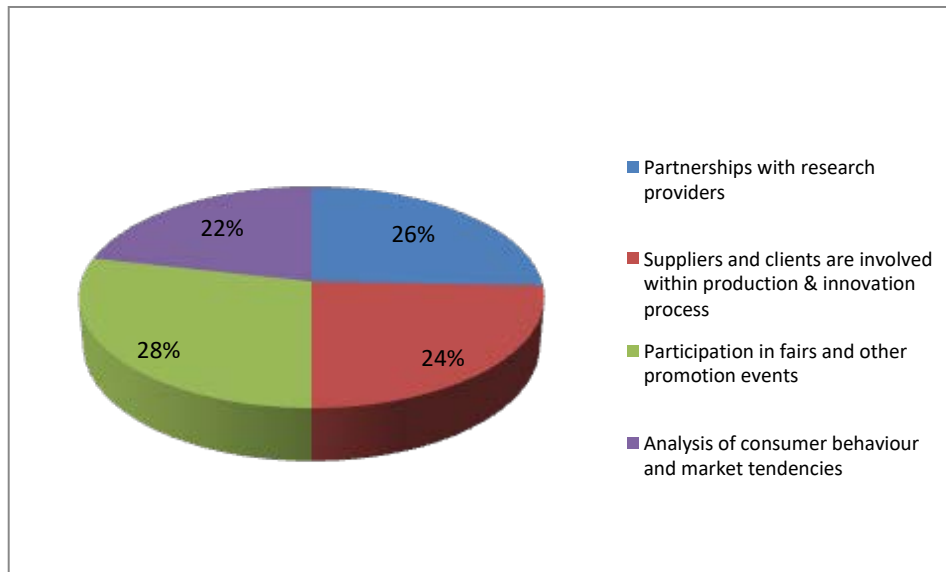


a) On fields of interest b) On expected age  
**Fig. 1. Profile of workforce needed**

Figure 1a presents the work profiles with higher education studies needed in the textile industry. There is a large need for Electronics and IT engineers when compared to existent work force. Quality engineers and textile engineers have the largest share when it comes to existent workforce, however demand of textile engineers is still at high percent of 30%. Another category of needed work force are marketing assistants and clothing designers, with 30% respectively 33%. Less interest was reported for chemistry engineers, a fact explained by less used chemical finishing.

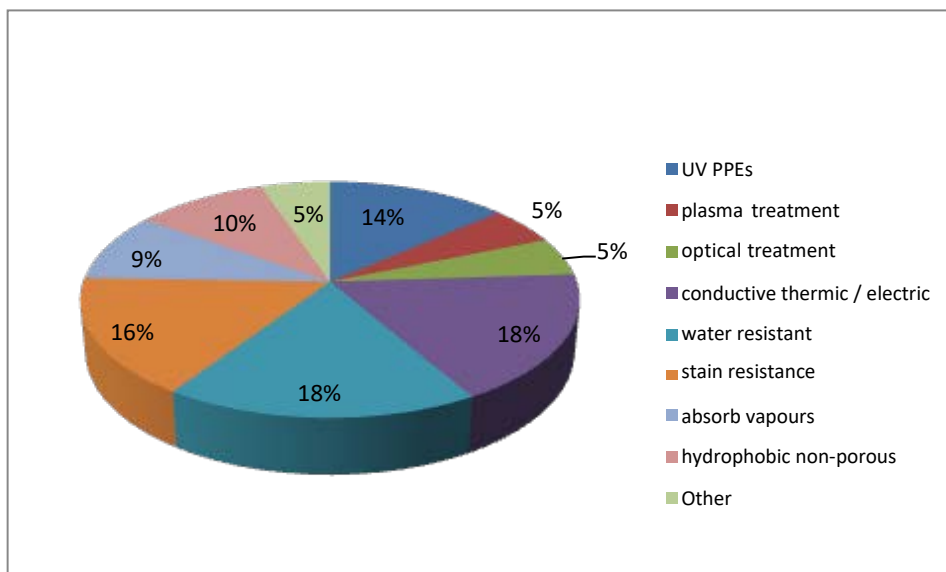
Figure 1b states the fact that textile professionals are mostly demanded with age expectation between 31-40 years, having a share of 47%, followed by the younger generation of specialists aged under 30 years, having a share of 29%. Experienced professionals over 51 years are still demanded, for their long-lasting expertise, with a percent of 8%.

Figure 2 shows modalities to foster innovations in technical and smart textiles within companies on partnership level. Great shares were reported for participation in fairs (28%) and partnership with research providers (26%), such as universities and research institutes. Still, suppliers and clients are involved within innovation process (24%) and consumer analysis is performed for market tendencies (22%), for the interviewed companies.



**Fig. 2.** Modalities to foster innovation in technical and smart textiles for companies

Figure 3 presents the interest of textile companies on partnership level to produce first generation smart textiles. Highest interest was reported for water resistant and conductive thermic and electric textile products with 18%. Another category of products was the stain resistance textiles (16%) and Personal Protection Equipment - PPE with ultraviolet light protection (14%). Other products were less envisaged, such as hydrophobic textiles (10%) or textiles to absorb water vapours (9%). Plasma and optical treatments on textiles, although modern technologies to impart novel functionalities on fabrics, had less interest (5%).



**Fig. 3.** Interest of companies in developing first generation smart textiles

### 3. CONCLUSIONS

Skills4Smartex project is still ongoing. Its results for the first year cover the Guide for smart practices of 74 pages with graphs and comments related to survey on smart textiles, some interviews with companies, meant to enable transfer of best practices from source sites (companies with results in smart textiles) to target sites (other interested companies and VET schools) and methods for an efficient smart practice transfer.



*Fig. 4. The Skills4Smartex team at the Joint staff event at UGent*

Future activities include the elaboration of the course's modules from STEM to SMART (shows basic disciplines relation to smart textiles) and from SMART to STEM (shows components of smart textile prototype into basic disciplines). Each partner is responsible for a chapter and each chapter tackles modules on physics and maths, material science and chemistry plus electronics, in both approaches. Chapters are: Novel fibres for smart textiles applications: INCDTP, Materials & methods (plane materials, composites) for smart textiles: UT Iasi, Virtual prototyping of sensors on garments: Uni Maribor, Smart textile design: TecMinho, Smart textiles prototypes: UGent, Data processing: INCDTP and New methods for testing smart textiles: TZU. Draft content of modules from STEM to SMART has been accomplished at the Joint staff event at UGent, 22-24.05.2019 (Figure 4). The total number of 42 modules will be however difficult to access: this is why Output3 of Skills4Smartex foresees a dedicated e-learning instrument, which will enable selection of desired module via a filter. The instrument will be programmed in PHP/MySQL and enables quick and direct access (without authentication) to the project's modules. This feature of the instrument is in line with the requirements of Erasmus+ program, which states free access for all outcomes resulting from the funded projects.

## ACKNOWLEDGEMENTS

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