



Report on the contribution to the standardization System regarding FISSAC products

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WP 3, Task 3.4, Subtask 3.4.1 & 3.4.2

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¹ PU = Public

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1. Introduction

In the context of FISSAC project two main tasks have taken place concerning standardization activities, basically under WP2 & WP3. The objective related to standardization was divided into two parts: on one side the analysis of related technical committees relevant for the project and the definition of a strategy for the communication with them, and secondly, based on the defined strategy, the contribution to standardization as a mean to promote and disseminate project results through the modification of the corresponding standards to include project results. These two main activities were thought in turn for secondary raw materials and for new products as developed within FISSAC project.

The first deliverable on standardization (*D 2.6 "Report on the contribution to the standardization system regarding FISSAC technologies"*) identified technical committees, published standards and works under development, which allowed to have a clear view of the state of art, the standardization gaps and needs and the next steps to take.

Throughout this deliverable, major subsequent standardization activities carried out are reported and explained. Apart from that, over the lifetime of the project additional advising has been provided to any partner requesting this advice with regard standardization framework.

Additionally, some of the dissemination activities within standardization community about intermediate and final results are reported as well. Not only in physical meetings but through digital communications, at national and European level, contribution has been made to increase visibility of FISSAC project and results.

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Abbreviation and acronyms

In this document the following abbreviations and acronyms are used, and in this list they are indicated with its meaning:

UNE	Spanish Association for Standardization
CEN	European Committee for Standardization
CENELEC (CLC)	European Committee for Standardization in the Electrical field
CWA	CEN or CENELEC Workshop Agreement
EAD	European Assessment Document
EN	European Standard
EOTA	European Organisation for Technical Assessment
ESO	European Standardisation Organisation
ETAG	European Technical Approval Guideline
hEN	Harmonised European Standard
ISO	International Organization for Standardization; International Standard
IEC	International Electrotechnical Commission
NMC	National Mirror Committee
NSB	National Standardization Body
SC	Subcommittee
TC	Technical Committee
TR	Technical Report
TS	Technical Specification
WG	Working Group
WI	Work Item
CPR	Construction Product Regulation



2. Background & current context

2.1 Standardization needs

As conclusion from preliminary study, standardization needs were detected mainly for new cements developed and produced within FISSAC project and for new wood-plastic composites.

In the field of cements, new cements obtained, i.e. new calcium sulphoaluminate cement and new blended cements, are not covered by existing published standards and therefore its commercialisation in the market could face some challenges. New blended cements could be covered by relevant umbrella standard for cements, EN 197-1, but with appropriate modifications. New calcium sulphoaluminate cement should be subject of a completely new standard.

FISSAC project has also developed and assessed new green concrete using the new eco cements and containing alternative aggregates coming from treated EAF slag and glass waste, which replaces natural aggregates. Standards covering aggregates, specifically EN 12620 *Aggregates for concrete*, are to be considered as their requirements are applicable to natural, artificial and recycled aggregates used in concrete. From this side, properties of new aggregates considered under FISSAC project need to be assessed taking EN 12620 as a basis. Although EAF are not considered in the current version of the standard, this standard is under revision and proper consideration of these new subproducts is expected. At this moment, aggregates standards revision have experienced many obstacles and could not be completed. Furthermore, core standard for concrete, EN 206, needs also to be considered together with specific standards for particular subproducts when used as additions in the production of concrete. The existence of national technical rules in the field of concrete is of special importance as well. No specific needs for standardization were detected in the field of concrete.

In the field of ceramic tiles, innovative ceramic tiles have been developed based on the valorization of selected industrial waste streams from the aluminium and natural stone industry. The core standard for these final products is EN 14411, which provides proper classification of tiles and the corresponding composition and technical requirements to be met by each group defined. No standardization needs have been detected.

Concerning new wood-plastic composites, developed using tyre rubber, waste plastic and wood, the standardization activities were considered important as new products could benefit from revised standards from CEN/TC 249/WG13.

2.2 Current context of standardization of construction products

As explained in Deliverable 2.6 on Standardization most of the construction products related to FISSAC project are under the scope of the Construction Products Regulation n°305/2011, that entered into full force on 1 July 2013 with the objective of providing a common technical language to assess the performance of construction products and to remove barriers to trade, establishing harmonised conditions for the marketing of construction products.

The common technical language comprises the harmonised technical specifications, i.e. hEN and European Assessment Documents (EADs). Harmonised European standards (hENs) are the harmonised technical specifications developed by CEN or CENELEC following the mandates or standardization requests given by the European Commission in support of European policies and legislation. Draft Standardization request (mandates) are drawn up by the Commission services through a process of consultation with a wide group of interested parties taking into account existing legislation in Member States

Manufacturers, other economic operators, or conformity assessment bodies can use harmonised standards to demonstrate that products, services, or processes comply with relevant EU legislation, but the references of harmonised standards must be published in the Official Journal to comply with this purpose. Generally Harmonised European standards remain voluntary in their use, excepting the case of the harmonised standards of construction products, which are compulsory to comply with the legislation.

According to the CPR, if a construction product is covered by a harmonised standard or conforms with a European Technical Assessment, then the manufacturer shall draw up a declaration of performance and affix CE marking. If a product is covered by a harmonised standard, then the manufacturer must complete a declaration of performance



and affix CE marking according to corresponding hEN. Harmonised standards have a key role for the implementation of the CPR because they contain the assessment methods for determining the performance of the construction product in relation to their essential characteristics.

Due to several circumstances the citation of candidate harmonised standards has been hampered in the last years and not many standards have been cited. In the 'James Elliot Construction Limited v Irish Asphalt Limited' case, the European Court of Justice concluded that hENs, the references to which have been published in the OJEU, form part of EU law and confirmed the European Commission's (EC) responsibility in the process of initiating, managing and monitoring of hEN. Furthermore, according to article 17 (5) of the CPR, the EC shall assess the conformity of hENs with the mandates. As an outcome of the James Elliot case the scrutiny was enhanced by the EC and as a result, the EC is taking a very legalistic approach when assessing hENs and this leads to very few citations in the OJEU.

Today, hENs of construction products are developed based on mandates, which were adopted in the 1990s and early 2000s, and since the CPR became effective as of 1st July 2013, no mandates have been revised according to the new Standardization Request procedure established in Regulation 1025/2012. This has led to a situation where some of the mandates do not fulfil market and Member States needs.

