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SUSTA SMART

D2.2Prioritisation of needs per domain

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Executive Summary

This document provides an overview of the approach taken and the results obtained towards the prioritization of the standardisation needs for the three focus domains of the project (Personal Protective Equipment, Construction Products and Consumer Goods) for Smart Textile products containing integrated electronics and ICT.

The results reported here are for one based on a SUSTA-SMART workshop held and interviews taken with people involved in research and development of Smart Textile products and prototypes and for another on the CEN-CLC BT WG 8 report answering the programming mandate M/509 EN, in the preparation of which SUSTA-SMART partners ESF and Centexbel were strongly involved and which was also followed up by partners EURATEX and FESI.

1. Introduction

SUSTA-SMART is an FP7 funded project supporting standardization for Smart Textiles to boost their use in the market.

In the past years several European cooperation projects on smart textiles have produced a variety of outcomes with high market potential in 3 target domains: Personal Protective Equipment, Construction and infrastructure or Consumer goods. SUSTA-SMART addresses these projects as it follows:

- Map the relevant standardization organizations and issues in FP6/FP7 projects. Define a standardization audit procedure.
- Synthesize and prioritize the needs for standards with a broad consensus and leading to a standardization roadmap.
- Produce standardization input documents (including New Work Item Proposals) to be presented to the relevant standardization committees.

During the first phase of the project, SUSTA-SMART partners have analyzed the standardization needs in selected projects obtaining first-hand information from projects coordinators or standards managers. The data collected have been analyzed and synthesized for each of the 3 application domains (D2.1-Synthesis of the identified needs per domain).

In order to prioritise the identified standardisation needs a workshop with stakeholders was organised on October 4, 2013. Here per domain (Personal protective equipment, Construction material and Consumer goods) the needs identified in D2.1 were presented to the stakeholders and the priority discussed with them. It was decided to organise this meeting in a form where interviews via telephone were done. Additional interviews were held done at a later moment by individual SUSTA-SMART consortium members.

In this deliverable the method for determining the prioritization and the synthesized results per domain will be presented.

2. Prioritisation of standardisation needs per domain – Methodology used

For the three domains the following standardisation needs were identified in D 2.1:

Personal Protective equipment (PPE)

1. Functionality and identification of relevant properties for the characterization and evaluation of smart textiles
2. Identification of reliable and suitable test methods to measure the proprieties able to fully characterize the smart textiles
3. Durability and washability: definition of the smart textiles features as far as the ageing and the washability are concerned.
4. Definition of the features in terms of comfort
5. Addressing all the aspects in terms of Health and Safety issues. Compliance with the current directives and supporting standards and to pay special attention at not introducing additional risks.
6. Definition of criteria in order to classify the smart textile performances according to the test results
7. Definition/identification of the main information/guidelines to be provided to users in order to fully exploit the smart textiles

Construction

1. Functionality and definition/identification of relevant properties (tear strength) for the characterization and evaluation of the technical textile based systems
2. Performance Evaluation of the new generation of multifunctional textiles for the construction and geo-textile sector
3. Durability of the new generation of multifunctional textiles in harsh environment
4. Evaluation of the embedded sensor performances when standard mechanical tests are applied to the multifunctional textiles (Shear Strength Testing, deformation tests)
5. Identification/definition of reliable and suitable test methods to measure the proprieties able to fully characterize the new technical textiles.
6. Definition of criteria in order to classify the new advanced technical textiles performances according to the test results
7. Definition/identification of the main information and application guidelines to be provided to users in order to fully exploit the new advanced technical textiles for the construction sector

Consumer goods

1. Functionality and definition/identification of relevant properties for the characterization and evaluation
2. Identification/definition of reliable and suitable test methods to measure the proprieties able to fully characterize the smart textiles.
3. Tests methods of healthcare systems have to be based also on apposite test protocols using gold standard as reference in order to accurately validate the system performances.
4. Durability and washability: definition of the smart textiles features as far as the ageing and the washability are concerned.
5. Identification of integration criteria for the new generation of smart textiles
6. Definition of the features in terms of comfort and user friendly aspects

