EUROPEAN COMMISSION
Research Executive Agency (REA)

Director

GRANT AGREEMENT

NUMBER — 653586 — SpeechXRays

This **Agreement** ('the Agreement') is **between** the following parties:

on the one part,

*the **Research Executive Agency (REA)** ('the Agency'), under the power delegated by the European Commission ('the Commission')*[1],

represented for the purposes of signature of this Agreement by Head of Unit, Research Executive Agency (REA), Industrial Leadership and Societal Challenges Department, Safeguarding Secure Society, Angelo MARINO,

and

on the other part,

1. 'the coordinator':

OBERTHUR TECHNOLOGIES SA (OT) FR39, 340709534, established in RUE D ESTIENNE D ORVES 420, COLOMBES 92700, France, FR38340709534, represented for the purposes of signing the Agreement by PLSIGN, Marc BERTIN

and the following other beneficiaries, if they sign their 'Accession Form' (see Annex 3 and Article 56):

2. **HOROWITZ BIOMETRICS LIMITED (HB)** LTD, 08820146, established in 364A HIGH ROAD, LONDON NW10 2EA, United Kingdom, GB206829208,

3. **SIVECO ROMANIA SA (SIV)** SA, J40146581992, established in SOSEAUA BUCURESTI-PLOIESTI COMPLEX VICTORIA PARK CORP CLADIRE C4 SECTOR 1 73-81, BUCURESTI 013685, Romania, RO476331 ,

4. **TECH INSPIRE LTD (INSP)** LTD, 8699805, established in Pragnell Road 15, London SE12 0LF, United Kingdom, GB176580184,

5. **REALEYES OU (EYE)** OU, 11730664 , established in VAHE 15, TALLINN 11615, Estonia, EE101347468 ,

6. **Hellenic Telecommunications & Telematics Applications Company (FNET)**, 34461/06/B/95/94, established in Science & Technology Park of Crete, Vassilikia Vouton, Innovation Dept. , Heraklion 71003, Greece, EL094444827,

7. **INSTITUTUL NATIONAL DE CERCETARE -DEZVOLTARE PENTRU FIZICA SI INGINERIE NUCLEARA "HORIA HULUBEI" (IFIN-HH) (IFIN)**, R3321234, established in Atomistilor Street 407, MAGURELE RO 077125, Romania, RO3321234,

8. **FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS (FORTH)** GR2, PD432/87, established in N PLASTIRA STR 100, HERAKLION 70013, Greece, EL090101655,

1 Text in *italics* shows the options of the Model Grant Agreement that are applicable to this Agreement.

9. **UNIVERSITY COLLEGE LONDON (UCL)**, RC000631, established in GOWER STREET, LONDON WC1E 6BT, United Kingdom, GB524371168,

10. **Institut Mines-Telecom (TSP)**, 180092025, established in RUE BARRAULT 46, PARIS 13 75634, France, FR55180092025,

Unless otherwise specified, references to 'beneficiary' or 'beneficiaries' include the coordinator.

The parties referred to above have agreed to enter into the Agreement under the terms and conditions below.

By signing the Agreement or the Accession Form, the beneficiaries accept the grant and agree to implement it under their own responsibility and in accordance with the Agreement, with all the obligations and conditions it sets out.

The Agreement is composed of:

Terms and Conditions

Annex 1 Description of the action

Annex 2 Estimated budget for the action

Annex 3 Accession Forms

Annex 4 Model for the financial statements

Annex 5 Model for the certificate on the financial statements

Annex 6 Model for the certificate on the methodology

TERMS AND CONDITIONS

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CHAPTER 1 GENERAL

ARTICLE 1 — SUBJECT OF THE AGREEMENT

This Agreement sets out the rights and obligations and the terms and conditions applicable to the grant awarded to the beneficiaries for implementing the action set out in Chapter 2.

CHAPTER 2 ACTION

ARTICLE 2 — ACTION TO BE IMPLEMENTED

The grant is awarded for the action entitled '***Multi-channel biometrics combining acoustic and machine vision analysis of speech, lip movement and face — SpeechXRays***' **('action')**, as described in Annex 1.

ARTICLE 3 — DURATION AND STARTING DATE OF THE ACTION

The duration of the action will be ***36*** **months** as of *the first day of the month following the date the Agreement enters into force (see Article 58)* ('**starting date of the action**').

ARTICLE 4 — ESTIMATED BUDGET AND BUDGET TRANSFERS

4.1 Estimated budget

The '**estimated budget**' for the action is set out in Annex 2.

It contains the estimated eligible costs and the forms of costs, broken down by beneficiary and budget category (see Articles 5, 6).

4.2 Budget transfers

The estimated budget breakdown indicated in Annex 2 may be adjusted by transfers of amounts between beneficiaries or between budget categories (or both). This does not require an amendment according to Article 55, if the action is implemented as described in Annex 1.

However, the beneficiaries may not add costs relating to subcontracts not provided for in Annex 1, unless such additional subcontracts are approved by an amendment or in accordance with Article 13.

CHAPTER 3 GRANT

ARTICLE 5 — GRANT AMOUNT, FORM OF GRANT, REIMBURSEMENT RATES AND FORMS OF COSTS

5.1 Maximum grant amount

The '**maximum grant amount**' is **EUR 4,102,467.00** (four million one hundred and two thousand four hundred and sixty seven EURO).

5.2 Form of grant, reimbursement rates and forms of costs

The grant reimburses ***100% of the eligible costs of the beneficiaries that are non-profit legal entities and 70% of the eligible costs of the beneficiaries that are profit legal entities*** (see Article 6) (‘**reimbursement of eligible costs grant**’) (see Annex 2).

The estimated eligible costs of the action are EUR **5,343,606.25** (five million three hundred and forty three thousand six hundred and six EURO and twenty five eurocents).

Eligible costs (see Article 6) must be declared under the following forms ('**forms of costs**'):

(a) for **direct personnel costs**:

- as actually incurred costs (‘**actual costs**’) or
- on the basis of an amount per unit calculated by the beneficiary in accordance with its usual cost accounting practices (‘**unit costs**’).

Personnel **costs for SME owners** or **beneficiaries that are natural persons** not receiving a salary (see Article 6.2, Points A.4 and A.5) must be declared on the basis of the amount per unit set out in Annex 2 (**unit costs**);

(b) for **direct costs for subcontracting**: as actually incurred costs (**actual costs**);

(c) for **direct costs of providing financial support to third parties**: *not applicable;*

(d) for **other direct costs**: as actually incurred costs (**actual costs**);

(e) for **indirect costs**: on the basis of a flat-rate applied as set out in Article 6.2, Point E (‘**flat-rate costs**’);

(f) ***specific cost category(ies):*** *not applicable.*

5.3 Final grant amount — Calculation

The ‘**final grant amount**’ depends on the actual extent to which the action is implemented in accordance with the Agreement’s terms and conditions.

This amount is calculated by the *Agency* — when the payment of the balance is made (see Article 21.4) — in the following steps:

Step 1 – Application of the reimbursement rates to the eligible costs

Step 2 – Limit to the maximum grant amount

Step 3 – Reduction due to the no-profit rule

Step 4 – Reduction due to improper implementation or breach of other obligations

5.3.1 Step 1 — Application of the reimbursement rates to the eligible costs

The reimbursement rate(s) (see Article 5.2) are applied to the eligible costs (actual costs, unit costs and flat-rate costs; see Article 6) declared by the beneficiaries (see Article 20) and approved by the *Agency* (see Article 21).

5.3.2 Step 2 — Limit to the maximum grant amount

If the amount obtained following Step 1 is higher than the maximum grant amount set out in Article 5.1, it will be limited to the latter.

5.3.3 Step 3 — Reduction due to the no-profit rule

The grant must not produce a profit.

'**Profit**' means the surplus of the amount obtained following Steps 1 and 2 plus the action's total receipts, over the action's total eligible costs.

The '**action's total eligible costs**' are the consolidated total eligible costs approved by the *Agency*.

The '**action's total receipts**' are the consolidated total receipts generated during its duration (see Article 3).

The following are considered **receipts**:

(a) income generated by the action; if the income is generated from selling equipment or other assets purchased under the Agreement, the receipt is up to the amount declared as eligible under the Agreement;

(b) financial contributions given by third parties to the beneficiary specifically to be used for the action, and

(c) in-kind contributions provided by third parties free of charge and specifically to be used for the action, if they have been declared as eligible costs.

The following are however not considered receipts:

(a) income generated by exploiting the action's results (see Article 28);

(b) financial contributions by third parties, if they may be used to cover costs other than the eligible costs (see Article 6);

(c) financial contributions by third parties with no obligation to repay any amount unused at the end of the period set out in Article 3.

If there is a profit, it will be deducted from the amount obtained following Steps 1 and 2.

5.3.4 Step 4 — Reduction due to improper implementation or breach of other obligations — Reduced grant amount — Calculation

If the grant is reduced (see Article 43), the *Agency* will calculate the reduced grant amount by deducting the amount of the reduction (calculated in proportion to the improper implementation of

the action or to the seriousness of the breach of obligations in accordance with Article 43.2) from the maximum grant amount set out in Article 5.1.

The final grant amount will be the lower of the following two:

- the amount obtained following Steps 1 to 3 or
- the reduced grant amount following Step 4.

5.4 Revised final grant amount — Calculation

If — after the payment of the balance (in particular, after checks, reviews, audits or investigations; see Article 22) — the *Agency* rejects costs (see Article 42) or reduces the grant (see Article 43), it will calculate the '**revised final grant amount**' for the beneficiary concerned by the findings.

This amount is calculated by the *Agency* on the basis of the findings, as follows:

- in case of **rejection of costs**: by applying the reimbursement rate to the revised eligible costs approved by the *Agency* for the beneficiary concerned;
- in case of **reduction of the grant**: by calculating the concerned beneficiary's share in the grant amount reduced in proportion to its improper implementation of the action or to the seriousness of its breach of obligations (see Article 43.2).

In case of **rejection of costs and reduction of the grant**, the revised final grant amount for the beneficiary concerned will be the lower of the two amounts above.

ARTICLE 6 — ELIGIBLE AND INELIGIBLE COSTS

6.1 General conditions for costs to be eligible

'**Eligible costs**' are costs that meet the following criteria:

(a) for **actual costs**:

(i) they must be actually incurred by the beneficiary;

(ii) they must be incurred in the period set out in Article 3, with the exception of costs relating to the submission of the periodic report for the last reporting period and the final report (see Article 20);

(iii) they must be indicated in the estimated budget set out in Annex 2;

(iv) they must be incurred in connection with the action as described in Annex 1 and necessary for its implementation;

(v) they must be identifiable and verifiable, in particular recorded in the beneficiary's accounts in accordance with the accounting standards applicable in the country where the beneficiary is established and with the beneficiary's usual cost accounting practices;

(vi) they must comply with the applicable national law on taxes, labour and social security, and

(vii) they must be reasonable, justified and must comply with the principle of sound financial management, in particular regarding economy and efficiency;

(b) for **unit costs**:

(i) they must be calculated as follows:

{amounts per unit set out in Annex 2 or calculated by the beneficiary in accordance with its usual cost accounting practices (see Article 6.2, Point A)

multiplied by

the number of actual units};

(ii) the number of actual units must comply with the following conditions:

- the units must be actually used or produced in the period set out in Article 3;
- the units must be necessary for implementing the action or produced by it, and
- the number of units must be identifiable and verifiable, in particular supported by records and documentation (see Article 18);

(c) for **flat-rate costs**:

(i) they must be calculated by applying the flat-rate set out in Annex 2, and

(ii) the costs (actual costs or unit costs) to which the flat-rate is applied must comply with the conditions for eligibility set out in this Article.

6.2 Specific conditions for costs to be eligible

Costs are eligible if they comply with the general conditions (see above) and the specific conditions set out below for each of the following budget categories:

A. direct personnel costs;
B. direct costs of subcontracting;
C. *not applicable;*
D. other direct costs;
E. indirect costs;
F. *not applicable.*

'Direct costs' are costs that are directly linked to the action implementation and can therefore be attributed to it directly. They must not include any indirect costs (see Point E below).

'Indirect costs' are costs that are not directly linked to the action implementation and therefore cannot be attributed directly to it.

A. Direct personnel costs

Types of eligible personnel costs

A.1 **Personnel costs** are eligible, if they are related to personnel working for the beneficiary under an employment contract (or equivalent appointing act) and assigned to the action ('**costs for employees (or equivalent)**'). They must be limited to salaries (including during parental leave), social security contributions, taxes and other costs included in the **remuneration**, if they arise from national law or the employment contract (or equivalent appointing act).

Beneficiaries that are non-profit legal entities[2] may also declare as personnel costs **additional remuneration** for personnel assigned to the action (including payments on the basis of supplementary contracts regardless of their nature), if:

(a) it is part of the beneficiary's usual remuneration practices and is paid in a consistent manner whenever the same kind of work or expertise is required;

(b) the criteria used to calculate the supplementary payments are objective and generally applied by the beneficiary, regardless of the source of funding used.

Additional remuneration for personnel assigned to the action is eligible up to the following amount:

(a) if the person works full time and exclusively on the action during the full year: up to EUR 8 000;

(b) if the person works exclusively on the action but not full-time or not for the full year: up to the corresponding pro-rata amount of EUR 8 000, or

(c) if the person does not work exclusively on the action: up to a pro-rata amount calculated as follows:

{{EUR 8 000

divided by

the number of annual productive hours (see below)},

multiplied by

the number of hours that the person has worked on the action during the year}.

A.2 The **costs for natural persons working under a direct contract** with the beneficiary other than an employment contract are eligible personnel costs, if:

(a) the person works under the beneficiary's instructions and, unless otherwise agreed with the beneficiary, on the beneficiary's premises;

[2] For the definition, see Article 2.1(14) of the Rules for Participation Regulation No 1290/2013: '**non-profit legal entity**' means a legal entity which by its legal form is non-profit-making or which has a legal or statutory obligation not to distribute profits to its shareholders or individual members.

(b) the result of the work carried out belongs to the beneficiary, and

(c) the costs are not significantly different from those for personnel performing similar tasks under an employment contract with the beneficiary.

A.3 The **costs of personnel seconded by a third party against payment** are eligible personnel costs, if the conditions in Article 11.1 are met.

A.4 **Costs of owners** of beneficiaries that are small and medium-sized enterprises ('**SME owners**') who are working on the action and who do not receive a salary are eligible personnel costs, if they correspond to the amount per unit set out in Annex 2 multiplied by the number of actual hours worked on the action.

A.5 **Costs of 'beneficiaries that are natural persons'** not receiving a salary are eligible personnel costs, if they correspond to the amount per unit set out in Annex 2 multiplied by the number of actual hours worked on the action.

Calculation

Personnel costs must be calculated by the beneficiaries as follows:

{{hourly rate

multiplied by

the number of actual hours worked on the action},

plus

for non-profit legal entities: additional remuneration to personnel assigned to the action under the conditions set out above (Point A.1)}.

The number of actual hours declared for a person must be identifiable and verifiable (see Article 18).