According to previous mandates under the Construction Product Directive, Technical Committees, through the called 'Technical Committee answer to the mandate' could make proposals to modify the original mandates, that could serve as a basis for the revision of standards. This common practice for the development of new or revised hENs and often used by the standardization community in the past, is being questioned for the reasons mentioned in previous paragraph, from a legal point of view.

In this context, and with the legal background as main reason for it, many of the standards prepared or under preparation by CEN/CENELC are not meeting Commission criteria for citation in the OJEU (for different causes being the issue of outdated mandates one of them) and citation of harmonised standards is being blocked. Many of the works under development within standardization technical committees are being affected by this situation.

3. Standardization activities

3.1 Standardization activities in the field of new cements

3.1.1 Background

As stated in the previous deliverable on standardization, FISSAC project has demonstrated the feasibility of producing eco-cement based mainly on the use of waste and sub-products at the clinker production stage (raw materials) and at the cement production stage (new additions). Two new products have been obtained:

- A calcium sulpho-aluminate cement (CSA), produced using ladle furnace slag, glass waste, ceramic waste and aluminium waste
- Blended cement, produced using glass waste and ladle furnace slag.

From the point of view of standardization, analysis was made, at an initial stage, concerning the applicable standards to new constituents to be incorporated in the new cements' formulations.

As mentioned above, the new secondary raw materials and sub-products used for cement production were incorporated at different stages of the process, which makes a difference when considering the standardization needs. For raw materials added to the kiln producing the clinker, no standards exist, and no standards are expected. Current cement standards specify requirements for the product obtained, the clinker, which shall fulfil the established provisions concerning its composition and proportions.

From the comprehensive analysis done, it was made clear that the standards portfolio does not include standards for the new cements developed within FISSAC project. Neither the main standard for common cements nor any other specific standard in the European catalogue cover particular cements developed: CSA cement and blended cement. Nevertheless, in order to undertake standardization initiatives, it was necessary to have a clear view of the objectives and goals sought. From the very beginning, the needs estimated were:

- New standard would be needed/appreciated for new CSA cement
- Blended cement developed could be covered by current EN 197-1 if properly amended.

Having this in mind, the attention was focussed in both:

- Revision of EN 197-1, which was being revised to include new ternary cements in addition to the accommodation to the Construction Product Regulation 305/2011 requirements.
- How to channel a proposal for a new standard for CSA cements.

With this purpose, but without ignoring some critical issues:

- Particular problems concerning harmonized standards under CPR, as commented previously in this deliverable.
- CEN/TR 16912:2016 *Guidelines for a procedure to support the European standardization of cements*, providing guidance for the procedure to be followed to support the European standardization of new cements not covered by existing standards and the information required.
- The information and data needed and required, as to initiate any standardization initiative, dependant from the project evolution, that conditioned our actions

The objective was to contact the corresponding technical committee to present project initial results and suggest possible standardization proposals.

3.1.2 Main actions carried out

With the clear purpose of presenting the initial project results concerning new cements to the relevant CEN Technical Committee, CEN/TC 51/WG6 “Cement and building limes- Definition and terminology of cements” was contacted. This working group is in charge of the standardization of specifications of cements.

First contact took place to introduce FISSAC Project to the working group convenor and Secretariat:

Dear Mr. Schneider, Steffen,

I'm contacting you as convenor of CEN/TC 51/WG6. My name is Raquel Martínez, from UNE, the Spanish Standardization Body. I'm the head of the construction unit within the Standardization Division and the technical officer in charge of the cement national mirror group following CEN/TC 51 activities. Apart from that, at this moment I'm participating, on behalf of UNE, and as part of the consortium, in FISSAC Project “Fostering Industrial Symbiosis for a Sustainable Resource Intensive Industry across the extended Construction Value Chain”, which is an H2020 project involving stakeholders at all levels of the construction and demolition value chain aimed at developing a methodology and software platform to facilitate information exchange, that can support industrial symbiosis networks and replicate pilot schemes at local and regional levels.

Among other objectives and activities within the project a variety of waste streams generated from six main industrial sectors are being analyzed together with its application to four construction sub-sectors: Eco cement, green concrete, ceramic industry and wood-plastic composites. The waste streams and sub products under consideration come from the steel industry, secondary aluminium industry, ceramic industry, C&DW recycling industry, natural stone and chemical (rubber). FISSAC will demonstrate the feasibility of producing new eco-cement formulations based mainly on EAF and LF slag, aluminium waste and ceramic waste from both, C&DW and tile ceramic industry to feed the kiln. The use of some kind of glass waste streams will be also assessed. The result will be a belite – yeelimite (calcium sulfoaluminate) cement.

Secondary raw materials will be used at two different stages:

- As raw meal for the clinker manufacturing: Electric Arc Furnace (EAF) slag, Ladle Furnace (LF) slag, glass waste, ceramic waste and aluminium saline slag will be used as raw meal for the rotary kiln feed.*
- As mineral addition guaranteeing hydraulic or pozzolanic activity: Ceramic waste, Ladle Furnace (LF) slag and glass waste will be studied as mineral addition for low carbon cement production.*

In view of the above, and given that the product being studied, developed and tested at real scale is a non-standardized product which is not covered by the current standards, one of the goals for the project, in the case of the eco-cement, is to explore the possibility of being standardized, as a way to get the project results widely spread in the market.

This is the reason why I'm approaching you, to let you know about FISSAC project, and to ask you about the way to proceed from now on. The results of the tests and trials performed to the new calcium sulfoaluminate cement are not fully processed, but I hope I will be able to present you some significant advances in short.

I know about the CEN/TR in CEN/TC 51 giving instructions on how to proceed with new cement proposals or new cement constituents and the information that needs to be provided, but I would be grateful if you could give me specific instructions. Should we send you general info on the results obtained? Or should we prepare a brief presentation on the issue? I imagine the complete dossier is required once interest has been proved by TC51/WG6.

I thank you for your attention. I look forward to your answer.

Best regards, Raquel

A initial response was received from CEN/TC 51/WG6

Dear Mr Martínez Egido

Martin Schneider has forwarded your e-mail to me. I was strongly involved in the preparation of CEN/TR 16912 "Guidelines for a procedure to support the European standardization of cements" and the related discussion. Furthermore I am convenor of CEN/TC 51 WG 13 "Conformity Evaluation" and member of WG 6. Thus I am glad to answer your question.