7. Definition standard protocol for all the ICT aspects in order to increase the interoperability of these systems
8. Addressing all the aspects in terms of Health and Safety issues. Compliance with the current directives and supporting standard & paying special attention at not introducing additional risks.
9. Definition of criteria in order to classify the smart textile performances according to the test results
10. Definition/identification of the main information/guidelines to be provided to users in order to fully exploit the smart textiles

These needs were presented to the different experts. The first questions towards them were whether they (1) considered all these needs relevant to them and (2) if there were needs they had identified which were not in the list. For the following part of the interview, irrelevant needs were deleted from the list and newly identified needs added.

The core group of the prioritization team composed by the representative of the project partners decided to propose as criteria for evaluating/prioritizing the needs the following:

- Economic impact
- Technological impact
- Legal impact

The experts agreed with the proposed criteria and therefore they were asked to evaluate the selected standardization needs by using them.

It has been discussed also the weight to be assigned to each criterion. The prioritization team agreed that all the three criteria had the same importance with respect to the standardization issues therefore they have been considered having the same weight.

The evaluation scores to be given to each criterion where *high*, *medium* and *low*.

The scores were recorded in table form, an example of which is shown in Table 1 below.

For determining the average of the scores were translated into 9 for High, 3 for medium and 1 for low, and the criteria were assigned the same weight, based on their relative importance:

Also a threshold value was defined, with needs scoring above the threshold value being true needs and those below less relevant. As threshold it has been identified the arithmetic mean of the three possible scores.

Table 1: Example for prioritization table, here for the domain PPE

Prioritization Matrix-PPE		Economic Impact	Technological Impact	Legal Impact		
	Need description					
					Total	Average
need 1	*Functionality and definition/ identification of relevant properties for the characterization and evaluation*	[Assign score per box: High, Medium or Low]				
need 2	*Identification/definition of reliable and suitable test methods to measure the proprieties able to fully characterize the smart textiles*					
need 3	*Durability and washability: definition of the smart textiles features as far as the ageing and the washability are concerned.*					
need 4	*Definition of the features in terms of comfort*					
need 5	*Addressing all the aspects in terms of Health and Safety issues. Compliance with the current directives /standards and to pay special attention at not introducing additional risks.*					
need 6	*Definition of criteria in order to classify the smart textile performances according to the test results*					
need 7	*Definition/identification of the main information/guidelines to be provided to users in order to fully exploit the smart textiles*					

3. Prioritisation of standardisation needs per domain – synthesis of results per domain

3.1 Personal Protective equipment (PPE)

For personal protective equipment (PPE) the final list of needs after the discussion with the experts was identical to the initially proposed list.

The result for the scores of the needs is shown in Figure 1:

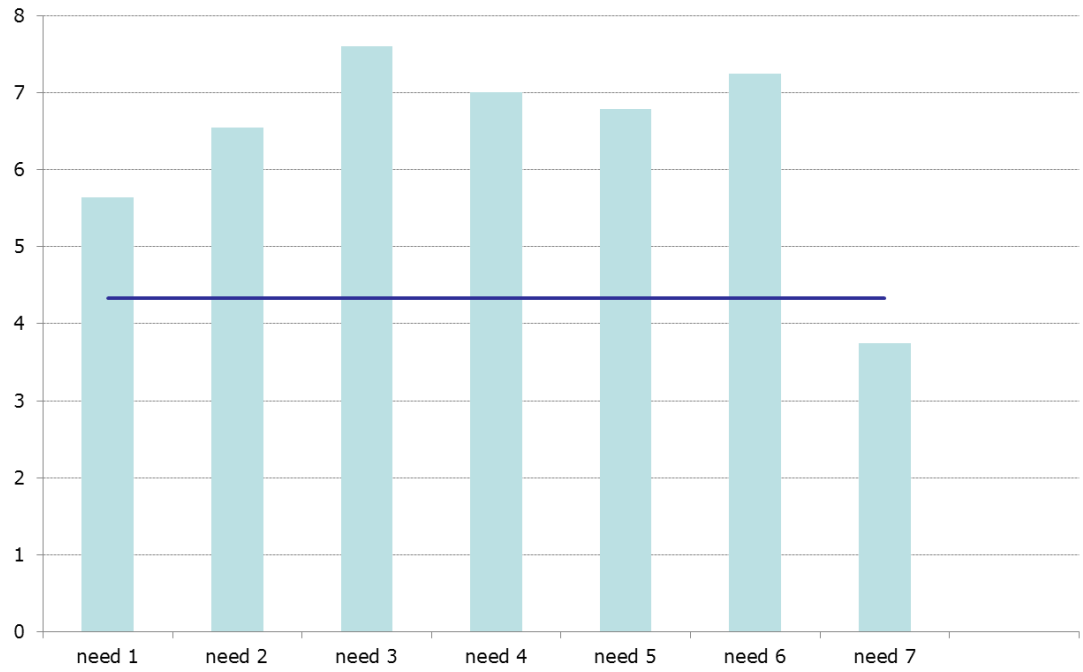

Figure 1: Prioritization of needs for Personal Protective equipment (PPE)

One need turned out to be below the threshold, namely need7.

As a result we obtain the following list of needs, sorted by priority:

1) Durability and washability: definition of the smart textiles features as far as the ageing and the washability are concerned.
2) Definition of criteria in order to classify the smart textile performances according to the test results
3) Definition of the features in terms of comfort
4) Addressing all the aspects in terms of Health and Safety issues. Compliance with the current directives and supporting standards and to pay special attention at not introducing additional risks.
5) Identification of reliable and suitable test methods to measure the proprieties able to fully characterize the smart textiles
6) Functionality and identification of relevant properties for the characterization and evaluation of smart textiles
7) *Definition/identification of the main information/guidelines to be provided to users in order to fully exploit the smart textiles*

The need scoring below the priority is indicated in *italic.*

3.2 Construction

For Construction the final list of needs after the discussion with the experts was identical to the initially proposed list.

1. Functionality and definition/identification of relevant properties (tear strength) for the characterization and evaluation of the technical textile based systems
2. Performance Evaluation of the new generation of multifunctional textiles for the construction and geo-textile sector
3. Durability of the new generation of multifunctional textiles in harsh environment
4. Evaluation of the embedded sensor performances when standard mechanical tests are applied to the multifunctional textiles (Shear Strength Testing, deformation tests)
5. Identification/definition of reliable and suitable test methods to measure the proprieties able to fully characterize the new technical textiles.
6. Definition of criteria in order to classify the new advanced technical textiles performances according to the test results
7. Definition/identification of the main information and application guidelines to be provided to users in order to fully exploit the new advanced technical textiles for the construction sector

The result for the scores of the needs is shown in Figure 2:

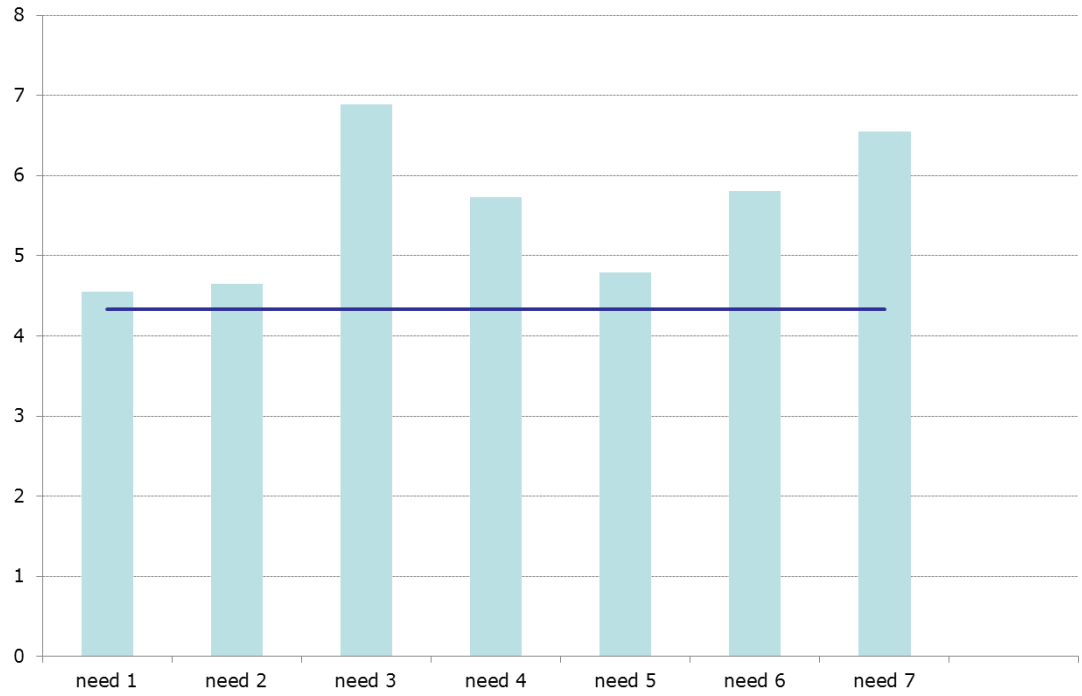

Figure 2: Prioritization of needs for construction

Here all initially identified needs turned out to be above the threshold (although need1, need2, need5 received a score just above the threshold).

As a result we obtain the following list of needs, sorted by priority:

1) Durability of the new generation of multifunctional textiles in harsh environment.
2) Definition/identification of the main information and application guidelines to be provided to users in order to fully exploit the new advanced technical textiles for the construction sector.

3) Definition of criteria in order to classify the new advanced technical textiles performances according to the test results.
4) Evaluation of the embedded sensor performances when standard mechanical tests are applied to the multifunctional textiles (Shear Strength Testing, deformation tests)
5) Identification/definition of reliable and suitable test methods to measure the proprieties able to fully characterize the new technical textiles.
6) Performance Evaluation of the new generation of multifunctional textiles for the construction and geo-textile sector
7) Functionality and definition/identification of relevant properties (tear strength) for the characterization and evaluation of the technical textile based systems

3.3 Consumer goods

For Consumer Goods one of the needs identified in D 2.1 turned out to be irrelevant/ too specific to the stakeholders interviewed in the workshop, so that the revised list which was evaluated was the following:

1. Functionality and definition/identification of relevant properties for the characterization and evaluation
2. Identification/definition of reliable and suitable test methods to measure the proprieties able to fully characterize the smart textiles.
3. Durability and washability: definition of the smart textiles features as far as the ageing and the washability are concerned.
4. Identification of integration criteria for the new generation of smart textiles
5. Definition of the features in terms of comfort and user friendly aspects
6. Definition standard protocol for all the ICT aspects in order to increase the interoperability of these systems
7. Addressing all the aspects in terms of Health and Safety issues. Compliance with the current directives and supporting standard & paying special attention at not introducing additional risks.
8. Definition of criteria in order to classify the smart textile performances according to the test results
9. Definition/identification of the main information/guidelines to be provided to users in order to fully exploit the smart textiles

The need removed was: *Tests methods of healthcare systems have to be based also on apposite test protocols using gold standard as reference in order to accurately validate the system performances.* As this need refers only to health care systems it is too narrow for all Smart Textile applications in the category Consumer Goods.

The result for the scores of the needs is shown in Figure 3.