The total number of hours declared in EU or Euratom grants, for a person for a year, cannot be higher than the annual productive hours used for the calculations of the hourly rate. Therefore, the maximum number of hours that can be declared for the grant is:

{the number of annual productive hours for the year (see below)

minus

total number of hours declared by the beneficiary for that person in that year for other EU or Euratom grants}.

The '**hourly rate**' is one of the following:

(a) for personnel costs declared as **actual costs:** the hourly rate is the amount calculated as follows:

{actual annual personnel costs (excluding additional remuneration) for the person

divided by

number of annual productive hours}.

The beneficiaries must use the annual personnel costs and the number of annual productive hours for each financial year covered by the reporting period. If a financial year is not closed at the end of the reporting period, the beneficiaries must use the hourly rate of the last closed financial year available.

For the 'number of annual productive hours', the beneficiaries may choose one of the following:

(i) 'fixed number of hours': 1 720 hours for persons working full time (or corresponding pro-rata for persons not working full time);

(ii) 'individual annual productive hours': the total number of hours worked by the person in the year for the beneficiary, calculated as follows:

{annual workable hours of the person (according to the employment contract, applicable collective labour agreement or national law)

plus

overtime worked

minus

absences (such as sick leave and special leave)}.

'Annual workable hours' means the period during which the personnel must be working, at the employer's disposal and carrying out his/her activity or duties under the employment contract, applicable collective labour agreement or national working time legislation.

If the contract (or applicable collective labour agreement or national working time legislation) does not allow to determine the annual workable hours, this option cannot be used;

(iii) 'standard annual productive hours': the 'standard number of annual hours' generally applied by the beneficiary for its personnel in accordance with its usual cost accounting practices. This number must be at least 90% of the 'standard annual workable hours'.

If there is no applicable reference for the standard annual workable hours, this option cannot be used.

For all options, the actual time spent on **parental leave** by a person assigned to the action may be deducted from the number of annual productive hours;

(b) for personnel costs declared on the basis of **unit costs**: the hourly rate is one of the following:

(i) for SME owners or beneficiaries that are natural persons: the hourly rate set out in Annex 2 (see Points A.4 and A.5 above), or

(ii) for personnel costs declared on the basis of the beneficiary's usual cost accounting practices: the hourly rate calculated by the beneficiary in accordance with its usual cost accounting practices, if:

- the cost accounting practices used are applied in a consistent manner, based on objective criteria, regardless of the source of funding;

- the hourly rate is calculated using the actual personnel costs recorded in the beneficiary's accounts, excluding any ineligible cost or costs included in other budget categories.

  The actual personnel costs may be adjusted by the beneficiary on the basis of budgeted or estimated elements. Those elements must be relevant for calculating the personnel costs, reasonable and correspond to objective and verifiable information;

and

- the hourly rate is calculated using the number of annual productive hours (see above).

B. Direct costs of subcontracting (including related duties, taxes and charges such as non-deductible value added tax (VAT) paid by the beneficiary) are eligible if the conditions in Article 13.1.1 are met.

C. Direct costs of providing financial support to third parties *not applicable.*

D. Other direct costs

D.1 **Travel costs and related subsistence allowances** (including related duties, taxes and charges such as non-deductible value added tax (VAT) paid by the beneficiary) are eligible if they are in line with the beneficiary's usual practices on travel.

D.2 *The **depreciation costs of equipment, infrastructure or other assets** (new or second-hand) as recorded in the beneficiary's accounts are eligible, if they were purchased in accordance with Article 10.1.1 and written off in accordance with international accounting standards and the beneficiary's usual accounting practices.*

*The **costs of renting or leasing** equipment, infrastructure or other assets (including related duties, taxes and charges such as non-deductible value added tax (VAT) paid by the beneficiary) are also eligible, if they do not exceed the depreciation costs of similar equipment, infrastructure or assets and do not include any financing fees.*

*The costs of equipment, infrastructure or other assets **contributed in-kind against payment** are eligible, if they do not exceed the depreciation costs of similar equipment, infrastructure or assets, do not include any financing fees and if the conditions in Article 11.1 are met.*

The only portion of the costs that will be taken into account is that which corresponds to the duration of the action and rate of actual use for the purposes of the action.

D.3 **Costs of other goods and services** (including related duties, taxes and charges such as non-deductible value added tax (VAT) paid by the beneficiary) are eligible, if they are:

(a) purchased specifically for the action and in accordance with Article 10.1.1 or

(b) contributed in kind against payment and in accordance with Article 11.1.

Such goods and services include, for instance, consumables and supplies, dissemination (including open access), protection of results, certificates on the financial statements (if they are required by the Agreement), certificates on the methodology, translations and publications.

D.4 **Capitalised and operating costs of 'large research infrastructure'**[3] *directly used for the action are eligible, if:*

(a) the value of the large research infrastructure represents at least 75% of the total fixed assets (at historical value in its last closed balance sheet before the date of the signature of the Agreement or as determined on the basis of the rental and leasing costs of the research infrastructure[4]*);*

*(b) the beneficiary's methodology for declaring the costs for large research infrastructure has been positively assessed by the Commission ('**ex-ante assessment**');*

(c) the beneficiary declares as direct eligible costs only the portion which corresponds to the duration of the action and the rate of actual use for the purposes of the action, and

(d) they comply with the conditions as further detailed in the annotations to the H2020 grant agreements.

E. Indirect costs

Indirect costs are eligible if they are declared on the basis of the flat-rate of 25% of the eligible direct costs (see Article 5.2 and Points A to D above), from which are excluded:

(a) costs of subcontracting and

(b) costs of in-kind contributions provided by third parties which are not used on the beneficiary's premises;

(c) *not applicable;*

(d) *not applicable.*

[3] '**Large research infrastructure**' means research infrastructure of a total value of at least EUR 20 million, for a beneficiary, calculated as the sum of historical asset values of each individual research infrastructure of that beneficiary, as they appear in its last closed balance sheet before the date of the signature of the Agreement or as determined on the basis of the rental and leasing costs of the research infrastructure.

[4] For the definition, see Article 2(6) of Regulation (EU) No 1291/2013 of the European Parliament and of the Council of 11 December 2013 establishing Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020) (OJ L 347, 20.12.2013 p.104)-('**Horizon 2020 Framework Programme Regulation No 1291/2013**'): '**Research infrastructure**' are facilities, resources and services that are used by the research communities to conduct research and foster innovation in their fields. Where relevant, they may be used beyond research, e.g. for education or public services. They include: major scientific equipment (or sets of instruments); knowledge-based resources such as collections, archives or scientific data; e-infrastructures such as data and computing systems and communication networks; and any other infrastructure of a unique nature essential to achieve excellence in research and innovation. Such infrastructures may be 'single-sited', 'virtual' or 'distributed'.

Beneficiaries receiving an operating grant[5] financed by the EU or Euratom budget cannot declare indirect costs for the period covered by the operating grant.

F. *Specific cost category(ies)*

Not applicable

6.3 Conditions for costs of linked third parties to be eligible

not applicable

6.4 Conditions for in-kind contributions provided by third parties free of charge to be eligible

In-kind contributions provided free of charge are eligible direct costs (for the beneficiary), if the costs incurred by the third party fulfil — *mutatis mutandis* — the general and specific conditions for eligibility set out in this Article (Article 6.1 and 6.2) and Article 12.1.

6.5 Ineligible costs

'**Ineligible costs**' are:

(a) costs that do not comply with the conditions set out above (Article 6.1 to 6.4), in particular:

(i) costs related to return on capital;

(ii) debt and debt service charges;

(iii) provisions for future losses or debts;

(iv) interest owed;

(v) doubtful debts;

(vi) currency exchange losses;

(vii) bank costs charged by the beneficiary's bank for transfers from the *Agency*;

(viii) excessive or reckless expenditure;

(ix) deductible VAT;

(x) costs incurred during suspension of the implementation of the action (see Article 49);

(b) costs declared under another EU or Euratom grant (including grants awarded by a Member State and financed by the EU or Euratom budget and grants awarded by bodies other than the

[5] For the definition, see Article 121(1)(b) of Regulation (EU, Euratom) No 966/2012 of the European Parliament and of the Council of 25 October 2012 on the financial rules applicable to the general budget of the Union and repealing Council Regulation (EC, Euratom) No 1605/2002 (OJ L 218, 26.10.2012, p.1) ('**Financial Regulation No 966/2012**'): '**operating grant**' means direct financial contribution, by way of donation, from the budget in order to finance the functioning of a body which pursues an aim of general EU interest or has an objective forming part of and supporting an EU policy.

Agency for the purpose of implementing the EU or Euratom budget); in particular, indirect costs if the beneficiary is already receiving an operating grant financed by the EU or Euratom budget in the same period.

6.6 Consequences of declaration of ineligible costs

Declared costs that are ineligible will be rejected (see Article 42).

This may also lead to any of the other measures described in Chapter 6.

CHAPTER 4 RIGHTS AND OBLIGATIONS OF THE PARTIES

SECTION 1 RIGHTS AND OBLIGATIONS RELATED TO IMPLEMENTING THE ACTION

ARTICLE 7 — GENERAL OBLIGATION TO PROPERLY IMPLEMENT THE ACTION

7.1 General obligation to properly implement the action

The beneficiaries must implement the action as described in Annex 1 and in compliance with the provisions of the Agreement and all legal obligations under applicable EU, international and national law.

7.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 8 — RESOURCES TO IMPLEMENT THE ACTION — THIRD PARTIES INVOLVED IN THE ACTION

The beneficiaries must have the appropriate resources to implement the action.

If it is necessary to implement the action, the beneficiaries may:

- purchase goods, works and services (see Article 10);
- use in-kind contributions provided by third parties against payment (see Article 11);
- use in-kind contributions provided by third parties free of charge (see Article 12);
- call upon subcontractors to implement action tasks described in Annex 1 (see Article 13);
- call upon linked third parties to implement action tasks described in Annex 1 (see Article 14).

In these cases, the beneficiaries retain sole responsibility towards the *Agency* and the other beneficiaries for implementing the action.

ARTICLE 9 — IMPLEMENTATION OF ACTION TASKS BY BENEFICIARIES NOT RECEIVING EU FUNDING

Not applicable

ARTICLE 10 — PURCHASE OF GOODS, WORKS OR SERVICES

10.1 Rules for purchasing goods, works or services

10.1.1 If necessary to implement the action, the beneficiaries may purchase goods, works or services.

The beneficiaries must make such purchases ensuring the best value for money or, if appropriate, the lowest price. In doing so, they must avoid any conflict of interests (see Article 35).

The beneficiaries must ensure that *the Agency,* the Commission, the European Court of Auditors (ECA) and the European Anti-Fraud Office (OLAF) can exercise their rights under Articles 22 and 23 also towards their contractors.

10.1.2 Beneficiaries that are 'contracting authorities' within the meaning of Directive 2004/18/EC[6] or 'contracting entities' within the meaning of Directive 2004/17/EC[7] must comply with the applicable national law on public procurement.

10.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under Article 10.1.1, the costs related to the contract concerned will be ineligible (see Article 6) and will be rejected (see Article 42).

If a beneficiary breaches any of its obligations under Article 10.1.2, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 11 — USE OF IN-KIND CONTRIBUTIONS PROVIDED BY THIRD PARTIES AGAINST PAYMENT

11.1 Rules for the use of in-kind contributions against payment

If necessary to implement the action, the beneficiaries may use in-kind contributions provided by third parties against payment.

The beneficiaries may declare costs related to the payment of in-kind contributions as eligible (see Article 6.1 and 6.2), up to the third parties' costs for the seconded persons, contributed equipment, infrastructure or other assets or other contributed goods and services.

The third parties and their contributions must be set out in Annex 1. The *Agency* may however approve in-kind contributions not set out in Annex 1 without amendment (see Article 55), if:

[6] Directive 2004/18/EC of the European Parliament and of the Council of 31 March 2004 on the coordination of procedures for the award of public work contracts, public supply contracts and public service contracts (OJ L 134, 30.04.2004, p. 114).

[7] Directive 2004/17/EC of the European Parliament and of the Council of 31 March 2004 coordinating the procurement procedures of entities operating in the water, energy, transport and postal services sectors (OJ L 134, 30.04.2004, p. 1).

- they are specifically justified in the periodic technical report and

- their use does not entail changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants.

The beneficiaries must ensure that *the Agency,* the Commission, the European Court of Auditors (ECA) and the European Anti-Fraud Office (OLAF) can exercise their rights under Articles 22 and 23 also towards the third parties.

11.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the costs related to the payment of the in-kind contribution will be ineligible (see Article 6) and will be rejected (see Article 42).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 12 — USE OF IN-KIND CONTRIBUTIONS PROVIDED BY THIRD PARTIES FREE OF CHARGE

12.1 Rules for the use of in-kind contributions free of charge

If necessary to implement the action, the beneficiaries may use in-kind contributions provided by third parties free of charge.

The beneficiaries may declare costs incurred by the third parties for the seconded persons, contributed equipment, infrastructure or other assets or other contributed goods and services as eligible in accordance with Article 6.4.

The third parties and their contributions must be set out in Annex 1. The *Agency* may however approve in-kind contributions not set out in Annex 1 without amendment (see Article 55), if:

- they are specifically justified in the periodic technical report and

- their use does not entail changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants.

The beneficiaries must ensure that *the Agency,* the Commission, the European Court of Auditors (ECA) and the European Anti-Fraud Office (OLAF) can exercise their rights under Articles 22 and 23 also towards the third parties.

12.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the costs incurred by the third parties related to the in-kind contribution will be ineligible (see Article 6) and will be rejected (see Article 42).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 13 — IMPLEMENTATION OF ACTION TASKS BY SUBCONTRACTORS

13.1 Rules for subcontracting action tasks

13.1.1 If necessary to implement the action, the beneficiaries may award subcontracts covering the implementation of certain action tasks described in Annex 1.

Subcontracting may cover only a limited part of the action.

The beneficiaries must award the subcontracts ensuring the best value for money or, if appropriate, the lowest price. In doing so, they must avoid any conflict of interests (see Article 35).

The tasks to be implemented and the estimated cost for each subcontract must be set out in Annex 1 and the total estimated costs of subcontracting per beneficiary must be set out in Annex 2. The *Agency* may however approve subcontracts not set out in Annex 1 and 2 without amendment (see Article 55), if:

- they are specifically justified in the periodic technical report and
- they do not entail changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants.

The beneficiaries must ensure that *the Agency,* the Commission, the European Court of Auditors (ECA) and the European Anti-Fraud Office (OLAF) can exercise their rights under Articles 22 and 23 also towards their subcontractors.

13.1.2 The beneficiaries must ensure that their obligations under Articles 35, 36, 38 and 46 also apply to the subcontractors.

Beneficiaries that are ‘contracting authorities’ within the meaning of Directive 2004/18/EC or ‘contracting entities’ within the meaning of Directive 2004/17/EC must comply with the applicable national law on public procurement.

13.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under Article 13.1.1, the costs related to the subcontract concerned will be ineligible (see Article 6) and will be rejected (see Article 42).