During the development of the CEN/TR the members of CEN/TC 51 and WG 6 fully understood that there is a strong interest to standardise new innovative and environment-friendly cements and binders in order to improve the acceptance of such new products and to facilitate their use. This was the reason to prepare guidelines for the procedure to be followed.

The convenors of the CEN/TC 51 working groups have discussed your proposal during the CEN/TC 51 Plenary Meeting last week and as a result I recommend you to proceed as follows:

1) The new cement shall be tested and assessed e.g. by an competent institute or laboratory. The testing scheme depends on the type of cement and is described in detail in CEN/TR 16912.

2) The cement and the complete testing and assessment procedure and results shall be described/reported in a dossier.

3) A national standardisation body (CEN Member) or a CEN Technical Committee or the EU or EFTA Secretariat or an international organisation or an European trade, professional, technical or scientific organisation has to submit an application to CEN/TC 51 to standardise the new cement.

4) The application should be presented using the CEN form for a New Work Item proposal and based on the dossier. In other words: An application without a dossier or with an incomplete dossier will hardly be successful.

5) CEN/TC 51 will then evaluate the application and the dossier and take a decision.

It might be helpful if you would send me the results obtained so far. You may also share with me the intended structure and the content of the technical dossier. I am well-prepared to give you a feedback which could be helpful for you to in the further application process.

I look forward with pleasure to hearing from you.

Best regards

In the e-mail message, it was clearly indicated that the new cements shall be tested and assessed according to CEN/TR 16912:2016, where the testing plan for new cements is specified, and that a complete dossier with all the related information (testing and assessment procedure results) must be presented. They also offered to review the results obtained until that moment to provide feedback and guidance on the way forward.

Mentioned CEN/TR and the information contained therein was studied in depth, although no further steps could be taken until additional results were available from test results of validation process of new products.

Due to the scheduled plan within FISSAC project, results from validation activities of the new developed cements at industrial scale were not available until late 2018. By that moment, it was then agreed to contact the technical committee with the aim of presenting available results to the working group.

Several contacts took place with this purpose and finally FISSAC was invited to participate in the meeting of CEN/TC 51/WG6 held on 26th of February 2019 to present the project, the new cement products being investigated, and the results obtained until then.

Agenda item	Document Number
1 Opening of the meeting	
2 Roll call of experts; Examination of list of members	L/ve/trk
3 Adoption of the draft agenda	N 476
4 Adoption of the report of the last meeting	N 465
5 Status of the Mandate M/114	
6 FISSAC project on the new calcium sulphoaluminate cement and the new designed blended cements	
7 Revision of EN 197-1 "Cement – Part 1: Composition, specifications and conformity criteria for common cements" — Result of the HAS Consultant's assessment	N 476
— Reporting on the meeting between CEN/TC 51, EC and the HAS Consultant	
— Handling of the comments from the CEN Enquiry on prEN 197-1:2018 (End of ENQ: 2019-01-31)	N to follow
8 Future development of the European cement standardisation	
9 Revision of EN 15368 "Hydraulic binder for non-structural applications – Definition, specifications and conformity criteria" — Result of the HAS Consultant's assessment	N 477
— Reporting on the meeting between CEN/TC 51, EC and the HAS Consultant	
— Handling of the comments from the CEN Enquiry on prEN 15368:2018 (End of ENQ: 2019-01-17)	N to follow
10 Any other business	
11 Date and place of the next meeting	
12 Closure of the meeting	

UNE attended referred meeting and gave a presentation on FISSAC project, new cement based products developed, progress made and related standardization needs.

Several proposals were made to the working group members in order to obtain feedback on feasibility of the different existing options:

- Drafting a new standard (EN) for CSA cement.
- If EN not possible, What about a Technical Specification (TS)? or a Common Workshop Agreement (CWA)?
- Possibility to amend EN 197-1 to include new blended cements?

The outcome of the meeting can be seen in the extract from the minutes circulated, which can be summarised as follows:

5- FISSAC project on the new calcium sulphoaluminate cement and the new designed blended cements

Ms Martinez gave a presentation on the FISSAC project within the Horizon 2020 research framework. The project partners would like to include the results of their work into standardisation. WG 6 recommended that the group should follow the path which is described in CEN/TR 16912. The national mirror group from one country needs to bring up a proposal together with a dossier to TC 51. WG 6 also highlighted that experience is necessary before the product can be standardised. An ETA might begood interim-solution before starting standardisation work, especially for being able To find sufficient applications for the new products. Some experts expressed scepticism concerning CSA standardisation because the variability of possible products is very broad. The presentation will be circulated in WG 6 after the meeting (see N 490).

- a) WG members agree that new CSA cement should be subject of a new standard
- b) WG members agree that new blended cements should be subject of EN 197-1 amendment, although given current situation concerning EN 197-1 revision underway, the proposed modification will be considered in future EN 197-1 revision.
- c) A technical dossier according to CEN/TR 16912:2016 *Guidelines for a procedure to support the European standardization of cements* shall be prepared for any proposal to be considered by CEN/TC 51.
- d) The national mirror group of the NSB proposing should agree on the proposal (internal rule)
- e) Environmental issues are very important for them. Although no “harmful” elements are incorporated in the new products, trace elements should be subject of a deeper analysis. The SRM behaviour in the cement, from the environmental point of view is of great importance. Special care with Chromium VI must be taken.
- f) Special consideration should be given to the real applications and intended use of the new cement . Concerns about tests performed in concrete, for example, and behaviour of these applications using new cement in XX years in time.
- g) It is recognized that in case standardization o CSA cement is undertaken new stakeholders/producers should be invited to participate in the WG
- h) There exist other more well known elements than the ones presented that are not yet standardised.

For the proper evaluation of the situation and the actions that could be taken, special consideration should be paid to the following constraints:

- Current situation of EN 197-1 revision in the context of the CPR
- Existence of a European Assessment Document on Calcium Sulphoaluminate based cement
- Available information from the project vs needed information for standardization.

3.1.3 Current situation of EN 197-1 revision in the context of Construction Product Regulation

As stated previously, harmonised European standards (hENs) are the harmonised technical specifications developed by CEN or CENELEC following the mandates (or Standardization Requests) given by the European Commission. The references of harmonised standards must be published in the Official Journal of the European Union to become an applicable standard valid for CE marking purposes.