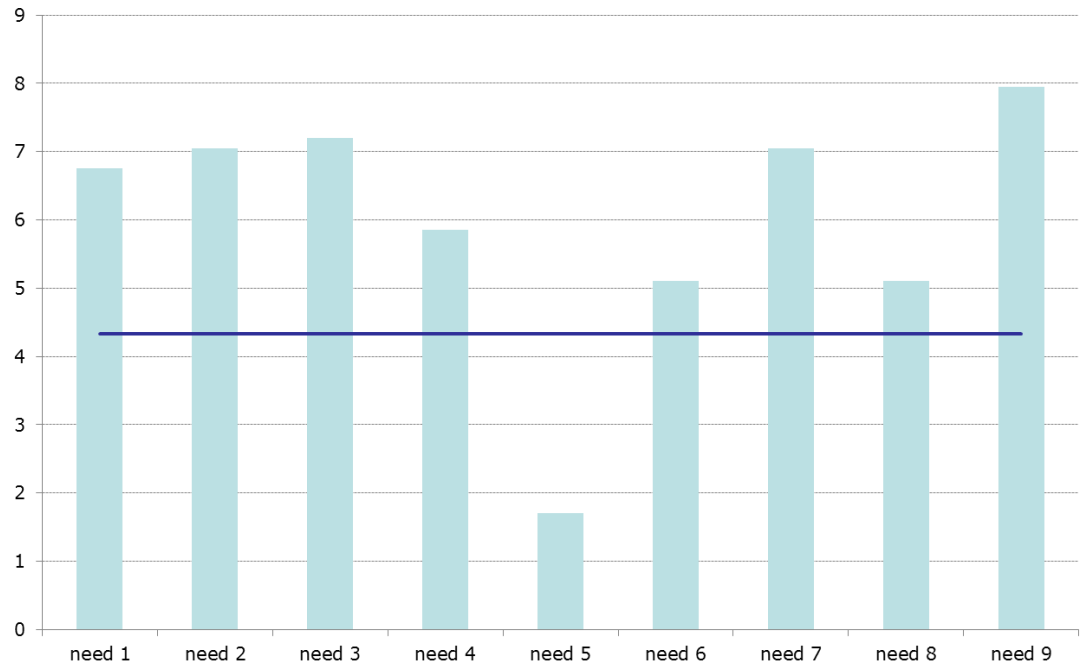

Figure 3: Prioritization of needs for Consumer Goods

Again one need turned out to be below the threshold, namely need5.

As a result we obtain the following list of needs, sorted by priority:

1) Definition/identification of the main information/guidelines to be provided to users in order to fully exploit the smart textiles
2) Durability and washability: definition of the smart textiles features as far as the ageing and the washability are concerned.
3) Identification/definition of reliable and suitable test methods to measure the proprieties able to fully characterize the smart textiles.
3) Addressing all the aspects in terms of Health and Safety issues. Compliance with the current directives and supporting standard &Paying special attention at not introducing additional risks.
5) Functionality and definition/identification of relevant properties for the characterization and evaluation.
6) Identification of integration criteria for the new generation of smart textiles.
7) Definition standard protocol for all the ICT aspects in order to increase the interoperability of these systems
7) Definition of criteria in order to classify the smart textile performances according to the test results
9) *Definition of the features in terms of comfort and user friendly aspects*

Same numbers indicate same level of priority. The need that scored below the threshold is indicated in *italic*.

3.4 Conclusions

For the three different focus domains the standardisation needs identified in D2.1 were discussed with different stakeholders during a first workshop and given priorities.

The prioritized needs, as reported in this deliverable (D2.2) were then presented and discussed during a second workshop with stakeholders also strongly involved in standardisation activities for preparing a first draft of the standardisation road map (D2.3).

4. CEN CLC BT WG8

Close in time to the start-up of SUSTA-SMART the programming mandate M/509 EN *Protective textiles and personal protective clothing and equipment*[1] was issued from the European Commission to CEN, CENELEC and ETSI. It was accepted by CEN and CENELEC in November 2012 and, as its content went beyond the scopes of the existing CEN or CENELEC TC's and WG's, CEN-CENELEC BT working group 8 was established in order to fulfil this mandate.

SUSTA-SMART partner Mr.Henk Vanhoute, ESF, CEN rapporteur for the Personal protective equipment (PPE) sector, was appointed as chair of BTWG8 with the support of NBN/ Centexbel (the Belgian Standardisation Sector operator for PPE) with Ms. Karin Eufinger, coordinator of SUSTA-SMART, acting as secretary. From the beginning a close link was seen between the report for the programming mandate M/509 and the tasks in SUSTA-SMART concerning prioritization and road mapping of the standardisation needs for the domain of personal protective equipment (PPE) with integrated technology (including electronics and ICT). Also SUSTA-SMART partners EURATEX and FESI followed up the preparation of the report as members of the working group.