If a beneficiary breaches any of its obligations under Article 13.1.2, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 14 — IMPLEMENTATION OF ACTION TASKS BY LINKED THIRD PARTIES

Not applicable

ARTICLE 15 — FINANCIAL SUPPORT TO THIRD PARTIES

15.1 Rules for providing financial support to third parties

Not applicable

15.2 Financial support in the form of prizes

Not applicable

15.3 Consequences of non-compliance

Not applicable

ARTICLE 16 — PROVISION OF TRANS-NATIONAL OR VIRTUAL ACCESS TO RESEARCH INFRASTRUCTURE

16.1 Rules for providing trans-national access to research infrastructure

Not applicable

16.2 Rules for providing virtual access to research infrastructure

Not applicable

16.3 Consequences of non-compliance

Not applicable

SECTION 2 RIGHTS AND OBLIGATIONS RELATED TO THE GRANT ADMINISTRATION

ARTICLE 17 — GENERAL OBLIGATION TO INFORM

17.1 General obligation to provide information upon request

The beneficiaries must provide — during implementation of the action or afterwards and in accordance with Article 41.2 — any information requested in order to verify eligibility of the costs, proper implementation of the action and compliance with any other obligation under the Agreement.

17.2 Obligation to keep information up to date and to inform about events and circumstances likely to affect the Agreement

Each beneficiary must keep information stored in the 'Beneficiary Register' (via the electronic exchange system; see Article 52) up to date, in particular, its name, address, legal representatives, legal form and organisation type.

Each beneficiary must immediately inform the coordinator — which must immediately inform the *Agency* and the other beneficiaries — of any of the following:

(a) **events** which are likely to affect significantly or delay the implementation of the action or the EU's financial interests, in particular:

  (i) changes in its legal, financial, technical, organisational or ownership situation

(b) **circumstances** affecting:

  (i) the decision to award the grant or

(ii) compliance with requirements under the Agreement.

17.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 18 — KEEPING RECORDS — SUPPORTING DOCUMENTATION

18.1 Obligation to keep records and other supporting documentation

The beneficiaries must — for a period of *five* years after the payment of the balance — keep records and other supporting documentation in order to prove the proper implementation of the action and the costs they declare as eligible.

They must make them available upon request (see Article 17) or in the context of checks, reviews, audits or investigations (see Article 22).

If there are on-going checks, reviews, audits, investigations, litigation or other pursuits of claims under the Agreement (including the extension of findings; see Articles 22), the beneficiaries must keep the records and other supporting documentation until the end of these procedures.

The beneficiaries must keep the original documents. Digital and digitalised documents are considered originals if they are authorised by the applicable national law. The *Agency* may accept non-original documents if it considers that they offer a comparable level of assurance.

18.1.1 Records and other supporting documentation on the scientific and technical implementation

The beneficiaries must keep records and other supporting documentation on scientific and technical implementation of the action in line with the accepted standards in the respective field.

18.1.2 Records and other documentation to support the costs declared

The beneficiaries must keep the records and documentation supporting the costs declared, in particular the following:

(a) for **actual costs**: adequate records and other supporting documentation to prove the costs declared, such as contracts, subcontracts, invoices and accounting records. In addition, the beneficiaries' usual cost accounting practices and internal control procedures must enable direct reconciliation between the amounts declared, the amounts recorded in their accounts and the amounts stated in the supporting documentation;

(b) for **unit costs**: adequate records and other supporting documentation to prove the number of units declared. Beneficiaries do not need to identify the actual eligible costs covered or to keep or provide supporting documentation (such as accounting statements) to prove the amount per unit.

In addition, **for direct personnel costs declared as unit costs calculated in accordance with the beneficiary's usual cost accounting practices**, the beneficiaries must keep adequate records and documentation to prove that the cost accounting practices used comply with the conditions set out in Article 6.2, Point A.

The beneficiaries may submit to the Commission, for approval, a certificate (drawn up in accordance with Annex 6) stating that their usual cost accounting practices comply with these conditions ('**certificate on the methodology**'). If the certificate is approved, costs declared in line with this methodology will not be challenged subsequently, unless the beneficiaries have concealed information for the purpose of the approval.

(c) for **flat-rate costs**: adequate records and other supporting documentation to prove the eligibility of the costs to which the flat-rate is applied. The beneficiaries do not need to identify the costs covered or provide supporting documentation (such as accounting statements) to prove the amount declared at a flat-rate.

In addition, for **personnel costs** (declared as actual costs or on the basis of unit costs), the beneficiaries must keep **time records** for the number of hours declared. The time records must be in writing and approved by the persons working on the action and their supervisors, at least monthly. In the absence of reliable time records of the hours worked on the action, the *Agency* may accept alternative evidence supporting the number of hours declared, if it considers that it offers an adequate level of assurance.

As an exception, for **persons working exclusively on the action**, there is no need to keep time records, if the beneficiary signs a **declaration** confirming that the persons concerned have worked exclusively on the action.

18.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, costs insufficiently substantiated will be ineligible (see Article 6) and will be rejected (see Article 42), and the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 19 — SUBMISSION OF DELIVERABLES

19.1 Obligation to submit deliverables

The coordinator must submit the '**deliverables**' identified in Annex 1, in accordance with the timing and conditions set out in it.

19.2 Consequences of non-compliance

If the coordinator breaches any of its obligations under this Article, the *Agency* may apply any of the measures described in Chapter 6.

ARTICLE 20 — REPORTING — PAYMENT REQUESTS

20.1 Obligation to submit reports

The coordinator must submit to the *Agency* (see Article 52) the technical and financial reports set out in this Article. These reports include the requests for payment and must be drawn up using the forms and templates provided in the electronic exchange system (see Article 52).

20.2 Reporting periods

The action is divided into the following '**reporting periods**':

- RP1: from month 1 to month 18
- *RP2: from month 19 to month 36*

20.3 Periodic reports — Requests for interim payments

The coordinator must submit a periodic report within 60 days following the end of each reporting period.

The **periodic report** must include the following:

(a) a '**periodic technical report**' containing:

(i) an **explanation of the work carried out** by the beneficiaries;

(ii) an **overview of the progress** towards the objectives of the action, including milestones and deliverables identified in Annex 1.

This report must include explanations justifying the differences between work expected to be carried out in accordance with Annex 1 and that actually carried out.

The report must also detail the exploitation and dissemination of the results and — if required in Annex 1 — an updated '**plan for the exploitation and dissemination of the results**';

(iii) a **summary** for publication by the *Agency*;

(iv) the answers to the '**questionnaire**', covering issues related to the action implementation and the economic and societal impact, notably in the context of the Horizon 2020 key performance indicators and the Horizon 2020 monitoring requirements;

(b) a '**periodic financial report**' containing:

(i) an '**individual financial statement**' (see Annex 4) from each beneficiary, for the reporting period concerned.

The individual financial statement must detail the eligible costs (actual costs, unit costs and flat-rate costs; see Article 6) for each budget category (see Annex 2).

The beneficiaries must declare all eligible costs, even if — for actual costs, unit costs and flat-rate costs — they exceed the amounts indicated in the estimated budget (see Annex

2). Amounts which are not declared in the individual financial statement will not be taken into account by the *Agency*.

If an individual financial statement is not submitted for a reporting period, it may be included in the periodic financial report for the next reporting period.

The individual financial statements of the last reporting period must also detail the **receipts of the action** (see Article 5.3.3).

Each beneficiary must **certify** that:

- the information provided is full, reliable and true;
- the costs declared are eligible (see Article 6);
- the costs can be substantiated by adequate records and supporting documentation (see Article 18) that will be produced upon request (see Article 17) or in the context of checks, reviews, audits and investigations (see Article 22), and
- for the last reporting period: that all the receipts have been declared (see Article 5.3.3);

(ii) an **explanation of the use of resources** and the information on subcontracting (see Article 13) and in-kind contributions provided by third parties (see Articles 11 and 12) from each beneficiary, for the reporting period concerned;

(iii) *not applicable;*

(iv) a '**periodic summary financial statement**' (see Annex 4), created automatically by the electronic exchange system, consolidating the individual financial statements for the reporting period concerned and including — except for the last reporting period — the **request for interim payment**.

20.4 Final report — Request for payment of the balance

In addition to the periodic report for the last reporting period, the coordinator must submit the final report within 60 days following the end of the last reporting period.

The **final report** must include the following:

(a) a '**final technical report**' with a **summary** for publication containing:

(i) an overview of the results and their exploitation and dissemination;

(ii) the conclusions on the action, and

(iii) the socio-economic impact of the action;

(b) a '**final financial report**' containing:

(i) a '**final summary financial statement**' (see Annex 4), created automatically by the electronic exchange system, consolidating the individual financial statements for all reporting periods and including the **request for payment of the balance** and

(ii) a '**certificate on the financial statements**' (drawn up in accordance with Annex 5) for each beneficiary , if it requests a total contribution of EUR 325 000 or more, as reimbursement of actual costs and unit costs calculated on the basis of its usual cost accounting practices (see Article 5.2 and Article 6.2, Point A).

20.5 Information on cumulative expenditure incurred

Not applicable

20.6 Currency for financial statements and conversion into euro

Financial statements must be drafted in euro.

Beneficiaries with accounting established in a currency other than the euro must convert the costs recorded in their accounts into euro, at the average of the daily exchange rates published in the C series of the *Official Journal of the European Union*, calculated over the corresponding reporting period.

If no daily euro exchange rate is published in the *Official Journal of the European Union* for the currency in question, they must be converted at the average of the monthly accounting rates published on the Commission's website, calculated over the corresponding reporting period.

Beneficiaries with accounting established in euro must convert costs incurred in another currency into euro according to their usual accounting practices.

20.7 Language of reports

All reports (technical and financial reports, including financial statements) must be submitted in the language of the Agreement.

20.8 Consequences of non-compliance — Suspension of the payment deadline — Termination

If the reports submitted do not comply with this Article, the *Agency* may suspend the payment deadline (see Article 47) and apply any of the other measures described in Chapter 6.

If the coordinator breaches its obligation to submit the reports and if it fails to comply with this obligation within 30 days following a written reminder sent by the *Agency*, the Agreement may be terminated (see Article 50).

ARTICLE 21 — PAYMENTS AND PAYMENT ARRANGEMENTS

21.1 Payments to be made

The following payments will be made to the coordinator:

- one **pre-financing payment**;

- one or more **interim payments**, on the basis of the request(s) for interim payment (see Article 20), and

- one **payment of the balance**, on the basis of the request for payment of the balance (see Article 20).

21.2 Pre-financing payment — Amount — Amount retained for the Guarantee Fund

The aim of the pre-financing is to provide the beneficiaries with a float.

It remains the property of the *EU* until the payment of the balance.

The amount of the pre-financing payment will be EUR **2,051,233.50** (two million fifty one thousand two hundred and thirty three EURO and fifty eurocents).

The *Agency* will — except if Article 48 applies — make the pre-financing payment to the coordinator within 30 days either from the entry into force of the Agreement (see Article 58) or from 10 days before the starting date of the action (see Article 3), whichever is the latest.

An amount of EUR **205,123.35** (two hundred and five thousand one hundred and twenty three EURO and thirty five eurocents), corresponding to 5% of the maximum grant amount (see Article 5.1), is retained by the *Agency* from the pre-financing payment and transferred into the '**Guarantee Fund**'.

21.3 Interim payments — Amount — Calculation

Interim payments reimburse the eligible costs incurred for the implementation of the action during the corresponding reporting periods.

The *Agency* will pay to the coordinator the amount due as interim payment within 90 days from receiving the periodic report (see Article 20.3), except if Articles 47 or 48 apply.

Payment is subject to the approval of the periodic report. Its approval does not imply recognition of the compliance, authenticity, completeness or correctness of its content.

The **amount due as interim payment** is calculated by the *Agency* in the following steps:

Step 1 – Application of the reimbursement rates

Step 2 – Limit to 90% of the maximum grant amount

21.3.1 Step 1 — Application of the reimbursement rates

The reimbursement rate(s) (see Article 5.2) are applied to the eligible costs (actual costs, unit costs and flat-rate costs ; see Article 6) declared by the beneficiaries (see Article 20) and approved by the *Agency* (see above) for the concerned reporting period.

21.3.2 Step 2 — Limit to 90% of the maximum grant amount

The total amount of pre-financing and interim payments must not exceed 90% of the maximum grant amount set out in Article 5.1. The maximum amount for the interim payment will be calculated as follows:

{90% of the maximum grant amount (see Article 5.1)

minus

{pre-financing and previous interim payments}}.

21.4 Payment of the balance — Amount — Calculation — Release of the amount retained for the Guarantee Fund

The payment of the balance reimburses the remaining part of the eligible costs incurred by the beneficiaries for the implementation of the action.

If the total amount of earlier payments is greater than the final grant amount (see Article 5.3), the payment of the balance takes the form of a recovery (see Article 44).

If the total amount of earlier payments is lower than the final grant amount, the *Agency* will pay the balance within 90 days from receiving the final report (see Article 20.4), except if Articles 47 or 48 apply.

Payment is subject to the approval of the final report. Its approval does not imply recognition of the compliance, authenticity, completeness or correctness of its content.

The **amount due as the balance** is calculated by the *Agency* by deducting the total amount of pre-financing and interim payments (if any) already made, from the final grant amount determined in accordance with Article 5.3:

{final grant amount (see Article 5.3)

minus

{pre-financing and interim payments (if any) made}}.

At the payment of the balance, the amount retained for the Guarantee Fund (see above) will be released and:

- if the balance is positive: the amount released will be paid in full to the coordinator together with the amount due as the balance;

- if the balance is negative (payment of the balance taking the form of recovery): it will be deducted from the amount released (see Article 44.1.2). If the resulting amount:

    - is positive, it will be paid to the coordinator

    - is negative, it will be recovered.

The amount to be paid may however be offset — without the beneficiary's consent — against any other amount owed by the beneficiary to the *Agency, the* Commission or an*other* executive agency (under the EU or Euratom budget), up to the maximum EU contribution indicated, for that beneficiary, in the estimated budget (see Annex 2).

21.5 Notification of amounts due

When making payments, the *Agency* will formally notify to the coordinator the amount due, specifying whether it concerns an interim payment or the payment of the balance.

For the payment of the balance, the notification will also specify the final grant amount.

In the case of reduction of the grant or recovery of undue amounts, the notification will be preceded by the contradictory procedure set out in Articles 43 and 44.

21.6 Currency for payments

The *Agency* will make all payments in euro.

21.7 Payments to the coordinator — Distribution to the beneficiaries

Payments will be made to the coordinator.

Payments to the coordinator will discharge the *Agency* from its payment obligation.

The coordinator must distribute the payments between the beneficiaries without unjustified delay.

Pre-financing may however be distributed only:

(a) if the minimum number of beneficiaries set out in the call for proposals has acceded to the Agreement (see Article 56) and

(b) to beneficiaries that have acceded to the Agreement (see Article 56).

21.8 Bank account for payments

All payments will be made to the following bank account:

Name of bank: STE GENERALE
Address of branch: ZAC FRANCISCO FERER VERN BAT B4 2A RENNES, France
Full name of the account holder: OBERTHUR TECHNOLOGIES CENTRAL
Full account number (including bank codes):
IBAN code: FR7630003017500002005448602

21.9 Costs of payment transfers

The cost of the payment transfers is borne as follows:

- the *Agency* bears the cost of transfers charged by its bank;
- the beneficiary bears the cost of transfers charged by its bank;
- the party causing a repetition of a transfer bears all costs of the repeated transfer.