Typically, CEN Technical Committees, under the former Construction Products Directive, used to prepare an answer to the mandate when accepting the mandate issued by the European Commission, compiling the standards to be drafted to comply with the mandate under consideration.

In cement field, the original mandate was released in 1997, and in the following decades the mandate was amended by several answers of CEN/TC 51 to the mandate, and accepted by the Commission, which enabled the technical committee to draft corresponding harmonized standards (and revised versions).

With the publication of the Construction Product Regulation (EU) 305/ 2011, some new rules became applicable and the revision of previous standards needed from both delegated acts from the Commission or either revised mandates or answers to mandates.

After last publication of EN 197-1:2011 as harmonized standard, CEN/TC 51 decided to amend the standard to include new cements. For that purpose, an amendment of the mandate was necessary. This process started already in August 2015, and in 2018 a proposal of revised Mandate M 114 (for cements) was sent to CEN by the Commission.

In response to this amended mandate, CEN/TC 51 prepared an answer to the mandate where the standards to be revised, and the new cements to be included were specified. In the meanwhile, CEN/TC 51 initiated the revision process of the EN 197-1, and different steps were taken.

However, concerns arose about whether the process of amending the mandate was in accordance with Regulation (EU) 1025/2012 on European standardization. Furthermore, the unbureaucratic approach used under the the Construction Products Directive (answer to the mandate and successive amendments of it to include modifications in standards), is no longer accepted by the European Commission. Motivation behind this can be found in some of the legal cases by the European Court of Justice (e.g. case “James Elliot”), by which is stated that harmonised standards are directly applicable as part of the European law, and therefore a tighter control shall be done on candidate harmonized standards.

As a direct consequence of the above matters, the revision of EN 197-1 was assessed by HAS Consultant from the Commission as “Lack of compliance” (some comments easy to solve, but other more severe due to the unrevised mandate and not accepted answer to the mandate). With this assessment result, the standard will most probably have no chance to be cited in the OJEU if published by CEN.

CEN/TC 51 is at this moment deciding on the way forward taking into consideration the context and the above circumstances. As decided on the occasion of the CEN/TC 51 Plenary meeting, if the explained situation with the revision of mandate and the answer to the mandate is unsuccessful, the intention is to leave the EN 197-1:2011 as it is currently, and to draft a new non-harmonised standard that covers the new cements intended to be included in the revised EN 197-1.

Concerning FISSAC project, and the standardization needs for blended cements, the inclusion within revision of EN 197-1 was refused given the difficult situation. Nevertheless, a small possibility of including these cements in a voluntary standard could be opened if appropriate information according to CEN/TR 16912:2016 is provided.

3.1.4 Information obtained from the project vs information required by CEN/TC 16912

As indicated previously, within CEN/TC 51 rules for the procedure to standardise new cements has been established consisting essentially:

- CEN/TR 16912:2016 “Guidelines for a procedure to support the European standardization of cements”
This CEN Technical Report provides guidance for the procedure to follow to support European standardization of new cements not covered by existing standards.
- An applicant shall request CEN/TC 51 to standardise new cements or new cement constituent(s).
- A dossier in accordance with CEN/TR 16912 shall be prepared
- CEN/TC 51 will take a decision on the basis of the information given in this dossier.

The procedure to follow depends on the type of new cement, what is to say, whether the new cement is similar to cements that already have been standardized or are substantially different. Therefore, new cements can be classified in three categories:

- Category 1: cement from a new combination of traditional and well-tried constituents.
- Category 2: cement basically corresponding to cement types defined in existing standards but containing one or more new constituents;
- Category 3: cement differing substantially from those types defined in existing standards.

According to this classification FISSAC new products could be included in the following categories:

- Blended cements: Category 2
- New CSA cement: Category 3

The general requirements for assessing new cements differ depending on their classification:

Figure 1 Classification of new cements – CEN/TR 16912:2016

<u>Category 1</u> Cement from a new combination of constituents according to EN 197-1	<u>Category 2</u> Cement containing a minor amount of one or more new constituents	<u>Category 3</u> Cement differing substantially from those types defined in existing standards
Assessment of mechanical, physical and chemical performances		
Assessment of durability related characteristics		
Assessment of influence on environmental performance		
Assessment of possible health impact		
		Relevant practical experience gained under approved conditions prior to European standardization

For FISSAC products, this means that information shall be provided not only for the assessment of mechanical, physical and chemical performance, and durability related characteristics, but also for the environmental performance, health impact and practical experience gained under approved conditions (for CSA cement).

During the evaluation process, among others, the following aspects are to be considered by CEN/TC 51:

- Classification of the new cement (category 1, 2 or 3);
- Characteristics of new cement relevant to its fitness for use;
- Methods for the verification and assessment of product characteristics
- Test results
- ...

When assessing the fitness for use, proper characteristics must be identified (for the intended use), which shall be tested according to corresponding test methods. The following table shows the characteristics identified in the CEN/TR as characteristics that may be relevant for the fitness for use. In the right column, the information obtained within FISSAC project is marked:

Table 1 - Product characteristics of new cements that may be relevant for its fitness for use. FISSAC results

Product characteristics	Results within FISSAC project
Constituents and composition	✓
Compressive strength (early)	✓
Compressive strength (standard)	✓
Initial setting time	✓
Final setting time	✓
Soundness (expansion)	✓
Penetration depth of fresh mortar	X
Air content of fresh mortar	X
Water retention of fresh mortar	X
Colour	✓
Density	✓
Fineness	✓
Particle size distribution	✓
Heat of hydration	✓ (Blended cements)
SO ₃ content	✓

Insoluble residue	X
Loss of ignition	✓
Chloride content	X
Sulphide content	✓
Alkali content	✓
Alumina content	✓
C ₃ A in clinker	X
Free calcium oxide (CaO)	X
Reactive calcium oxide	X
Reactive silicon dioxide	X
Water-soluble chromium (VI)	✓ (Blended cements)
Total organic carbon (TOC)	X
Total carbon (TC)	X
Pozzolanicity	X
Available lime	X
Reactivity of unslaked lime	X
Durability	See below
Release of dangerous substances	X
Possible health impact	X

The composition of new cements, i.e. the composition limits of all cement constituents, shall be characterized and characteristics of both, main constituents according to EN 197-1 or new constituents, must be described and determined by appropriate test methods. Following table shows the required characteristics to be determined in the characterization process, and the information obtained within FISSAC project:

Table 2 - Characterization of constituents. FISSAC results

Product characteristics	Results within FISSAC project
Loss on ignition	✓
CO ₂ and H ₂ O content	X
Main elements (SiO ₂ , Al ₂ O ₃ , TiO ₂ , Fe ₂ O ₃ , MnO ₃ , P ₂ O ₅ , CaO, MgO, Na ₂ O, K ₂ O)	✓
Sulfate content (SO ₃)	✓
Sulphide content (S ²⁻)	X
Chloride content (Cl ⁻)	✓
Free calcium oxide (CaO)	✓
Insoluble residue	X
Reactive calcium oxide (CaO)	✓
Reactive silicon dioxide (SiO ₂)	✓
Elemental silicon (Si)	✓
Clay content	X
Quantitative phase analysis	✓
Glassy material content	✓
Minor and trace elements	✓
Total organic carbon content (TOC)	✓
Total carbon content (TC)	X
Density	✓
Fineness	✓
Colour	✓

The durability aspects of new cements relate to products like concrete, mortar or other construction products for which cement is used. Although durability should be assessed according to the application rules valid in the place of use with regard the intended use of cement, for standardization purposes of new cements, the following related characteristics of concrete/mortar should be determined:

- Long-term stability
- Resistance against reinforcement corrosion (carbonatation, chloride penetration...)
- Free-thaw resistance
- Free.thaw and de-icing agent resistance;
- Shrinkage and expansion;
- Sulfate resistance;
- Seawater resistance;
- Microstructure porosity and permeability.

Within FISSAC project following characteristics have been tested

- Flexural and compressive strength (2, 7, 28 days)
- Free-thaw cycles and depth of waterpenetration under pressure

According to CEN/TR 16912, for standardization purposes of new cements (category 2 & 3), environmental performance shall be assessed through determination, declaration and verification of content and/or release/emission of dangerous substances and reporting, apart from other relevant information on sustainability.

Neither these aspects nor the one relating to the possible health impact have been assessed or evaluated within FISSAC project and no information could be provided.

3.1.5 Other technical specifications under the Construction Product Regulation

As commented previously, within the context of the Construction Products Regulation n°305/2011, the harmonised technical specifications are the Harmonised standards and the European Assessment Documents (or European Technical Approval Guidelines).

The European Assessment Documents (EADs) (or former European Technical Approval Guidelines (ETAGs)) are harmonised technical specifications developed by the European Organisation for Technical Assessment (EOTA). They constitute the basis for the assessment of products not covered or not fully covered by a harmonised standard and for which the performance in relation to its essential characteristics cannot be entirely assessed according to an existing harmonised standard. EADs are the basis for issuing European Technical Assessments by national Technical Assessment Bodies (TABs). It should be noticed that this organisation (EOTA) is not a standardization body and it does not issues standards, but their documents (EADs) are deemed important within the European construction sector for the assessment of the performances and marketing of construction products and systems.

According to the CPR, when a manufacturer decides to place a construction product on the market and that product is covered by a harmonised standard, it must complete a declaration of performance which contain information like the product reference, the systems of assessment and verification of constancy of performance of the product, the intended use or uses for the product and the declared performance. Once the declaration of performance has been drawn up, the manufacturer must affix CE marking to the product.

If no harmonised standard exists, then, the manufacturer has the option of declaring the performance of the product and fix the corresponding CE marking associated following the assessment procedure contained in a European Assessment Document, specifically prepared and written for the product in question.

It is worth noting here that in January 2017 a European Assessment Document (EAD) for calcium sulphoaluminate based cement was published by EOTA. This document, although could not be suitable for the new CSA developed within FISSAC, could be the basis for a new European Assessment Document specific for FISSAC product. The request for the preparation of this assessment document, which finally could allow the product to be CE marked, is made by one of the corresponding members of EOTA following the procedure established in CPR.

3.1.6 Conclusions and way forward

In summarising what has been said above, the standardization of new cements has proven to be very complicated. Despite the attempts to address a proposal to the corresponding European technical committee, it has not been possible given the following circumstances:

- Difficult situation of harmonised standards in the framework of the CPR prevented any attempt to propose a revision of EN 197-1 to accommodate new blended cements. Future revision of this particular standard is not even an option in the current situation, at least in the short term. Given the shift of the initial approach concerning revision of EN 197-1, the only possibility that could be considered is a voluntary standard including new blended cements (no CE marking orientated).
- The information required by the CEN Technical Committee to consider any proposal to standardize new products is quite comprehensive and relates to many characteristics and topics. Results obtained within FISSAC project needs to be completed to ensure success of the proposal. Nevertheless, results and information gained in FISSAC project has been offered to the CEN technical committee for its future considerations in standardization activities, with the following response:

Dear Raquel

Thank you very much for providing this additional information.

As you know the current situation of Mandate M/114 and prEN 197-1 is indeed very unsatisfactory and frustrating for all the experts involved in the cement standardisation. Even if these problems were solved, the harmonised European standardisation of the products developed and studied in the FISSAC project would not be possible within a short time. In a first step a further amendment of the mandate or, more probably, the preparation of a completely new standardisation request (i.e. mandate) by the European Commission would be necessary. According to our experience such a process would take several years. Furthermore, as a precondition of standardisation, a national mirror group from one country needs to bring up a proposal together with a technical dossier to CEN/TC 51.

You surely remember that the WG 6 experts emphasized that experience is necessary before new products can be standardised. An ETA might be good interim-solution before starting standardisation work, especially for being able to find sufficient applications for the new products.

Concerning CSA cements, the broad variability of possible products makes a standardisation really difficult. A few years ago a group of European cement producers tried to develop a working document on how a European standard for CSA cement could look like. The group did not succeed due to the big differences of the products.

As you see, short-term solutions are unlikely, in particular due to the legal understanding of the Commission concerning harmonised European standards.

In any case, it is good to know that we can come back to you as soon as the standardisation of products dealt with in the FISSAC project is followed-up again.