The report from BTWG8 was finalized in November 2013, with some amendments in January 2014. At the moment of finalization of this deliverable D2.2 the report has been submitted to the EC (early February 2014) and is now under evaluation.

While many of the conclusions drawn and the proposals made focus on PPE for professional use, it is recognised that these are in many instances also applicable to private or consumer use, e.g. PPE for use in sports & leisure activities.

It is beyond the scope of this deliverable to present all the results obtained during the 1 year of work of this working group. Nevertheless, the core results will be presented here and compared to the results obtained in the SUSTA-SMART workshops (chapter 5).

In the following we will give a summary of the Programming Mandate M/509, the methodology of BTWG8, the identified needs for standardisation and the proposed solutions.

Programming mandate M/509

The scope of the mandate concerned the development of a programme for standardisation deliverables in the area of protective textiles and personal protective clothing and equipment, including revision of existing European standards and other standardisation deliverables as appropriate.

The tasks to be carried out were to1:

- "*Further explore and identify key recent technological developments for the deployment of smart integrated protection systems which integrate ICT, other electronics and other technologies in protective textiles, clothing and equipment.*
- *Identify cross-cutting barriers and drivers for the integration of technological developments resulting from R&D projects into new standards (or other standardisation deliverables). Among others, such barriers may include differing intellectual property right (IPR) management or protection of personal data.*

[1] M/509 EN *Protective textiles and personal protective clothing and equipment*; more information is available under http://ec.europa.eu/enterprise/standards_policy/mandates/database/index.cfm?fuseaction=search.detail&id=512

- *Explore existing standards in the field of ergonomics and comfort in order to identify whether recent technological developments and smart integrated protection systems would require further standardisation in this field.*
- *Explore existing methodologies to assess the overall lifecycle cost of protective textiles, clothing and equipment as well as the overall environmental impact in order to identify further standardisation needs.*
- *Establish a programme of standardisation deliverables, including Technical Reports and Technical Specifications that could eventually lead to European Standards for the three areas:*
    1. *Advanced integrated smart protection systems*
    2. *User-driven ergonomics and comfort*
    3. *Assessment of lifecycle cost and environmental impact*

The programme should clearly identify the work items that are likely to involve the development or revision of harmonised standards supporting essential requirements of the Directive 89/686/EEC. The programme should also identify and indicate any needs to develop new test methods, including needs for inter-laboratory trials."

Methodology of CEN-CLC BT WG 8

The tasks given in the programming mandate were translated into the key challenges to be tackled by CEN-CLC BTWG8:

- integration (both of new technologies and of different parts of a protective system/ensemble)
- comfort and ergonomics (with a strong user focus looking from head to toe and from skin to outer layer)
- sustainability and environmental aspects (including life cycle costing, selection, use, care and maintenance)

Since a rather large number of experts had registered for the working group it was more feasible to split up this large group into smaller Task Groups, each dealing with one of the key challenges. Since the topics *integration of new technologies* and *integration of the different components of PPE* were considered to need a somewhat different approach, it was decided to form two separate Task Groups.

As a result the following four Task Groups were formed, each with their assigned tasks from the mandate:

TG 1: Compatibility of different elements -Technology

- Explore and identify key recent technological developments for the deployment of smart integrated protection systems which integrate ICT, other electronics and other technologies in protective textiles, clothing and equipment.
- Identify cross-cutting barriers and drivers for the integration of technological developments resulting from R&D projects into new standards (or other standardisation deliverables). Among others, such barriers may include differing intellectual property right (IPR) management or protection of personal data (privacy).

TG 2: Compatibility of different elements -Integration of the complete system

- Identify needs for testing and standardisation of complete PPE systems from the point of view of the user.