21.10 Date of payment

Payments by the *Agency* are considered to have been carried out on the date when they are debited to its account.

21.11 Consequences of non-compliance

21.11.1 If the *Agency* does not pay within the payment deadlines (see above), the beneficiaries are entitled to **late-payment interest** at the rate applied by the European Central Bank (ECB) for its main refinancing operations in euros ('reference rate'), plus three and a half points. The reference rate is the rate in force on the first day of the month in which the payment deadline expires, as published in the C series of the *Official Journal of the European Union*.

If the late-payment interest is lower than or equal to EUR 200, it will be paid to the coordinator only upon request submitted within two months of receiving the late payment.

Late-payment interest is not due if all beneficiaries are EU Member States (including regional and local government authorities or other public bodies acting on behalf of a Member State for the purpose of this Agreement).

Suspension of the payment deadline or payments (see Articles 47 and 48) will not be considered as late payment.

Late-payment interest covers the period running from the day following the due date for payment (see above), up to and including the date of payment.

Late-payment interest is not considered for the purposes of calculating the final grant amount.

21.11.2 If the coordinator breaches any of its obligations under this Article, the grant may be reduced (see Article 43) and the Agreement or the participation of the coordinator may be terminated (see Article 50).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 22 — CHECKS, REVIEWS, AUDITS AND INVESTIGATIONS — EXTENSION OF FINDINGS

22.1 Checks, reviews and audits by the *Agency and the* Commission

22.1.1 Right to carry out checks

The *Agency or the* Commission will — during the implementation of the action or afterwards — check the proper implementation of the action and compliance with the obligations under the Agreement, including assessing deliverables and reports.

For this purpose the *Agency or the* Commission may be assisted by external persons or bodies.

The *Agency or the* Commission may also request additional information in accordance with Article 17. The *Agency or the* Commission may request beneficiaries to provide such information to it directly.

Information provided must be accurate, precise and complete and in the format requested, including electronic format.

22.1.2 Right to carry out reviews

The *Agency or the* Commission may — during the implementation of the action or afterwards — carry out reviews on the proper implementation of the action (including assessment of deliverables

and reports), compliance with the obligations under the Agreement and continued scientific or technological relevance of the action.

Reviews may be started **up to two years after the payment of the balance**. They will be formally notified to the coordinator or beneficiary concerned and will be considered to have started on the date of the formal notification.

If the review is carried out on a third party (see Articles 10 to 16), the beneficiary concerned must inform the third party.

The *Agency or the* Commission may carry out reviews directly (using its own staff) or indirectly (using external persons or bodies appointed to do so). It will inform the coordinator or beneficiary concerned of the identity of the external persons or bodies. They have the right to object to the appointment on grounds of commercial confidentiality.

The coordinator or beneficiary concerned must provide — within the deadline requested — any information and data in addition to deliverables and reports already submitted (including information on the use of resources). The *Agency or the* Commission may request beneficiaries to provide such information to it directly.

The coordinator or beneficiary concerned may be requested to participate in meetings, including with external experts.

For **on-the-spot** reviews, the beneficiaries must allow access to their sites and premises, including to external persons or bodies, and must ensure that information requested is readily available.

Information provided must be accurate, precise and complete and in the format requested, including electronic format.

On the basis of the review findings, a '**review report**' will be drawn up.

The *Agency or the* Commission will formally notify the review report to the coordinator or beneficiary concerned, which has 30 days to formally notify observations ('**contradictory review procedure**').

Reviews (including review reports) are in the language of the Agreement.

22.1.3 Right to carry out audits

The *Agency or the* Commission may — during the implementation of the action or afterwards — carry out audits on the proper implementation of the action and compliance with the obligations under the Agreement.

Audits may be started **up to two years after the payment of the balance**. They will be formally notified to the coordinator or beneficiary concerned and will be considered to have started on the date of the formal notification.

If the audit is carried out on a third party (see Articles 10 to 16), the beneficiary concerned must inform the third party.

The *Agency or the* Commission may carry out audits directly (using its own staff) or indirectly (using external persons or bodies appointed to do so). It will inform the coordinator or beneficiary concerned

of the identity of the external persons or bodies. They have the right to object to the appointment on grounds of commercial confidentiality.

The coordinator or beneficiary concerned must provide — within the deadline requested — any information (including complete accounts, individual salary statements or other personal data) to verify compliance with the Agreement. The *Agency or the* Commission may request beneficiaries to provide such information to it directly.

For **on-the-spot** audits, the beneficiaries must allow access to their sites and premises, including to external persons or bodies, and must ensure that information requested is readily available.

Information provided must be accurate, precise and complete and in the format requested, including electronic format.

On the basis of the audit findings, a '**draft audit report**' will be drawn up.

The *Agency or the* Commission will formally notify the draft audit report to the coordinator or beneficiary concerned, which has 30 days to formally notify observations ('**contradictory audit procedure**'). This period may be extended by the *Agency or the* Commission in justified cases.

The '**final audit report**' will take into account observations by the coordinator or beneficiary concerned. The report will be formally notified to it.

Audits (including audit reports) are in the language of the Agreement.

The *Agency or the* Commission may also access the beneficiaries' statutory records for the periodical assessment of unit costs or flat-rate amounts.

22.2 Investigations by the European Anti-Fraud Office (OLAF)

Under Regulations No 883/2013[15] and No 2185/96[16] (and in accordance with their provisions and procedures) the European Anti-Fraud Office (OLAF) may — at any moment during implementation of the action or afterwards — carry out investigations, including on-the-spot checks and inspections, to establish whether there has been fraud, corruption or any other illegal activity affecting the financial interests of the EU.

22.3 Checks and audits by the European Court of Auditors (ECA)

Under Article 287 of the Treaty on the Functioning of the European Union (TFEU) and Article 161 of the Financial Regulation No 966/2012[17], the European Court of Auditors (ECA) may — at any moment during implementation of the action or afterwards — carry out audits.

[15] Regulation (EU, Euratom) No 883/2013 of the European Parliament and of the Council of 11 September 2013 concerning investigations conducted by the European Anti-Fraud Office (OLAF) and repealing Regulation (EC) No 1073/1999 of the European Parliament and of the Council and Council Regulation (Euratom) No 1074/1999 (OJ L 248, 18.09.2013, p. 1).

[16] Council Regulation (Euratom, EC) No 2185/1996 of 11 November 1996 concerning on-the-spot checks and inspections carried out by the Commission in order to protect the European Communities' financial interests against fraud and other irregularities (OJ L 292, 15.11.1996, p. 2).

[17] Regulation (EU, Euratom) No 966/2012 of the European Parliament and of the Council of 25 October 2012 on the financial rules applicable to the general budget of the Union and repealing Council Regulation (EC, Euratom) No 1605/2002 ('**Financial Regulation No 966/2012**') (OJ L 298, 26.10.2012, p. 1).

The ECA has the right of access for the purpose of checks and audits.

22.4 Checks, reviews, audits and investigations for international organisations

Not applicable

22.5 Consequences of findings in checks, reviews, audits and investigations — Extension of findings

22.5.1 Findings in this grant

Findings in checks, reviews, audits or investigations carried out in the context of this grant may lead to the rejection of ineligible costs (see Article 42), reduction of the grant (see Article 43), recovery of undue amounts (see Article 44) or to any of the other measures described in Chapter 6.

Rejection of costs or reduction of the grant after the payment of the balance will lead to a revised final grant amount (see Article 5.4).

Findings in checks, reviews, audits or investigations may lead to a request for amendment for the modification of Annex 1 (see Article 55).

Checks, reviews, audits or investigations that find systemic or recurrent errors, irregularities, fraud or breach of obligations may also lead to consequences in other EU or Euratom grants awarded under similar conditions ('**extension of findings from this grant to other grants**').

Moreover, findings arising from an OLAF investigation may lead to criminal prosecution under national law.

22.5.2 Findings in other grants

The *Agency or the* Commission may extend findings from other grants to this grant ('**extension of findings from other grants to this grant**'), if:

(a) the beneficiary concerned is found, in other EU or Euratom grants awarded under similar conditions, to have committed systemic or recurrent errors, irregularities, fraud or breach of obligations that have a material impact on this grant and

(b) those findings are formally notified to the beneficiary concerned — together with the list of grants affected by the findings — no later than two years after the payment of the balance of this grant.

The extension of findings may lead to the rejection of costs (see Article 42), reduction of the grant (see Article 43), recovery of undue amounts (see Article 44), suspension of payments (see Article 48), suspension of the action implementation (see Article 49) or termination (see Article 50).

22.5.3 Procedure

The *Agency or the* Commission will formally notify the beneficiary concerned the systemic or recurrent errors and its intention to extend these audit findings, together with the list of grants affected.

22.5.3.1 If the findings concern **eligibility of costs**: the formal notification will include:

(a) an invitation to submit observations on the list of grants affected by the findings;

(b) the request to submit **revised financial statements** for all grants affected;

(c) the **correction rate for extrapolation** established by the *Agency or the* Commission on the basis of the systemic or recurrent errors, to calculate the amounts to be rejected if the beneficiary concerned:

(i) considers that the submission of revised financial statements is not possible or practicable or

(ii) does not submit revised financial statements.

The beneficiary concerned has 90 days from receiving notification to submit observations, revised financial statements or to propose a duly substantiated **alternative correction method**. This period may be extended by the *Agency or the* Commission in justified cases.

The amounts to be rejected will be determined on the basis of the revised financial statements, subject to their approval.

If the *Agency or the* Commission does not receive any observations or revised financial statements, does not accept the observations or the proposed alternative correction method or does not approve the revised financial statements, it will formally notify the beneficiary concerned the application of the initially notified correction rate for extrapolation.

If the *Agency or the* Commission accepts the alternative correction method proposed by the beneficiary concerned, it will formally notify the application of the accepted alternative correction method.

22.5.3.2 If the findings concern **improper implementation** or a **breach of another obligation**: the formal notification will include:

(a) an invitation to submit observations on the list of grants affected by the findings and

(b) the flat-rate the *Agency or the* Commission intends to apply according to the principle of proportionality.

The beneficiary concerned has 90 days from receiving notification to submit observations or to propose a duly substantiated alternative flat-rate.

If the *Agency or the* Commission does not receive any observations or does not accept the observations or the proposed alternative flat-rate, it will formally notify the beneficiary concerned the application of the initially notified flat-rate.

If the *Agency or the* Commission accepts the alternative flat-rate proposed by the beneficiary concerned, it will formally notify the application of the accepted alternative flat-rate.

22.6 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, any insufficiently substantiated costs will be ineligible (see Article 6) and will be rejected (see Article 42).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 23 — EVALUATION OF THE IMPACT OF THE ACTION

23.1 Right to evaluate the impact of the action

The *Agency or the* Commission may carry out interim and final evaluations of the impact of the action measured against the objective of the *EU* programme.

Evaluations may be started during implementation of the action and up to *five* years after the payment of the balance. The evaluation is considered to start on the date of the formal notification to the coordinator or beneficiaries.

The *Agency or the* Commission may make these evaluations directly (using its own staff) or indirectly (using external bodies or persons it has authorised to do so).

The coordinator or beneficiaries must provide any information relevant to evaluate the impact of the action, including information in electronic format.

23.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the *Agency* may apply the measures described in Chapter 6.

SECTION 3 RIGHTS AND OBLIGATIONS RELATED TO BACKGROUND AND RESULTS

SUBSECTION 1 GENERAL

ARTICLE 23a — MANAGEMENT OF INTELLECTUAL PROPERTY

23a.1 Obligation to take measures to implement the Commission Recommendation on the management of intellectual property in knowledge transfer activities

Beneficiaries that are universities or other public research organisations must take measures to implement the principles set out in Points 1 and 2 of the Code of Practice annexed to the Commission Recommendation on the management of intellectual property in knowledge transfer activities[18].

This does not change the obligations set out in Subsections 2 and 3 of this Section.

The beneficiaries must ensure that researchers and third parties involved in the action are aware of them.

23a.2 Consequences of non-compliance

If a beneficiary breaches its obligations under this Article, the *Agency* may apply any of the measures described in Chapter 6.

[18] Commission Recommendation C (2008) 1329 of 10.4.2008 on the management of intellectual property in knowledge transfer activities and the Code of Practice for universities and other public research institutions attached to this recommendation.

SUBSECTION 2 RIGHTS AND OBLIGATIONS RELATED TO BACKGROUND

ARTICLE 24 — AGREEMENT ON BACKGROUND

24.1 Agreement on background

The beneficiaries must identify and agree (in writing) on the background for the action ('**agreement on background**').

'**Background**' means any data, know-how or information — whatever its form or nature (tangible or intangible), including any rights such as intellectual property rights — that:

(a) is held by the beneficiaries before they acceded to the Agreement, and

(b) is needed to implement the action or exploit the results.

24.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 25 — ACCESS RIGHTS TO BACKGROUND

25.1 Exercise of access rights — Waiving of access rights — No sub-licensing

To exercise access rights, this must first be requested in writing ('**request for access**').

'**Access rights**' means rights to use results or background under the terms and conditions laid down in this Agreement.

Waivers of access rights are not valid unless in writing.

Unless agreed otherwise, access rights do not include the right to sub-license.

25.2 Access rights for other beneficiaries, for implementing their own tasks under the action

The beneficiaries must give each other access — on a royalty-free basis — to background needed to implement their own tasks under the action, unless the beneficiary that holds the background has — before acceding to the Agreement —:

(a) informed the other beneficiaries that access to its background is subject to legal restrictions or limits, including those imposed by the rights of third parties (including personnel), or

(b) agreed with the other beneficiaries that access would not be on a royalty-free basis.

25.3 Access rights for other beneficiaries, for exploiting their own results

The beneficiaries must give each other access — under fair and reasonable conditions — to background needed for exploiting their own results, unless the beneficiary that holds the background has — before acceding to the Agreement — informed the other beneficiaries that access to its

background is subject to legal restrictions or limits, including those imposed by the rights of third parties (including personnel).

'**Fair and reasonable conditions**' means appropriate conditions, including possible financial terms or royalty-free conditions, taking into account the specific circumstances of the request for access, for example the actual or potential value of the results or background to which access is requested and/or the scope, duration or other characteristics of the exploitation envisaged.

Requests for access may be made — unless agreed otherwise — up to one year after the period set out in Article 3.

25.4 Access rights for affiliated entities

Unless otherwise agreed in the consortium agreement, access to background must also be given — under fair and reasonable conditions (see above; Article 25.3) and unless it is subject to legal restrictions or limits, including those imposed by the rights of third parties (including personnel) — to affiliated entities[19] established in an EU Member State or '**associated country**' [20], if this is needed to exploit the results generated by the beneficiaries to which they are affiliated.

Unless agreed otherwise (see above; Article 25.1), the affiliated entity concerned must make the request directly to the beneficiary that holds the background.

Requests for access may be made — unless agreed otherwise — up to one year after the period set out in Article 3.