*Kind regards
Silvan*

- Last but not least, another critical issue arose over the course of the project related to the information that could be distributed to the standardization committee for standardization purposes that could also be subject of intellectual property rights. Corresponding consultation was addressed to the Commission IPR Helpdesk although no clear instructions were obtained given the particularity of the standardization system. Patent should be possible and compatible with the standardization activities if information keeps secret and the invention undisclosed. Following CEN rules, patents rights may be compatible with the standards content although the holder of the patent right might need to negotiate licences of the mentioned patent. What remains unclear is the extent to which critical information from the project may need to be revealed for the standardization process

3.2 Standardization activities in the field of new Wood-Plastic Composites (WPC)

3.2.1 General

As stated in previous deliverable on standardization, bearing in mind the continuous evolution and improvement of polymers and plastics, and the newly and growing societal demands on plastics and their impact in the environment, new developments concerning recycled materials and new plastic based products with an increased use of secondary raw materials and with better environmental performances are on the radar screen not only of producers but also of administrations and standardizers.

For FISSAC project, and in view of one of the new eco products developed under its objectives (a new wood plastic composites using tyre rubber, waste plastic and wood), focus was put on the activities of CEN/TC 249/WG13 and ISO/TC 61/SC11/WG11 on Wood Plastics Composites (WPC).

ECODEK, partner of FISSAC project in charge of the development of the new wood plastic composite using secondary raw materials, considered of the utmost importance the participation in the mentioned technical groups and the involvement in the standardization activities. The standards from CEN/TC 249/WG13 have been used in many of the test carried out within FISSAC and they have been the basis for the verification and checking of the product performances.

3.2.2 CEN activities

A representative from ECODEK was nominated as expert in CEN/TC 249/WG13 and has been working actively in its activities during this period, which can be summarized as follows.

Over the course of the project FISSAC, the main activities of the group have involved the revision of two existing standards, the publication of a new Technical Specification and two new developments.

From the beginning of FISSAC project, 11 meetings of this working group have taken place:

- November 2015
- May & November 2016
- March & September 2017
- January, May, October & November 2018
- May & June 2019

The result of the work carried out being:

- EN 15534-1:2014 + A1:2017: *Composites made from cellulose-based materials and thermoplastics (usually called wood-polymer composites (WPC) or natural fibre composites (NFC)) - Part 1: Test methods for characterisation of compounds and products*

This standard compiles the test methods for the determination of a large variety of properties of WCP products, i.e. physical, mechanical and thermal properties as well as durability among others.

The modification of the existing published standard has included the determination of colorimetric coordinates as the main change of the previous standard taking into account the international standard ISO 7724 for colour measurement has been superseded and replaced by others.

Apart from this amendment published in 2017, further revision of this standard is envisaged. The revision will include, among others, modification to the slippery test as well as other issues.

- prEN 15534-2 *Composites made from cellulose-based materials and thermoplastics (usually called wood-polymer composites (WPC) or natural fibre composites (NFC)) - Part 2: Characterisation of compounds*

Although initially registered in the TC 249/WG13 work programme, there has been limited progress on this particular item, as the group has focused on other projects of the work programme. Prenormative tests are under preparation to identify which test pieces are suitable for the different production procedures. Round robin tests need to be carried out.

- PrEN 15534-5 *Composites made from cellulose-based materials and thermoplastics (usually called wood-polymer composites (WPC) or natural fibre composites (NFC)) - Part 5: Specifications for cladding profiles and tiles*

The main objective concerning the revision of the existing standard EN 15534-5:2014 has been, not only the revision of technical content, but the conversion of the previous voluntary standard to become a harmonized standard in the framework of the Construction Product Regulation (EU) 305/2011.

An ad-hoc group was created within the working group with the task to prepare a proposal for a harmonized standard together with the corresponding modification of the answer to the mandate M/121 that should provide legal coverage to the proposed standard. Representative from ECODEK was appointed as member of this ad-hoc group and has participated actively during the last 4-5 years with contributions to the task assigned.

Initial activities within the WG were devoted to the transformation of the previous standard in a standard aligned with the CPR technical specifications requirements (addition of annex ZA etc). The answer to the mandate covering these products (M 121) was modified accordingly and processed through the Technical Committee CEN/TC 249 to the European Commission for its approval. The aim of this modification of the answer to the mandate was the inclusion of the WPC & NFC cladding profiles and tiles, with the associated essential characteristics in support of BWRs of the CPR, compiled in the relevant harmonized standard, as construction products under CPR obligations.

CEN Enquiry was launched in January 2019 until March 2019. The working group is working on the comments received from different CEN members and also from HAS Consultant, who has stressed the need to undertake several changes in the draft text to comply with Commission requirements for harmonized standards under CPR (e.g, only essential characteristics relevant in terms of CPR, dated normative references...). The draft standard needs to be restructured and some technical changes need to be considered as well. Furthermore, a new answer to the mandate should be written.

- EN 15534-6:2014 + A1:2017 *Composites made from cellulose-based materials and thermoplastics (usually called wood-polymer composites (WPC) or natural fibre composites (NFC)) - Part 6: Specifications for fencing profiles and elements*

This standard specifies the characteristics of fencing profiles and elements for fencing systems, and the updating has included modifications in one of its annexes describing the deformation due the exposure to thermal radiations from the sun.

- CEN/TS 17158 *Composites made from cellulose based materials and thermoplastics (usually called wood polymer composites (WPC) or natural fibre composites (NFC)) - Determination of particle size of lignocelulosic material*

Technical Specification specifying mechanical and optical test methods for the determination of particle size of WPC and NFC composites.

Published in April 2018.

Another standard published in the field of WPC is:

EN 15534-4:2014 *Composites made from cellulose-based materials and thermoplastics (usually called wood-polymer composites (WPC) or natural fibre composites (NFC)) - Part 4: Specifications for decking profiles and tiles*

Further revision of existing standard will take place, although not initiated to date.

3.2.3 ISO activities

At ISO level, representative from ECODEK was also nominated as expert in ISO/TC 61/SC11/WG11 “*Plastics. Products. Wood-plastic composites*”, has followed the activities of this group and even has participated in some the meetings that have taken place during this period of time.

The projects under development that is worth highlighting is:

ISO/FDIS 20819-1 Plastics — Wood-plastic recycled composites (WPRC) — Part 1: Specification

This project revises a previous version published in 2018. Under final approval vote (FDIS) until 2020-03-20.

The convenor of the group visited ECODEK facilities in 2019 to gather company experiences and inputs for further WG projects, particularly, part 2 of the above-mentioned standard on wood-plastic recycled composites.