TG3: Comfort and ergonomics

- Explore existing standards in the field of ergonomics and comfort in order to identify whether recent technological developments and smart integrated protection systems would require further standardisation in this field.

TG 4: Environmental sustainability and total cost of ownership

- Explore existing methodologies to assess the overall lifecycle cost of protective textiles, clothing and equipment as well as the overall environmental impact in order to identify further standardisation needs.

As the scopes task groups 1 and 4 also where closest to the scope of SUSTA-SMART, SUSTA-SMART partners Ms. Karin Eufinger and Mr.Henk Vanhoutte chaired Task Groups 1 and 4, respectively.

Identified needs for standardization and related needs

During the work of the Task Groups not only concrete needs for standardisation (development of new standards or standardization deliverables) were identified, but also needs towards improving the standardisation work structure, general challenges to the PPE sector and other related needs were identified.

Specifically towards the topics addressed in SUSTA-SMART, namely towards smart textiles, it was decided not to give a complete list of concrete standardisation deliverables, as these were very case specific. It was identified as more important and given higher priority to first tackle some basic needs before going into details.

The starting point is that all personal protective equipment, which is introduced to the market, needs to conform to EU legislation, which has been established to ensure the safety of the wearer. For PPE there are two directives applicable, being 89/686/EEC on Personal Protective Equipment and Directive 89/656/EEC on the Use of Personal Protective Equipment. (As a note, the second directive is often forgotten, as manufacturers usually focus on the directive 89/686/EEC).

As discussed in D2.1, when integrating novel functionalities into PPE, especially electronics and ICT, other directives, applicable to electronic and ICT devices may also apply. Since new developments (including prototypes from research) also include interaction of (parts of) the PPE with external devices, conformity assessment should no longer be limited to the PPE only but needs to include the external devices. This makes it necessary to define a personal protective system, which includes the original (parts of) PPE as well as the external devices. In order to clearly define all necessary terms a dedicated standard will need to be developed, which can then guarantee that the correct vocabulary will be used in the future.

A complete list of the identified needs for standardisation and related needs can be found in the BTWG8 report, which can be obtained from the secretariat of CEN-CLC BT WG 8 (Ms Karin Eufinger). The essence of this list has been integrated in the needs identified in D2.1 and has been used in the 1st SUSTA-SMART workshop. Also the network established among BTWG8 experts has been and will be helpful to SUSTA-SMART partners for finding experts for further workshops and for introducing the proposals for standardisation deliverables developed in SUSTA-SMART. This will be discussed in more detail in D2.3, D3.1 and D3.2.

5. Comparison of results from the SUSTA-SMART workshops and the CEN-CLC BT WG 8 report

Since the group of experts working on the CEN-CLC BT WG 8 report and that participated in the SUSTA-SMART workshops was composed differently, there were some differences in prioritizing the needs.

One of the most striking differences was the prioritization of the need concerning the "Definition/identification of the main information/guidelines to be provided to users in order to fully exploit the smart textiles". This need was evaluated below the threshold for the SUSTA-SMART workshop but was given a high priority in the CEN-CLC BT WG 8 report. The reason for this is most likely explained by the fact that among the CEN-CLC BT WG 8 members experts supporting the needs of users were present, while this was not the case for the SUSTA-SMART workshops, in which the focus was more on companies interested in marketing smart textile products. Additionally the focus of CEN-CLC BT WG 8 was only on PPE and aimed at integrating all needs for standardisation, while SUSTA-SMART focusses on Smart Textiles with integrated electronics and ICT developed in R&D projects for three different domains, one of which being PPE. As a result it is not surprising that there is some difference in the results obtained.

6. Conclusions

From the first workshop of SUSTA-SMART good results could be obtained for the prioritisation of needs for the three focus domains Personal Protective Equipment (PPE), Construction Goods and Consumer Goods. For the focus domain Personal Protective Equipment the SUSTA-SMART consortium took the opportunity to become involved in the working group CEN-CLC BT WG 8 *Protective textiles and personal protective clothing and equipment* which allowed validating and expanding the SUSTA-SMART results against a larger scale evaluation of the needs.