25.5 Access rights for third parties

Not applicable

25.6 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

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[19] [19] For the definition, see Article 2.1(2) of the Rules for Participation Regulation No 1290/2013: '**affiliated entity**' means any legal entity that is under the direct or indirect control of a participant, or under the same direct or indirect control as the participant, or that is directly or indirectly controlling a participant.
'Control' may take any of the following forms:
(a) the direct or indirect holding of more than 50% of the nominal value of the issued share capital in the legal entity concerned, or of a majority of the voting rights of the shareholders or associates of that entity;
(b) the direct or indirect holding, in fact or in law, of decision-making powers in the legal entity concerned.
However the following relationships between legal entities shall not in themselves be deemed to constitute controlling relationships:
(a) the same public investment corporation, institutional investor or venture-capital company has a direct or indirect holding of more than 50% of the nominal value of the issued share capital or a majority of voting rights of the shareholders or associates;
(b) the legal entities concerned are owned or supervised by the same public body.

[20] For the definition, see Article 2.1(3) of the Rules for Participation Regulation No 1290/2013: '**associated country**' means a third country which is party to an international agreement with the Union, as identified in *Article 7 of Horizon 2020 Framework Programme Regulation No 1291/2013. Article 7 sets out the conditions for association of non-EU countries to Horizon 2020.*

SUBSECTION 3 RIGHTS AND OBLIGATIONS RELATED TO RESULTS

ARTICLE 26 — OWNERSHIP OF RESULTS

26.1 Ownership by the beneficiary that generates the results

Results are owned by the beneficiary that generates them.

'**Results**' means any (tangible or intangible) output of the action such as data, knowledge or information — whatever its form or nature, whether it can be protected or not — that is generated in the action, as well as any rights attached to it, including intellectual property rights.

26.2 Joint ownership by several beneficiaries

Two or more beneficiaries own results jointly if:

(a) they have jointly generated them and

(b) it is not possible to:

(i) establish the respective contribution of each beneficiary, or

(ii) separate them for the purpose of applying for, obtaining or maintaining their protection (see Article 27).

The joint owners must agree (in writing) on the allocation and terms of exercise of their joint ownership ('**joint ownership agreement**'), to ensure compliance with their obligations under this Agreement.

Unless otherwise agreed in the joint ownership agreement, each joint owner may grant non-exclusive licences to third parties to exploit jointly-owned results (without any right to sub-license), if the other joint owners are given:

(a) at least 45 days advance notice and

(b) fair and reasonable compensation.

Once the results have been generated, joint owners may agree (in writing) to apply another regime than joint ownership (such as, for instance, transfer to a single owner (see Article 30) with access rights for the others).

26.3 Rights of third parties (including personnel)

If third parties (including personnel) may claim rights to the results, the beneficiary concerned must ensure that it complies with its obligations under the Agreement.

If a third party generates results, the beneficiary concerned must obtain all necessary rights (transfer, licences or other) from the third party, in order to be able to respect its obligations as if those results were generated by the beneficiary itself.

If obtaining the rights is impossible, the beneficiary must refrain from using the third party to generate the results.

26.4 *Agency* ownership, to protect results

26.4.1 *The Agency* may — with the consent of the beneficiary concerned — assume ownership of results to protect them, if a beneficiary intends — up to four years after the period set out in Article 3 — to disseminate its results without protecting them, except in any of the following cases:

(a) the lack of protection is because protecting the results is not possible, reasonable or justified (given the circumstances);

(b) the lack of protection is because there is a lack of potential for commercial or industrial exploitation, or

(c) the beneficiary intends to transfer the results to another beneficiary or third party established in an EU Member State or associated country, which will protect them.

Before the results are disseminated and unless any of the cases above under Points (a), (b) or (c) applies, the beneficiary must formally notify the *Agency* and at the same time inform it of any reasons for refusing consent. The beneficiary may refuse consent only if it can show that its legitimate interests would suffer significant harm.

If the *Agency* decides to assume ownership, it will formally notify the beneficiary concerned within 45 days of receiving notification.

No dissemination relating to these results may before the end of this period or, if the *Agency* takes a positive decision, until it has taken the necessary steps to protect the results.

26.4.2 *The Agency* may — with the consent of the beneficiary concerned — assume ownership of results to protect them, if a beneficiary intends — up to four years after the period set out in Article 3 — to stop protecting them or not to seek an extension of protection, except in any of the following cases:

(a) the protection is stopped because of a lack of potential for commercial or industrial exploitation;

(b) an extension would not be justified given the circumstances.

A beneficiary that intends to stop protecting results or not seek an extension must — unless any of the cases above under Points (a) or (b) applies — formally notify the *Agency* at least 60 days before the protection lapses or its extension is no longer possible and at the same time inform it of any reasons for refusing consent. The beneficiary may refuse consent only if it can show that its legitimate interests would suffer significant harm.

If the *Agency* decides to assume ownership, it will formally notify the beneficiary concerned within 45 days of receiving notification.

26.5 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to the any of the other measures described in Chapter 6.

ARTICLE 27 — PROTECTION OF RESULTS — VISIBILITY OF EU FUNDING

27.1 Obligation to protect the results

Each beneficiary must examine the possibility of protecting its results and must adequately protect them — for an appropriate period and with appropriate territorial coverage — if:

(a) the results can reasonably be expected to be commercially or industrially exploited and

(b) protecting them is possible, reasonable and justified (given the circumstances).

When deciding on protection, the beneficiary must consider its own legitimate interests and the legitimate interests (especially commercial) of the other beneficiaries.

27.2 *Agency* ownership, to protect the results

If a beneficiary intends not to protect its results, to stop protecting them or not seek an extension of protection, *The Agency* may — under certain conditions (see Article 26.4) — assume ownership to ensure their (continued) protection.

27.3 Information on EU funding

Applications for protection of results (including patent applications) filed by or on behalf of a beneficiary must — unless the *Agency* requests or agrees otherwise or unless it is impossible — include the following:

> "The project leading to this application has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 653586".

27.4 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such a breach may also lead to any of the other measures described in Chapter 6.

ARTICLE 28 — EXPLOITATION OF RESULTS

28.1 Obligation to exploit the results

Each beneficiary must — up to four years after the period set out in Article 3 — take measures aiming to ensure '**exploitation**' of its results (either directly or indirectly, in particular through transfer or licensing; see Article 30) by:

(a) using them in further research activities (outside the action);

(b) developing, creating or marketing a product or process;

(c) creating and providing a service, or

(d) using them in standardisation activities.

This does not change the security obligations in Article 37, which still apply.

28.2 Results that could contribute to European or international standards — Information on EU funding

If results could reasonably be expected to contribute to European or international standards, the beneficiary concerned must — up to four years after the period set out in Article 3 — inform the Agency.

If results are incorporated in a standard, the beneficiary concerned must — unless the *Agency* requests or agrees otherwise or unless it is impossible — ask the standardisation body to include the following statement in (information related to) the standard:

> "Results incorporated in this standard received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 653586".

28.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced in accordance with Article 43.

Such a breach may also lead to any of the other measures described in Chapter 6.

ARTICLE 29 — DISSEMINATION OF RESULTS — OPEN ACCESS — VISIBILITY OF EU FUNDING

29.1 Obligation to disseminate results

Unless it goes against their legitimate interests, each beneficiary must — as soon as possible — '**disseminate**' its results by disclosing them to the public by appropriate means (other than those resulting from protecting or exploiting the results), including in scientific publications (in any medium).

This does not change the obligation to protect results in Article 27, the confidentiality obligations in Article 36, the security obligations in Article 37 or the obligations to protect personal data in Article 39, all of which still apply.

A beneficiary that intends to disseminate its results must give advance notice to the other beneficiaries of — unless agreed otherwise — at least 45 days, together with sufficient information on the results it will disseminate.

Any other beneficiary may object within — unless agreed otherwise — 30 days of receiving notification, if it can show that its legitimate interests in relation to the results or background would be significantly harmed. In such cases, the dissemination may not take place unless appropriate steps are taken to safeguard these legitimate interests.

If a beneficiary intends not to protect its results, it may — under certain conditions (see Article 26.4.1) — need to formally notify the *Agency* before dissemination takes place.

29.2 Open access to scientific publications

Each beneficiary must ensure open access (free of charge online access for any user) to all peer-reviewed scientific publications relating to its results.

In particular, it must:

(a) as soon as possible and at the latest on publication, deposit a machine-readable electronic copy of the published version or final peer-reviewed manuscript accepted for publication in a repository for scientific publications;

Moreover, the beneficiary must aim to deposit at the same time the research data needed to validate the results presented in the deposited scientific publications.

(b) ensure open access to the deposited publication — via the repository — at the latest:

(i) on publication, if an electronic version is available for free via the publisher, or

(ii) within six months of publication (twelve months for publications in the social sciences and humanities) in any other case.

(c) ensure open access — via the repository — to the bibliographic metadata that identify the deposited publication.

The bibliographic metadata must be in a standard format and must include all of the following:

- the terms *"European Union (EU)" and "Horizon 2020"*;
- the name of the action, acronym and grant number;
- the publication date, and length of embargo period if applicable, and
- a persistent identifier.

29.3 Open access to research data

Not applicable

29.4 Information on EU funding — Obligation and right to use the EU emblem

Unless the *Agency* requests or agrees otherwise or unless it is impossible, any dissemination of results (in any form, including electronic) must:

(a) display the EU emblem and

(b) include the following text:

"This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 653586".

When displayed together with another logo, the EU emblem must have appropriate prominence.

For the purposes of their obligations under this Article, the beneficiaries may use the EU emblem without first obtaining approval from the *Agency*.

This does not however give them the right to exclusive use.

Moreover, they may not appropriate the EU emblem or any similar trademark or logo, either by registration or by any other means.

29.5 Disclaimer excluding *Agency* responsibility

Any dissemination of results must indicate that it reflects only the author's view and that the *Agency* is not responsible for any use that may be made of the information it contains.

29.6 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such a breach may also lead to any of the other measures described in Chapter 6.

ARTICLE 30 — TRANSFER AND LICENSING OF RESULTS

30.1 Transfer of ownership

Each beneficiary may transfer ownership of its results.

It must however ensure that its obligations under Articles 26.2, 26.4, 27, 28, 29, 30 and 31 also apply to the new owner and that this owner has the obligation to pass them on in any subsequent transfer.

This does not change the security obligations in Article 37, which still apply.

Unless agreed otherwise (in writing) for specifically-identified third parties or unless impossible under applicable EU and national laws on mergers and acquisitions, a beneficiary that intends to transfer ownership of results must give at least 45 days advance notice (or less if agreed in writing) to the other beneficiaries that still have (or still may request) access rights to the results. This notification must include sufficient information on the new owner to enable any beneficiary concerned to assess the effects on its access rights.

Unless agreed otherwise (in writing) for specifically-identified third parties, any other beneficiary may object within 30 days of receiving notification (or less if agreed in writing), if it can show that the transfer would adversely affect its access rights. In this case, the transfer may not take place until agreement has been reached between the beneficiaries concerned.

30.2 Granting licenses

Each beneficiary may grant licences to its results (or otherwise give the right to exploit them), if:

(a) this does not impede the rights under Article 31 and

(b) *not applicable.*

In addition to Points (a) and (b), exclusive licences for results may be granted only if all the other beneficiaries concerned have waived their access rights (see Article 31.1).

This does not change the dissemination obligations in Article 29 or security obligations in Article 37, which still apply.

30.3 *Agency* right to object to transfers or licensing

The Agency may — up to four years after the period set out in Article 3 — object to a transfer of ownership or the exclusive licensing of results, if:

(a) it is to a third party established in a non-EU country not associated with Horizon 2020 and

(b) the Agency considers that the transfer or licence is not in line with EU interests regarding competitiveness or is inconsistent with ethical principles or security considerations.

A beneficiary that intends to transfer ownership or grant an exclusive licence must formally notify the Agency before the intended transfer or licensing takes place and:

- *identify the specific results concerned;*
- *describe in detail the new owner or licensee and the planned or potential exploitation of the results, and*
- *include a reasoned assessment of the likely impact of the transfer or licence on EU competitiveness and its consistency with ethical principles and security considerations.*

The Agency may request additional information.

If the Agency decides to object to a transfer or exclusive licence, it must formally notify the beneficiary concerned within 60 days of receiving notification (or any additional information it has requested).

No transfer or licensing may take place in the following cases:

- *pending the Agency decision, within the period set out above;*
- *if the Agency objects;*
- *until the conditions are complied with, if the Agency objection comes with conditions.*

30.4 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such a breach may also lead to any of the other measures described in Chapter 6.

ARTICLE 31 — ACCESS RIGHTS TO RESULTS

31.1 Exercise of access rights — Waiving of access rights — No sub-licensing

The conditions set out in Article 25.1 apply.

The obligations set out in this Article do not change the security obligations in Article 37, which still apply.

31.2 Access rights for other beneficiaries, for implementing their own tasks under the action

The beneficiaries must give each other access — on a royalty-free basis — to results needed for implementing their own tasks under the action.

31.3 Access rights for other beneficiaries, for exploiting their own results

The beneficiaries must give each other — under fair and reasonable conditions (see Article 25.3) — access to results needed for exploiting their own results.

Requests for access may be made — unless agreed otherwise — up to one year after the period set out in Article 3.

31.4 Access rights of affiliated entities

Unless agreed otherwise in the consortium agreement, access to results must also be given — under fair and reasonable conditions (Article 25.3) — to affiliated entities established in an EU Member State or associated country, if this is needed for those entities to exploit the results generated by the beneficiaries to which they are affiliated.

Unless agreed otherwise (see above; Article 31.1), the affiliated entity concerned must make any such request directly to the beneficiary that owns the results.

Requests for access may be made — unless agreed otherwise — up to one year after the period set out in Article 3.

31.5 Access rights for the EU institutions, bodies, offices or agencies and EU Member States

The beneficiaries must give access to their results — on a royalty-free basis — to EU institutions, bodies, offices and agencies as well as EU Member States' national authorities, necessary for developing, implementing or monitoring their policies or programmes in this area.

Such access rights are limited to non-commercial and non-competitive use.

Access is conditional on an agreement to define specific conditions ensuring that:

(a) the access will be used only for the intended purpose and

(b) appropriate confidentiality obligations are in place.

The requesting EU Member State or EU institution, body, office or agency must inform all other EU Member States of such a request.

This does not change the security obligations in Article 37, which still apply.

31.6 Access rights for third parties

Not applicable

31.7 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

SECTION 4 OTHER RIGHTS AND OBLIGATIONS

ARTICLE 32 — RECRUITMENT AND WORKING CONDITIONS FOR RESEARCHERS

32.1 Obligation to take measures to implement the European Charter for Researchers and Code of Conduct for the Recruitment of Researchers

The beneficiaries must take all measures to implement the principles set out in the Commission Recommendation on the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers[22], in particular regarding:

- working conditions;
- transparent recruitment processes based on merit, and
- career development.

The beneficiaries must ensure that researchers and third parties involved in the action are aware of them.

32.2 Consequences of non-compliance

If a beneficiary breaches its obligations under this Article, the *Agency* may apply any of the measures described in Chapter 6.