4. Participation in CEN Workshop “Industrial Symbiosis”

4.1 General

On 17-01-2018 CEN Technical Board presented a proposal to launch a CEN Workshop to work on a CWA (Common Workshop Agreement) on industrial symbiosis. This Workshop was supported by the Horizon 2020 SPIRE projects, SHAREBOX (Secure Platform for the Flexible Management of Shared Process Resources) and EPOS (Enhanced energy and resource efficiency and Performance in process industry Operations via onsite and cross-sectorial Symbiosis), and the Interreg Europe projects, TRIS (Transitioning Regions to Industrial Symbiosis) and SYMBI (Industrial Symbiosis for a Resource Efficient Economy).

The information concerning this CEN Workshop was submitted to the coordinator team of FISSAC, as a first step, and subsequently was presented to the rest of the consortium members on the occasion of the 6th General Assembly of FISSAC held on 18/19 April 2018.

The information to both, coordinator team and the partners, included general details on the functioning of this kind of groups (CEN Workshops), the documents developed by them, and the purpose of this specific proposal on industrial symbiosis.

As presented to the members, it was explained that a Common Workshop Agreement (CWA) is a document published by CEN in at least one of the CEN three official languages, which is an agreement developed and approved in a CEN Workshop, which is a group open to the direct participation of anyone with an interest in the development of the agreement. There is no geographical limit on participation, and the procedures for its elaboration are faster and more flexible than the ones applicable to other CEN deliverables.

Additionally, it was highlighted that a CWA does not have the status of a European Standard, and it may not conflict with any existing European standard but may compete with any European normative document. Therefore, if a EN is subsequently published, the CWA shall be withdrawn. It also involves no obligation at national level: conflicting national normative documents may continue to exist. A CWA is valid for 3 years, after which the former Workshop Secretariat is consulted about its confirmation for another 3 years, revised, transformed into another deliverable, or withdrawn. In case it is decided to confirm or revise it, after 6 years from initial publication the CWA shall be submitted to the CEN/CENELEC BT(s) for decision regarding its transformation into another deliverable or its withdrawal.

The particular proposal for the CWA on industrial symbiosis was intended, and had among its objectives and benefits, to provide a consensus on best practice methodologies for industrial symbiosis in use around the world (supporting in this way the effective adoption of industrial symbiosis by the public and private sector); and to support the mutual understanding of businesses/policy makers/users/organisations using the term “industrial symbiosis” by providing common terminologies (consensus on the variety of terms used).

Together with the information on the activities of this new group it was made a proposal to participate actively in the development of the document to be produced. The proposal was well received by both, the FISSAC coordinator team and the partners, and it was then decided to register participants from ACCIONA (FISSAC coordination) and UNE in the CEN Workshop

The representation of FISSAC project in the CEN Workshop was made through three representatives from ACCIONA and one representative from UNE.

The kick-off meeting took place on 21st of February 2018, where representatives from the European industry (cement, ceramic or steel, among others), public sector, academia and European Commission as well, formally approved the project plan presented. Participants came from different European countries and Turkey.

The first CWA draft was submitted on 7-05-2018 for comments until 21-05-2018, and some contributions from FISSAC team were sent. The main deliverables where FISSAC deals directly with IS were used as a basis for the inputs (D1.6:

Industrial Symbiosis Indicators; D1.5: Assessment of BAT and emerging techniques to facilitate the collaboration across sectors and D1.8: Initial outline of FISSAC Industrial Symbiosis Model and Methodology /Report).

Two virtual meetings took place on 1st June and 18th September 2018, at which comments gathered from different participants were discussed. The final document was submitted to CEN to be processed and finally the CWA 17354:2018

“Industrial Symbiosis: Core Elements and Implementation Approaches” was delivered in December 2018. The published document is free of charge and it is accessible through

<https://www.cencenelec.eu/research/CWA/Pages/default.aspx>

As stated in the foreword of the published document, it was developed and approved by the following organisations:

International Synergies Limited
IEOS Group AG
University of Ghent
CEPI - Confederation of European Paper Industries
CEMBUREAU - the European Cement association
Motiva
University of Sussex
EIT RawMaterials
University of Cantabria
Ministry of Development, Turkey
Industrial Symbiosis Limited
ENEA - Italian National Agency for New Technologies, Energy and Sustainable Economic Development
Gorenje Surovina
BTC Company
Evonik Industries
DECHEMA - Expert network for chemical engineering and biotechnology
BSI Group
ACCIONA Construcción
UNE
AIDIMME - Technological Institute
Dr. Teresa Domenech, consultant
Giovanni Impoco, consultant

Figure 2 – Front page CWA 17354



4.2 Main aspects covered by CWA 17354:2018

As mentioned above, the document intends to help organizations, Governments and individuals to consider and implement the industrial symbiosis. For this purpose, the document provides:

- Common terminology on the subject (which, due to the different sectors and scales applying the concept has resulted in confusing and misleading),
- Consensus on the core elements of industrial symbiosis that enable its identification,
- Drivers of the IS,
- Approaches for IS, and finally
- Good practices for its implementation, supporting in this way the effective adoption of industrial symbiosis by the public and private sector.

The document identifies the core elements for industrial symbiosis, which are defined as the aspects that enable its identification. The following are included:

- Returning underutilised resources to productive use. Transactions (synergies) involving material, energy and water tend to be at the core of industrial symbiosis
- Information about opportunities (e.g., data on other organisations' resources or new technologies) to advance a synergy.
- Business conditions which promote industrial symbiosis: market conditions, policies and regulations

- Collaboration through networks
- Innovation
- Shared services

Concerning approaches to IS, there have been identified the following:

- Self organised: direct interaction among industrial actors without external coordination, motivated by business concerns due to eg legislation. Case studies are presented at the document
- Facilitated: where a third party coordinates the activity working with organizations to identify the opportunities and promoting synergies. They are facilitators, engaging organizations, enabling flowing information and providing technical support.
- ICT supported: to improve the information flow between actors
- Strategic or planned: central plan or strategic vision for strategic economic development.

Finally, factors enabling good practice are identified. Some of the referred at the document are:

- Facilitation
- Public sector investment
- Policies supporting IS
- ICT (software)
- Industrial diversity
- Network engaging business across all sectors, research and government

The document concludes with a section for industrial symbiosis implementation and good practices required:

1. Fully characterising the resources available: thinking broadly about resources (including waste, by-products, residues, energy, water, logistics, capacity, expertise, equipment and materials); and reassessing waste for value as a resource.
2. Identifying and assessing opportunities to return underutilised resources to productive use.

5. Dissemination activities within standardization community of FISSAC results and developments

In previous stage of the project, and as reflected in Deliverable 2.6 on standardization, following Technical Committees were identified and considered affected by FISSAC activities:

- CEN/TC 51 “Cements”
- CEN/TC 104 “Concrete and related products”
- CEN/TC 229 “Precast concrete products”
- CEN/TC 154 “Aggregates”
- CEN/TC 177 “Prefabricated reinforced components of autoclaved aerated concrete or light-weight aggregate concrete with open structure”
- CEN/TC 459 “Iron and Steel Standardization”
- CEN/TC 67 “Ceramic tiles”
- CEN/TC 249/WG13 “Wood Plastics Composites” (WPC)

As previously mentioned, clear gaps and place for standardization were detected for cements and wood-plastic composites, and therefore efforts were focussed in standardization technical committees for these products (CEN/TC 51 & CEN/TC 249/WG13) as it has been described in this document.

Nevertheless proper dissemination activities has been done to concrete related committees (“Concrete”, “Precast concrete products”, “Aggregates” “Steel”...), at European but also at national level, informing on FISSAC activities on the occasion of standardization technical committees meetings, national sectorial meetings etc.

Final communication has been forwarded to the referred technical committees, inviting them to learn about results and case studies carried out within FISSAC project and to register in the platform developed.

Dear Ms Meløysund,

I write to you concerning FISSAC project upon which some information was circulated some time ago.

As a reminder of the subject and objectives of the project, FISSAC “*Fostering Industrial Symbiosis for a Sustainable Resource Intensive Industry across the extended Construction Value Chain*” is a H2020 project, in which UNE (Spanish Association for Standardization) has taken part as a member of the consortium, and that has involved stakeholders at all levels of the construction and demolition value chain with the aim of developing a methodology and software platform to facilitate information exchange, that can support industrial symbiosis networks and replicate pilot schemes at local and regional levels.

Among other activities, a variety of waste streams generated from six main industrial sectors have been analyzed together with its application to four construction sub-sectors: Eco cement, green concrete, ceramic industry and wood-plastic composites. The waste streams and sub products under consideration came from the steel industry, secondary aluminium industry, ceramic industry, C&DW recycling industry, natural stone and chemical (rubber).

FISSAC, which has reached the final stage, aimed to demonstrate the effectiveness of the processes, services and products through:

- Demonstration of recycling processes to transform waste into valuable secondary raw materials
- Demonstration of the manufacturing processes of the novel products at industrial scale
- Demonstration of the eco-design of eco-innovative construction products in pre-industrial processes under life-cycle approach
- Demonstration at real scale of the application and technical performance of eco-innovative products in a variety of case studies
- Demonstration of the software platform
- Replicability assessment of the model through living lab concept.

In the case of the new cement based products, the following new eco products have been produced and

studied:

- Two types of eco-cements: Calcium sulfoaluminate cement (using aluminium saline slags, glass waste, ceramic waste and ladle furnace slag within the raw meal) and new blended cements partially incorporating ladle furnace slag, glass waste and ceramic waste. Lower CO₂ footprint and lower embodied energy, reduction of the consumption of natural resources and reduction of environmental impacts are the main benefits of the new designed cements.
- Green concrete, ready mix concrete produced using the new eco-cement manufactured during the project, EAF steel slags as aggregates and ceramic waste as mineral admixture. Trials with different dosages showed the suitability of producing this kind of concrete with reasonable mechanical and durability performances. Reduction of the natural raw materials and minimizing the carbon footprint are some of the benefits of the new product.
- Autoclaved aerated concrete blocks/panels, produced using ceramic waste, EAF slag and LF slag within the raw meal. The result is the reduction of the amount of quartzite mineral in the receipt, with advantages in the production cost and lesser environmental impacts.

New products have been validated at preindustrial scale through the production of green concrete slabs and green precast concrete elements like New Jerseys or concrete bricks. Several case studies at real scale demonstrated the suitability and feasibility of the new products.

More information can be found in the project website (<http://fissacproject.eu/en>), where some final information on the project results can be explored.

As commented, one of the goals of the project was the development of an ICT platform to support Industrial Symbiosis model between all the stakeholders concerned in the construction value chain. The final platform has just been launched and next 26 of February 2020 a webinar is scheduled, where the tool will be explained in detail. Registrations to the webinar are [open](#). Considering that this could be of your potential interest, you are kindly invited to register in the platform as well.

Hope this information is of your interest.

Kind regards and thank you in advance for your attention,

6. CONCLUSIONS

From preliminary analysis standardization needs were detected in the field of cements and Wood-Plastic Composites (WPC) and therefore main efforts have been focussed to contribute to the corresponding standardization technical committees.

In the field of cements, new cements produced under FISSAC project were not covered by existing published standards and therefore actions were taken to approach the technical committee CEN/TC 51/WG6 with proposals for a new standard for the new calcium sulphoaluminate cement produced as well as for the amendment of EN 197-1 (umbrella standard for common cements) that could accommodate the new blended cements developed.

Despite the initial previsions, and although actions and attempts have been made, the standardization initiatives envisaged have proven to be very ambitious. Revision of harmonised standards under the framework of CPR is facing a critical situation, lasting several years, and with no good expectations in the short term. Additionally, standardization experts claim that further experience with new products is needed before they could be standardised.

Developing a European Assessment Document (EAD) through any of the members of EOTA appears to be an alternative to enable the marketing of new cement products with CE marking.

In the field of WPC, participation in standardization groups have been very active and fruitful on ECODEK side. Nevertheless, one of the main goals concerning the harmonization of one of the standards developed with CE marking purposes, has not succeed due to the already commented complicated situation with the CPR. Progress will continue to be done. New initiatives at ISO level on wood-plastic recycled composites will contribute to extend the standards catalogue for these products.

It is worth noting the contribution to the CWA "Industrial Symbiosis", the content of which has represented a valuable input for some tasks under FISSAC project. Proper assessment was made to prepare additional CWA documents to supplement the mentioned one within FISSAC project, but it was finally dismissed.

Finally, dissemination of FISSAC activities within standardization community has contributed to the visibility of the works carried out.