ARTICLE 33 — GENDER EQUALITY

33.1 Obligation to aim for gender equality

The beneficiaries must take all measures to promote equal opportunities between men and women in the implementation of the action. They must aim, to the extent possible, for a gender balance at all levels of personnel assigned to the action, including at supervisory and managerial level.

33.2 Consequences of non-compliance

If a beneficiary breaches its obligations under this Article, the *Agency* may apply any of the measures described in Chapter 6.

ARTICLE 34 — ETHICS

34.1 Obligation to comply with ethical principles

The beneficiaries must carry out the action in compliance with:

[22] Commission recommendation (EC) No 251/2005 of 11 March 2005 on the European Charter for Researchers and on a Code of Conduct for the Recruitment of Researchers (OJ L 75, 22.03.2005, p. 67).

(a) ethical principles (including the highest standards of research integrity — as set out, for instance, in the European Code of Conduct for Research Integrity[23] — and including, in particular, avoiding fabrication, falsification, plagiarism or other research misconduct) and

(b) applicable international, EU and national law.

Funding will not be granted for activities carried out outside the EU if they are prohibited in all Member States.

The beneficiaries must ensure that the activities under the action have an exclusive focus on civil applications.

The beneficiaries must ensure that the activities under the action do not:

(a) aim at human cloning for reproductive purposes;

(b) intend to modify the genetic heritage of human beings which could make such changes heritable (with the exception of research relating to cancer treatment of the gonads, which may be financed), or

(c) intend to create human embryos solely for the purpose of research or for the purpose of stem cell procurement, including by means of somatic cell nuclear transfer.

34.2 Activities raising ethical issues

Activities raising ethical issues must comply with the '**ethics requirements**' set out in Annex 1.

Before the beginning of an activity raising an ethical issue, the coordinator must submit (see Article 52) to the *Agency* copy of:

(a) any ethics committee opinion required under national law and

(b) any notification or authorisation for activities raising ethical issues required under national law.

If these documents are not in English, the coordinator must also submit an English summary of the submitted opinions, notifications and authorisations (containing, if available, the conclusions of the committee or authority concerned).

If these documents are specifically requested for the action, the request must contain an explicit reference to the action title. The coordinator must submit a declaration by each beneficiary concerned that all the submitted documents cover the action tasks.

34.3 Activities involving human embryos or human embryonic stem cells

Activities involving research on human embryos or human embryonic stem cells may be carried out only if:

- they are set out in Annex 1 or

[23] The European Code of Conduct for Research Integrity of ALLEA (All European Academies) and ESF (European Science Foundation) of March 2011.
http://www.esf.org/fileadmin/Public_documents/Publications/Code_Conduct_ResearchIntegrity.pdf

- the coordinator has obtained explicit approval (in writing) from the *Agency* (see Article 52).

34.4 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43) and the Agreement or participation of the beneficiary may be terminated (see Article 50).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 35 — CONFLICT OF INTERESTS

35.1 Obligation to avoid a conflict of interests

The beneficiaries must take all measures to prevent any situation where the impartial and objective implementation of the action is compromised for reasons involving economic interest, political or national affinity, family or emotional ties or any other shared interest ('**conflict of interests**').

They must formally notify to the *Agency* without delay any situation constituting or likely to lead to a conflict of interests and immediately take all the necessary steps to rectify this situation.

The *Agency* may verify that the measures taken are appropriate and may require additional measures to be taken by a specified deadline.

35.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43) and the Agreement or participation of the beneficiary may be terminated (see Article 50).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 36 — CONFIDENTIALITY

36.1 General obligation to maintain confidentiality

During implementation of the action and for four years after the period set out in Article 3, the parties must keep confidential any data, documents or other material (in any form) that is identified as confidential at the time it is disclosed ('**confidential information**').

If a beneficiary requests, the *Agency* may agree to keep such information confidential for an additional period beyond the initial four years.

If information has been identified as confidential only orally, it will be considered to be confidential only if this is confirmed in writing within 15 days of the oral disclosure.

Unless otherwise agreed between the parties, they may use confidential information only to implement the Agreement.

The beneficiaries may disclose confidential information to their personnel or third parties involved in the action only if they:

(a) need to know to implement the Agreement and

(b) are bound by an obligation of confidentiality.

This does not change the security obligations in Article 37, which still apply.

The *Agency* may disclose confidential information to its staff, other EU institutions and bodies or third parties, if:

(a) this is necessary to implement the Agreement or safeguard the EU's financial interests and

(b) the recipients of the information are bound by an obligation of confidentiality.

Under the conditions set out in Article 4 of the Rules for Participation Regulation No 1290/2013[24], the Commission must moreover make available information on the results to other EU institutions, bodies, offices or agencies as well as Member States or associated countries.

The confidentiality obligations no longer apply if:

(a) the disclosing party agrees to release the other party;

(b) the information was already known by the recipient or is given to him without obligation of confidentiality by a third party that was not bound by any obligation of confidentiality;

(c) the recipient proves that the information was developed without the use of confidential information;

(d) the information becomes generally and publicly available, without breaching any confidentiality obligation, or

(e) the disclosure of the information is required by EU or national law.

36.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 37 — SECURITY-RELATED OBLIGATIONS

37.1 Results with a security recommendation

'Results with a security recommendation' (see Annex 1) may be disclosed or disseminated only under the conditions set out in Annex 1.

Before disclosing such results to a third party (including linked third parties, such as affiliated entities), a beneficiary must inform the coordinator — which must request written approval from the Agency.

[24] Regulation (EU) No 1290/2013 of the European Parliament and of the Council of 11 December 2013 laying down the rules for participation and dissemination in "Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020)" (OJ L 347, 20.12.2013 p.81).

37.2 Classified results

Not applicable

37.3 Activities involving dual-use goods or dangerous materials and substances

Not applicable

37.4 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 38 — PROMOTING THE ACTION — VISIBILITY OF EU FUNDING

38.1 Communication activities by beneficiaries

38.1.1 Obligation to promote the action and its results

The beneficiaries must promote the action and its results, by providing targeted information to multiple audiences (including the media and the public) in a strategic and effective manner.

This does not change the dissemination obligations in Article 29, the confidentiality obligations in Article 36 or the security obligations in Article 37, all of which still apply.

Before engaging in a communication activity expected to have a major media impact, the beneficiaries must inform the *Agency* (see Article 52).

38.1.2 Information on EU funding — Obligation and right to use the EU emblem

Unless the *Agency* requests or agrees otherwise or unless it is impossible, any communication activity related to the action (including in electronic form, via social media, etc.) and any infrastructure, equipment and major results funded by the grant must:

(a) display the EU emblem and

(b) include the following text:

> For communication activities: "This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 653586".
>
> For infrastructure, equipment and major results: "This *[infrastructure][equipment][insert type of result]* is part of a project that has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 653586".

When displayed together with another logo, the EU emblem must have appropriate prominence.

For the purposes of their obligations under this Article, the beneficiaries may use the EU emblem without first obtaining approval from the *Agency*.

This does not, however, give them the right to exclusive use.

Moreover, they may not appropriate the EU emblem or any similar trademark or logo, either by registration or by any other means.

38.1.3 Disclaimer excluding the *Agency* responsibility

Any communication activity related to the action must indicate that it reflects only the author's view and that the *Agency* is not responsible for any use that may be made of the information it contains.

38.2 Communication activities by the *Agency*

38.2.1 Right to use beneficiaries' materials, documents or information

The *Agency* may use, for its communication and publicising activities, information relating to the action, documents notably summaries for publication and public deliverables as well as any other material, such as pictures or audio-visual material that it receives from any beneficiary (including in electronic form).

This does not change the confidentiality obligations in Article 36 and the security obligations in Article 37, all of which still apply.

However, if the *Agency's* use of these materials, documents or information would risk compromising legitimate interests, the beneficiary concerned may request the *Agency* not to use it (see Article 52).

The right to use a beneficiary's materials, documents and information includes:

(a) **use for its own purposes** (in particular, making them available to persons working for the *Agency* or any other EU institution, body, office or agency or body or institutions in EU Member States; and copying or reproducing them in whole or in part, in unlimited numbers);

(b) **distribution to the public** (in particular, publication as hard copies and in electronic or digital format, publication on the internet, as a downloadable or non-downloadable file, broadcasting by any channel, public display or presentation, communicating through press information services, or inclusion in widely accessible databases or indexes);

(c) **editing or redrafting** for communication and publicising activities (including shortening, summarising, inserting other elements (such as meta-data, legends, other graphic, visual, audio or text elements), extracting parts (e.g. audio or video files), dividing into parts, use in a compilation);

(d) **translation**;

(e) giving **access in response to individual requests** under Regulation No 1049/2001[25], without the right to reproduce or exploit;

(f) **storage** in paper, electronic or other form;

(g) **archiving**, in line with applicable document-management rules, and

[25] Regulation (EC) No 1049/2001 of the European Parliament and of the Council of 30 May 2001 regarding public access to European Parliament, Council and Commission documents, OJ L 145, 31.5.2001, p. 43.

(h) the right to authorise **third parties** to act on its behalf or sub-license the modes of use set out in Points (b),(c),(d) and (f) to third parties if needed for the communication and publicising activities of the *Agency*.

If the right of use is subject to rights of a third party (including personnel of the beneficiary), the beneficiary must ensure that it complies with its obligations under this Agreement (in particular, by obtaining the necessary approval from the third parties concerned).

Where applicable (and if provided by the beneficiaries), the *Agency* will insert the following information:

> "© – [year] – [name of the copyright owner]. All rights reserved. Licensed to the *Research Executive Agency* under conditions."

38.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 39 — PROCESSING OF PERSONAL DATA

39.1 Processing of personal data by the *Agency and the* Commission

Any personal data under the Agreement will be processed by the *Agency or the* Commission under Regulation No 45/2001[26] and according to the 'notifications of the processing operations' to the Data Protection Officer (DPO) of the *Agency or the* Commission (publicly accessible in the DPO register).

Such data will be processed by the '**data controller**' of the *Agency or the* Commission for the purposes of implementing, managing and monitoring the Agreement or protecting the financial interests of the EU or Euratom (including checks, reviews, audits and investigations; see Article 22).

The persons whose personal data are processed have the right to access and correct their own personal data. For this purpose, they must send any queries about the processing of their personal data to the data controller, via the contact point indicated in the 'service specific privacy statement(s) (SSPS)' that are published on the *Agency and the* Commission websites.

They also have the right to have recourse at any time to the European Data Protection Supervisor (EDPS).

39.2 Processing of personal data by the beneficiaries

The beneficiaries must process personal data under the Agreement in compliance with applicable EU and national law on data protection (including authorisations or notification requirements).

The beneficiaries may grant their personnel access only to data that is strictly necessary for implementing, managing and monitoring the Agreement.

[26] Regulation (EC) No 45/2001 of the European Parliament and of the Council of 18 December 2000 on the protection of individuals with regard to the processing of personal data by the Community institutions and bodies and on the free movement of such data (OJ L 8, 12.01.2001, p. 1).

The beneficiaries must inform the personnel whose personal data are collected and processed by the *Agency or the* Commission . For this purpose, they must provide them with the service specific privacy statement (SSPS) (see above), before transmitting their data to the *Agency or the* Commission .

39.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under Article 39.2, the *Agency* may apply any of the measures described in Chapter 6.

ARTICLE 40 — ASSIGNMENTS OF CLAIMS FOR PAYMENT AGAINST THE *AGENCY*

The beneficiaries may not assign any of their claims for payment against the *Agency* to any third party, except if approved by the *Agency* on the basis of a reasoned, written request by the coordinator (on behalf of the beneficiary concerned).

If the *Agency* has not accepted the assignment or the terms of it are not observed, the assignment will have no effect on it.

In no circumstances will an assignment release the beneficiaries from their obligations towards the *Agency*.

CHAPTER 5 DIVISION OF BENEFICIARIES' ROLES AND RESPONSIBILITIES

ARTICLE 41 — DIVISION OF BENEFICIARIES' ROLES AND RESPONSIBILITIES

41.1 Roles and responsibilities towards the *Agency*

The beneficiaries have full responsibility for implementing the action and complying with the Agreement.

The beneficiaries are jointly and severally liable for the **technical implementation** of the action as described in Annex 1. If a beneficiary fails to implement its part of the action, the other beneficiaries become responsible for implementing this part (without being entitled to any additional EU funding for doing so), unless the *Agency* expressly relieves them of this obligation.

The **financial responsibility** of each beneficiary is governed by Articles 44, 45 and 46.

41.2 Internal division of roles and responsibilities

The internal roles and responsibilities of the beneficiaries are divided as follows:

(a) Each **beneficiary** must:

(i) keep information stored in the 'Beneficiary Register' (via the electronic exchange system) up to date (see Article 17);

(ii) inform the coordinator immediately of any events or circumstances likely to affect significantly or delay the implementation of the action (see Article 17);

(iii) submit to the coordinator in good time:

- individual financial statements for itself and, if required, certificates on the financial statements (see Article 20);

- the data needed to draw up the technical reports (see Article 20);

- ethics committee opinions and notifications or authorisations for activities raising ethical issues (see Article 34);

- any other documents or information required by the *Agency or the* Commission under the Agreement, unless the Agreement requires the beneficiary to submit this information directly to the *Agency or the* Commission.

(b) The **coordinator** must:

(i) monitor that the action is implemented properly (see Article 7);

(ii) act as the intermediary for all communications between the beneficiaries and the *Agency* (in particular, providing the *Agency* with the information described in Article 17), unless the Agreement specifies otherwise;

(iii) request and review any documents or information required by the *Agency* and verify their completeness and correctness before passing them on to the *Agency*;

(iv) submit the deliverables and reports to the *Agency* (see Articles 19 and 20);

(v) ensure that all payments are made to the other beneficiaries without unjustified delay (see Article 21);

(vi) inform the *Agency* of the amounts paid to each beneficiary, when required under the Agreement (see Articles 44 and 50) or requested by the *Agency*.

The coordinator may not delegate the above-mentioned tasks to any other beneficiary or subcontract them to any third party.

41.3 Internal arrangements between beneficiaries — Consortium agreement

*The beneficiaries must have internal arrangements regarding their operation and co-ordination to ensure that the action is implemented properly. These internal arrangements must be set out in a written '**consortium agreement**' between the beneficiaries, which may cover:*

- *internal organisation of the consortium;*

- *management of access to the electronic exchange system;*

- *distribution of EU funding;*

- *additional rules on rights and obligations related to background and results (including whether access rights remain or not, if a beneficiary is in breach of its obligations) (see Section 3 of Chapter 4);*

- *settlement of internal disputes;*

- *liability, indemnification and confidentiality arrangements between the beneficiaries.*

The consortium agreement must not contain any provision contrary to the Agreement.

41.4 Relationship with complementary beneficiaries — Collaboration agreement

Not applicable

41.5 Relationship with partners of a joint action — Coordination agreement

Not applicable

CHAPTER 6 REJECTION OF COSTS — REDUCTION OF THE GRANT — RECOVERY — PENALTIES — DAMAGES — SUSPENSION — TERMINATION — FORCE MAJEURE

SECTION 1 REJECTION OF COSTS — REDUCTION OF THE GRANT — RECOVERY — PENALTIES

ARTICLE 42 — REJECTION OF INELIGIBLE COSTS

42.1 Conditions

42.1.1 The *Agency* will — at the time of an **interim payment, at the payment of the balance** or **afterwards** — reject any costs which are ineligible (see Article 6), in particular following checks, reviews, audits or investigations (see Article 22).

42.1.2 The rejection may also be based on the **extension of findings from other grants to this grant**, under the conditions set out in Article 22.5.2.

42.2 Ineligible costs to be rejected — Calculation — Procedure

Ineligible costs will be rejected in full.

If the *Agency* rejects costs **without reduction of the grant** (see Article 43) or **recovery of undue amounts** (see Article 44), it will formally notify the coordinator or beneficiary concerned the rejection of costs, the amounts and the reasons why (if applicable, together with the notification of amounts due; see Article 21.5). The coordinator or beneficiary concerned may — within 30 days of receiving notification — formally notify the *Agency* of its disagreement and the reasons why.

If the *Agency* rejects costs **with reduction of the grant** or **recovery of undue amounts** , it will formally notify the rejection in the '**pre-information letter**' on reduction or recovery set out in Articles 43 and 44.

42.3 Effects

If the *Agency* rejects costs at the time of an **interim payment** or **the payment of the balance**, it will deduct them from the total eligible costs declared, for the action, in the periodic or final summary

financial statement (see Articles 20.3 and 20.4). It will then calculate the interim payment or payment of the balance as set out in Articles 21.3 or 21.4.

If the *Agency* — **after an interim payment but before the payment of the balance** — rejects costs declared in a periodic summary financial statement, it will deduct them from the total eligible costs declared, for the action, in the next periodic summary financial statement or in the final summary financial statement. It will then calculate the interim payment or payment of the balance as set out in Articles 21.3 or 21.4.

If the *Agency* rejects costs **after the payment of the balance**, it will deduct the amount rejected from the total eligible costs declared, by the beneficiary, in the final summary financial statement. It will then calculate the revised final grant amount as set out in Article 5.4.

ARTICLE 43 — REDUCTION OF THE GRANT

43.1 Conditions

43.1.1 The *Agency* may — **at the payment of the balance** or **afterwards** — reduce the maximum grant amount (see Article 5.1), if the action has not been implemented properly as described in Annex 1 or another obligation under the Agreement has been breached.

43.1.2 The *Agency* may also reduce the maximum grant amount on the basis of the **extension of findings from other grants to this grant**, under the conditions set out in Article 22.5.2.

43.2 Amount to be reduced — Calculation — Procedure

The amount of the reduction will be proportionate to the improper implementation of the action or to the seriousness of the breach.

Before reduction of the grant, the *Agency* will formally notify a '**pre-information letter**' to the coordinator or beneficiary concerned:

- informing it of its intention to reduce the grant, the amount it intends to reduce and the reasons why and

- inviting it to submit observations within 30 days of receiving notification

If the *Agency* does not receive any observations or decides to pursue reduction despite the observations it has received, it will formally notify **confirmation** of the reduction (if applicable, together with the notification of amounts due; see Article 21).

43.3 Effects

If the *Agency* reduces the grant at the time of **the payment of the balance**, it will calculate the reduced grant amount for the action and then determine the amount due as payment of the balance (see Articles 5.3.4 and 21.4).

If the *Agency* reduces the grant **after the payment of the balance**, it will calculate the revised final grant amount for the beneficiary concerned (see Article 5.4). If the revised final grant amount for the beneficiary concerned is lower than its share of the final grant amount, the *Agency* will recover the difference (see Article 44).

ARTICLE 44 — RECOVERY OF UNDUE AMOUNTS

44.1 Amount to be recovered — Calculation — Procedure

The *Agency* will — after **termination of the participation of a beneficiary, at the payment of the balance** or **afterwards** — claim back any amount that was paid but is not due under the Agreement.

Each beneficiary's financial responsibility in case of recovery is limited to its own debt, except for the amount retained for the Guarantee Fund (see Article 21.4).

44.1.1 Recovery after termination of a beneficiary's participation

If recovery takes place after termination of a beneficiary's participation (including the coordinator), the *Agency* will claim back the undue amount from the beneficiary concerned, by formally notifying it a debit note (see Article 50.2 and 50.3). This note will specify the amount to be recovered, the terms and the date for payment.

If payment is not made by the date specified in the debit note, the *Agency or the* Commission will **recover** the amount:

(a) by '**offsetting**' it — without the beneficiary's consent — against any amounts owed to the beneficiary concerned by the *Agency, the* Commission or an*other* executive agency (from the EU or Euratom budget).

In exceptional circumstances, to safeguard the EU's financial interests, the *Agency* may offset before the payment date specified in the debit note;

(b) *Not applicable;*

(c) by **taking legal action** (see Article 57) or by **adopting an enforceable decision** under Article 299 of the Treaty on the Functioning of the EU (TFEU) and Article 79(2) of the Financial regulation No 966/2012.

If payment is not made by the date specified in the debit note, the amount to be recovered (see above) will be increased by **late-payment interest** at the rate set out in Article 21.11, from the day following the payment date in the debit note, up to and including the date the *Agency or the* Commission receives full payment of the amount.

Partial payments will be first credited against expenses, charges and late-payment interest and then against the principal.

Bank charges incurred in the recovery process will be borne by the beneficiary, unless Directive 2007/64/EC[27] applies.

44.1.2 Recovery at payment of the balance

If the payment of the balance takes the form of a recovery (see Article 21.4), the *Agency* will formally notify a '**pre-information letter**' to the coordinator:

[27] Directive 2007/64/EC of the European Parliament and of the Council of 13 November 2007 on payment services in the internal market amending Directives 97/7/EC, 2002/65/EC, 2005/60/EC and 2006/48/EC and repealing Directive 97/5/EC (OJ L 319, 05.12.2007, p. 1).

- informing it of its intention to recover, the amount due as the balance and the reasons why;
- specifying that it intends to deduct the amount to be recovered from the amount retained for the Guarantee Fund;
- requesting the coordinator to submit a report on the distribution of payments to the beneficiaries within 30 days of receiving notification, and
- inviting the coordinator to submit observations within 30 days of receiving notification.

If no observations are submitted or the *Agency* decides to pursue recovery despite the observations it has received, it will **confirm recovery** (together with the notification of amounts due; see Article 21.5) and:

- pay the difference between the amount to be recovered and the amount retained for the Guarantee Fund, **if the difference is positive** or
- formally notify to the coordinator a **debit note** for the difference between the amount to be recovered and the amount retained for the Guarantee Fund, **if the difference is negative**. This note will also specify the terms and the date for payment.

If the coordinator does not repay the *Agency* by the date in the debit note and has not submitted the report on the distribution of payments: the *Agency or the* Commission will **recover** the amount set out in the debit note from the coordinator (see below).

If the coordinator does not repay the *Agency* by the date in the debit note, but has submitted the report on the distribution of payments: the *Agency* will:

(a) identify the beneficiaries for which the amount calculated as follows is negative:

{{{{beneficiary's costs declared in the final summary financial statement and approved by the *Agency* multiplied by the reimbursement rate set out in Article 5.2 for the beneficiary concerned}

divided by

the EU contribution for the action calculated according to Article 5.3.1}

multiplied by

the final grant amount (see Article 5.3)},

minus

{pre-financing and interim payments received by the beneficiary}}.

(b) formally notify to each beneficiary identified according to point (a) a **debit note** specifying the terms and date for payment. The amount of the debit note is calculated as follows:

{{amount calculated according to point (a) for the beneficiary concerned

divided by

the sum of the amounts calculated according to point (a) for all the beneficiaries identified according to point (a)}

multiplied by

the amount set out in the debit note formally notified to the coordinator}.

If payment is not made by the date specified in the debit note, the *Agency* will **recover** the amount:

(a) by '**offsetting**' it — without the beneficiary's consent — against any amounts owed to the beneficiary concerned by the *Agency, the* Commission or an*other* executive agency (from the EU or Euratom budget).

In exceptional circumstances, to safeguard the EU's financial interests, the *Agency* may offset before the payment date specified in the debit note;

(b) by **drawing on the Guarantee Fund**. The *Agency or the* Commission will formally notify the beneficiary concerned the debit note on behalf of the Guarantee Fund and recover the amount:

(i) *not applicable;*

(ii) by **taking legal action** (see Article 57) or by **adopting an enforceable decision** under Article 299 of the Treaty on the Functioning of the EU (TFEU) and Article 79(2) of the Financial Regulation No 966/2012.

If payment is not made by the date in the debit note, the amount to be recovered (see above) will be increased by **late-payment interest** at the rate set out in Article 21.11, from the day following the payment date in the debit note, up to and including the date the *Agency or the* Commission receives full payment of the amount.

Partial payments will be first credited against expenses, charges and late-payment interest and then against the principal.

Bank charges incurred in the recovery process will be borne by the beneficiary, unless Directive 2007/64/EC applies.

44.1.3 Recovery of amounts after payment of the balance

If, for a beneficiary, the revised final grant amount (see Article 5.4) is lower than its share of the final grant amount, it must repay the difference to the *Agency*.

The beneficiary's share of the final grant amount is calculated as follows:

{{{beneficiary's costs declared in the final summary financial statement and approved by the *Agency* multiplied by the reimbursement rate set out in Article 5.2 for the beneficiary concerned}

divided by

the EU contribution for the action calculated according to Article 5.3.1}

multiplied by

the final grant amount (see Article 5.3)}.

If the coordinator has not distributed amounts received (see Article 21.7), the *Agency* will also recover these amounts.

The *Agency* will formally notify a **pre-information letter** to the beneficiary concerned:

- informing it of its intention to recover, the due amount and the reasons why and
- inviting it to submit observations within 30 days of receiving notification.

If no observations are submitted or the *Agency* decides to pursue recovery despite the observations it has received, it will **confirm** the amount to be recovered and formally notify to the beneficiary concerned a **debit note**. This note will also specify the terms and the date for payment.

If payment is not made by the date specified in the debit note, the *Agency* will **recover** the amount:

(a) by '**offsetting**' it — without the beneficiary's consent — against any amounts owed to the beneficiary concerned by the *Agency, the* Commission or an*other* executive agency (from the EU or Euratom budget).

In exceptional circumstances, to safeguard the EU's financial interests, the *Agency* may offset before the payment date specified in the debit note;

(b) by **drawing on the Guarantee Fund**. The *Agency or the* Commission will formally notify the beneficiary concerned the debit note on behalf of the Guarantee Fund and recover the amount:

(i) *not applicable;*

(ii) by **taking legal action** (see Article 57) or by **adopting an enforceable decision** under Article 299 of the Treaty on the Functioning of the EU (TFEU) and Article 79(2) of the Financial Regulation No 966/2012.

If payment is not made by the date in the debit note, the amount to be recovered (see above) will be increased by **late-payment interest** at the rate set out in Article 21.11, from the day following the date for payment in the debit note, up to and including the date the *Agency or the* Commission receives full payment of the amount.

Partial payments will be first credited against expenses, charges and late-payment interest and then against the principal.

Bank charges incurred in the recovery process will be borne by the beneficiary, unless Directive 2007/64/EC applies.

ARTICLE 45 — ADMINISTRATIVE AND FINANCIAL PENALTIES

45.1 Conditions

Under Articles 109 and 131(4) of the Financial Regulation No 966/2012, the *Agency* may impose **administrative** and **financial penalties** if a beneficiary:

(a) has committed substantial errors, irregularities or fraud or is in serious breach of its obligations under the Agreement or

(b) has made false declarations about information required under the Agreement or for the submission of the proposal (or has not supplied such information).

Each beneficiary is responsible for paying the financial penalties imposed on it.

Under Article 109(3) of the Financial Regulation No 966/2012, the *Agency or the* Commission may — under certain conditions and limits — publish decisions imposing administrative or financial penalties.

45.2 Duration — Amount of penalty — Calculation

Administrative penalties exclude the beneficiary from all contracts and grants financed from the EU or Euratom budget for a maximum of five years from the date the infringement is established by the *Agency*.

If the beneficiary commits another infringement within five years of the date the first infringement is established, the *Agency* may extend the exclusion period up to 10 years.

Financial penalties will be between 2% and 10% of the maximum EU contribution indicated, for the beneficiary concerned, in the estimated budget (see Annex 2).

If the beneficiary commits another infringement within five years of the date the first infringement is established, the *Agency* may increase the rate of financial penalties to between 4% and 20%.

45.3 Procedure

Before applying a penalty, the *Agency* will formally notify the beneficiary concerned:

- informing it of its intention to impose a penalty, its duration or amount and the reasons why and

- inviting it to submit observations within 30 days.

If the *Agency* does not receive any observations or decides to impose the penalty despite of observations it has received, it will formally notify **confirmation** of the penalty to the beneficiary concerned and — in case of financial penalties — deduct the penalty from the payment of the balance or formally notify a **debit note**, specifying the amount to be recovered, the terms and the date for payment.

If payment is not made by the date specified in the debit note, the *Agency or the* Commission may **recover** the amount:

(a) by '**offsetting**' it — without the beneficiary's consent — against any amounts owed to the beneficiary concerned by the *Agency, the* Commission or an*other* executive agency (from the EU or Euratom budget).

In exceptional circumstances, to safeguard the EU's financial interests, the *Agency* may offset before the payment date specified in the debit note;

(b) by **taking legal action** (see Article 57) or by **adopting an enforceable decision** under Article 299 of the Treaty on the Functioning of the EU (TFEU) and Article 79(2) of the Financial Regulation No 966/2012.

If payment is not made by the date in the debit note, the amount to be recovered (see above) will be increased by **late-payment interest** at the rate set out in Article 21.11, from the day following the payment date in the debit note, up to and including the date the *Agency or the* Commission receives full payment of the amount.

Partial payments will be first credited against expenses, charges and late-payment interest and then against the principal.

Bank charges incurred in the recovery process will be borne by the beneficiary, unless Directive 2007/64/EC applies.

SECTION 2 LIABILITY FOR DAMAGES

ARTICLE 46 — LIABILITY FOR DAMAGES

46.1 Liability of the *Agency*

The *Agency* cannot be held liable for any damage caused to the beneficiaries or to third parties as a consequence of implementing the Agreement, including for gross negligence.

The *Agency* cannot be held liable for any damage caused by any of the beneficiaries or third parties involved in the action, as a consequence of implementing the Agreement.

46.2 Liability of the beneficiaries

46.2.1 Conditions

Except in case of force majeure (see Article 51), the beneficiaries must compensate the *Agency* for any damage it sustains as a result of the implementation of the action or because the action was not implemented in full compliance with the Agreement.

Each beneficiary is responsible for paying the damages claimed from it.

46.2.2 Amount of damages - Calculation

The amount the *Agency* can claim from a beneficiary will correspond to the damage caused by that beneficiary.

46.2.3 Procedure

Before claiming damages, the *Agency* will formally notify the beneficiary concerned:

- informing it of its intention to claim damages, the amount and the reasons why and

- inviting it to submit observations within 30 days.

If the *Agency* does not receive any observations or decides to claim damages despite the observations it has received, it will formally notify **confirmation** of the claim for damages and a **debit note**, specifying the amount to be recovered, the terms and the date for payment.

If payment is not made by the date specified in the debit note, the *Agency or the* Commission may **recover** the amount:

(a) by '**offsetting**' it — without the beneficiary's consent — against any amounts owed to the beneficiary concerned by the *Agency, the* Commission or an*other* executive agency (from the EU or Euratom budget).

In exceptional circumstances, to safeguard the EU's financial interests, the *Agency* may offset before the payment date specified in the debit note;

(b) by **taking legal action** (see Article 57) or by **adopting an enforceable decision** under Article 299 of the Treaty on the Functioning of the EU (TFEU) and Article 79(2) of the Financial Regulation No 966/2012.

If payment is not made by the date in the debit note, the amount to be recovered (see above) will be increased by **late-payment interest** at the rate set out in Article 21.11, from the day following the payment date in the debit note, up to and including the date the *Agency or the* Commission receives full payment of the amount.

Partial payments will be first credited against expenses, charges and late-payment interest and then against the principal.

Bank charges incurred in the recovery process will be borne by the beneficiary, unless Directive 2007/64/EC applies.

SECTION 3 SUSPENSION AND TERMINATION

ARTICLE 47 — SUSPENSION OF PAYMENT DEADLINE

47.1 Conditions

The *Agency* may — at any moment — suspend the payment deadline (see Article 21.2 to 21.4) if a request for payment (see Article 20) cannot be approved because:

(a) it does not comply with the provisions of the Agreement (see Article 20);

(b) the technical reports or financial reports have not been submitted or are not complete or additional information is needed, or

(c) there is doubt about the eligibility of the costs declared in the financial statements and additional checks, reviews, audits or investigations are necessary.

47.2 Procedure

The *Agency* will formally notify the coordinator of the suspension and the reasons why.

The suspension will **take effect** the day notification is sent by the *Agency* (see Article 52).

If the conditions for suspending the payment deadline are no longer met, the suspension will be **lifted** — and the remaining period will resume.

If the suspension exceeds two months, the coordinator may request the *Agency* if the suspension will continue.

If the payment deadline has been suspended due to the non-compliance of the technical or financial reports (see Article 20) and the revised report or statement is not submitted or was submitted but is also rejected, the *Agency* may also terminate the Agreement or the participation of the beneficiary (see Article 50.3.1(l)).

ARTICLE 48 — SUSPENSION OF PAYMENTS

48.1 Conditions

The *Agency* may — at any moment — suspend, in whole or in part, the pre-financing payment and interim payments for one or more beneficiaries or the payment of the balance for all beneficiaries, if a beneficiary:

(a) has committed or is suspected of having committed substantial errors, irregularities, fraud or serious breach of obligations in the award procedure or under this Agreement or

(b) has committed — in other EU or Euratom grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant (**extension of findings from other grants to this grant**; see Article 22.5.2).

48.2 Procedure

Before suspending payments, the *Agency* will formally notify the coordinator:

- informing it of its intention to suspend payments and the reasons why and

- inviting it to submit observations within 30 days of receiving notification.

If the *Agency* does not receive observations or decides to pursue the procedure despite the observations it has received, it will formally notify **confirmation** of the suspension. Otherwise, it will formally notify that the suspension procedure is not continued.

The suspension will **take effect** the day the confirmation notification is sent by the *Agency*.

If the conditions for resuming payments are met, the suspension will be **lifted**. The *Agency* will formally notify the coordinator.

During the suspension, the periodic report(s) (see Article 20.3) must not contain any individual financial statements from the beneficiary concerned. When the *Agency* resumes payments, the coordinator may include them in the next periodic report.

The beneficiaries may suspend implementation of the action (see Article 49.1) or terminate the Agreement or the participation of the beneficiary concerned (see Article 50.1 and 50.2).

ARTICLE 49 — SUSPENSION OF THE ACTION IMPLEMENTATION

49.1 Suspension of the action implementation, by the beneficiaries

49.1.1 Conditions

The beneficiaries may suspend implementation of the action or any part of it, if exceptional circumstances — in particular *force majeure* (see Article 51) — make implementation impossible or excessively difficult.

49.1.2 Procedure

The coordinator must immediately formally notify to the *Agency* the suspension (see Article 52), stating:

- the reasons why and
- the expected date of resumption.

The suspension will **take effect** the day this notification is received by the *Agency*.

Once circumstances allow for implementation to resume, the coordinator must immediately formally notify the *Agency* and request an **amendment** of the Agreement to set the date on which the action will be resumed, extend the duration of the action and make other changes necessary to adapt the action to the new situation (see Article 55) — unless the Agreement or the participation of a beneficiary has been terminated (see Article 50).

The suspension will be **lifted** with effect from the resumption date set out in the amendment. This date may be before the date on which the amendment enters into force.

Costs incurred during suspension of the action implementation are not eligible (see Article 6).

49.2 Suspension of the action implementation, by the *Agency*

49.2.1 Conditions

The *Agency* may suspend implementation of the action or any part of it:

(a) if a beneficiary has committed or is suspected of having committed substantial errors, irregularities, fraud or serious breach of obligations in the award procedure or under this Agreement;

(b) if a beneficiary has committed — in other EU or Euratom grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant (**extension of findings from other grants to this grant**; see Article 22.5.2), or

(c) if the action is suspected of having lost its scientific or technological relevance.

49.2.2 Procedure

Before suspending implementation of the action, the *Agency* will formally notify the coordinator:

- informing it of its intention to suspend the implementation and the reasons why and
- inviting it to submit observations within 30 days of receiving notification.

If the *Agency* does not receive observations or decides to pursue the procedure despite the observations it has received, it will formally notify **confirmation** of the suspension. Otherwise, it will formally notify that the procedure is not continued.

The suspension will **take effect** five days after confirmation notification is received by the coordinator (or on a later date specified in the notification).

It will be **lifted** if the conditions for resuming implementation of the action are met.

The coordinator will be formally notified of the lifting and the Agreement will be **amended** to set the date on which the action will be resumed, extend the duration of the action and make other changes necessary to adapt the action to the new situation (see Article 55) — unless the Agreement has already been terminated (see Article 50).

The suspension will be lifted with effect from the resumption date set out in the amendment. This date may be before the date on which the amendment enters into force.

Costs incurred during suspension are not eligible (see Article 6).

The beneficiaries may not claim damages due to suspension by the *Agency* (see Article 46).

Suspension of the action implementation does not affect the *Agency's* right to terminate the Agreement or participation of a beneficiary (see Article 50), reduce the grant or recover amounts unduly paid (see Articles 43 and 44).

ARTICLE 50 — TERMINATION OF THE AGREEMENT OR OF THE PARTICIPATION OF ONE OR MORE BENEFICIARIES

50.1 Termination of the Agreement by the beneficiaries

50.1.1 Conditions and procedure

The beneficiaries may terminate the Agreement.

The coordinator must formally notify termination to the *Agency* (see Article 52), stating:

- the reasons why and
- the date the termination will take effect. This date must be after the notification.

If no reasons are given or if the *Agency* considers the reasons do not justify termination, the Agreement will be considered to have been '**terminated improperly**'.

The termination will **take effect** on the day specified in the notification.

50.1.2 Effects

The coordinator must — within 60 days from when termination takes effect — submit:

(i) a periodic report (for the open reporting period until termination; see Article 20.3) and

(ii) the final report (see Article 20.4).

If the *Agency* does not receive the reports within the deadline (see above), only costs which are included in an approved periodic report will be taken into account.

The *Agency* will **calculate** the final grant amount (see Article 5.3) and the balance (see Article 21.4) on the basis of the reports submitted. Only costs incurred until termination are eligible (see Article 6). Costs relating to contracts due for execution only after termination are not eligible.

Improper termination may lead to a reduction of the grant (see Article 43).

After termination, the beneficiaries' obligations (in particular Articles 20, 22, 23, Section 3 of Chapter 4, 36, 37, 38 and 40) continue to apply.

50.2 Termination of the participation of one or more beneficiaries, by the beneficiaries

50.2.1 Conditions and procedure

The participation of one or more beneficiaries may be terminated by the coordinator, on request of the beneficiary concerned or on behalf of the other beneficiaries.

The coordinator must formally notify termination to the *Agency* (see Article 52) and inform the beneficiary concerned.

If the coordinator's participation is terminated without its agreement, the formal notification must be done by another beneficiary (acting on behalf of the other beneficiaries).

The notification must include:

- the reasons why;
- the opinion of the beneficiary concerned (or proof that this opinion has been requested in writing);
- the date the termination takes effect. This date must be after the notification, and
- a request for amendment (see Article 55), with a proposal for reallocation of the tasks and the estimated budget of the beneficiary concerned (see Annexes 1 and 2) and, if necessary, the addition of one or more new beneficiaries (see Article 56). If termination takes effect after the period set out in Article 3, no request for amendment must be included unless the beneficiary concerned is the coordinator. In this case, the request for amendment must propose a new coordinator.

If this information is not given or if the *Agency* considers that the reasons do not justify termination, the participation will be considered to have been **terminated improperly**.

The termination will **take effect** on the day specified in the notification.

50.2.2 Effects

The coordinator must — within 30 days from when termination takes effect — submit:

(i) a report on the distribution of payments to the beneficiary concerned and

(ii) if termination takes effect during the period set out in Article 3, a '**termination report**' from the beneficiary concerned, for the open reporting period until termination, containing an overview of the progress of the work, an overview of the use of resources, the individual financial statement and, if applicable, the certificate on the financial statement (see Articles 20.3 and 20.4).

The information in the termination report must also be included in the periodic report for the next reporting period (see Article 20.3).

If the request for amendment is rejected by the *Agency*, (because it calls into question the decision awarding the grant or breaches the principle of equal treatment of applicants), the Agreement may be terminated according to Article 50.3.1(c).

If the request for amendment is accepted by the *Agency*, the Agreement is **amended** to introduce the necessary changes (see Article 55).

The *Agency* will **calculate** — on the basis of the periodic reports, the termination report and the report on the distribution of payments — if the (pre-financing and interim) payments received by the beneficiary concerned exceed the beneficiary's EU contribution (calculated by applying the reimbursement rate(s) to the eligible costs declared by the beneficiary and approved by the *Agency*). Only costs incurred by the beneficiary concerned until termination takes effect are eligible (see Article 6). Costs relating to contracts due for execution only after termination are not eligible.

- If the payments received **exceed the amounts due**:

  - if termination takes effect during the period set out in Article 3 and the request for amendment is accepted, the beneficiary concerned must repay to the coordinator the amount unduly received. The *Agency* will formally notify the amount unduly received and request the beneficiary concerned to repay it to the coordinator within 30 days of receiving notification. If it does not repay the coordinator, the *Agency* will draw upon the Guarantee Fund to pay the coordinator and then notify a **debit note** on behalf of the Guarantee Fund to the beneficiary concerned (see Article 44);

  - in all other cases (in particular if termination takes effect after the period set out in Article 3), the *Agency* will formally notify a **debit note** to the beneficiary concerned. If payment is not made by the date in the debit note, the Guarantee Fund will pay to the *Agency* the amount due and the *Agency* will notify a debit note on behalf of the Guarantee Fund to the beneficiary concerned (see Article 44);

  - if the beneficiary concerned is the former coordinator, it must repay the new coordinator according to the procedure above, unless:

    - termination is after an interim payment and

    - the former coordinator has not distributed amounts received as pre-financing or interim payments (see Article 21.7).

In this case, the *Agency* will formally notify a **debit note** to the former coordinator. If payment is not made by the date in the debit note, the Guarantee Fund will pay to the *Agency* the amount due. The *Agency* will then pay the new coordinator and notify a debit note on behalf of the Guarantee Fund to the former coordinator (see Article 44).

- If the payments received **do not exceed the amounts due**: amounts owed to the beneficiary concerned will be included in the next interim or final payment.

If the *Agency* does not receive the termination report within the deadline (see above), only costs included in an approved periodic report will be taken into account.

If the *Agency* does not receive the report on the distribution of payments within the deadline (see above), it will consider that:

- the coordinator did not distribute any payment to the beneficiary concerned and that

- the beneficiary concerned must not repay any amount to the coordinator.

Improper termination may lead to a reduction of the grant (see Article 43) or termination of the Agreement (see Article 50).

After termination, the concerned beneficiary's obligations (in particular Articles 20, 22, 23, Section 3 of Chapter 4, 36, 37, 38 and 40) continue to apply.

50.3 Termination of the Agreement or the participation of one or more beneficiaries, by the *Agency*

50.3.1 Conditions

The *Agency* may terminate the Agreement or the participation of one or more beneficiaries, if:

(a) one or more beneficiaries do not accede to the Agreement (see Article 56);

(b) a change to their legal, financial, technical, organisational or ownership situation is likely to substantially affect or delay the implementation of the action or calls into question the decision to award the grant;

(c) following termination of participation for one or more beneficiaries (see above), the necessary changes to the Agreement would call into question the decision awarding the grant or breach the principle of equal treatment of applicants (see Article 55);

(d) implementation of the action is prevented by force majeure (see Article 51) or suspended by the coordinator (see Article 49.1) and either:

(i) resumption is impossible, or

(ii) the necessary changes to the Agreement would call into question the decision awarding the grant or breach the principle of equal treatment of applicants;

(e) a beneficiary is declared bankrupt, being wound up, having its affairs administered by the courts, has entered into an arrangement with creditors, has suspended business activities, or is subject to any other similar proceedings or procedures under national law;

(f) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf) has been found guilty of professional misconduct, proven by any means;

(g) a beneficiary does not comply with the applicable national law on taxes and social security;

(h) the action has lost scientific or technological relevance;

(i) *not applicable;*

(j) *not applicable;*

(k) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf) has committed fraud, corruption, or is involved in a criminal organisation, money laundering or any other illegal activity affecting the EU's financial interests;

(l) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf) has — in the award procedure or under the Agreement — committed:

(i) substantial errors, irregularities, fraud or

(ii) serious breach of obligations, including improper implementation of the action, submission of false information, failure to provide required information, breach of ethical principles;

(m) a beneficiary has committed — in other EU or Euratom grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant ('**extension of findings from other grants to this grant**').

50.3.2 Procedure

Before terminating the Agreement or participation of one or more beneficiaries, the *Agency* will formally notify the coordinator:

- informing it of its intention to terminate and the reasons why and

- inviting it, within 30 days of receiving notification, to submit observations and — in case of Point (l.ii) above — to inform the *Agency* of the measures to ensure compliance with the obligations under the Agreement.

If the *Agency* does not receive observations or decides to pursue the procedure despite the observations it has received, it will formally notify to the coordinator **confirmation** of the termination and the date it will take effect. Otherwise, it will formally notify that the procedure is not continued.

The termination will **take effect**:

- for terminations under Points (b), (c), (e), (g), (h), (j), and (l.ii) above: on the day specified in the notification of the confirmation (see above);

- for terminations under Points (a), (d), (f), (i), (k), (l.i) and (m) above: on the day after the notification of the confirmation is received by the coordinator.

50.3.3 Effects

(a) for **termination of the Agreement**:

The coordinator must — within 60 days from when termination takes effect — submit:

(i) a periodic report (for the last open reporting period until termination; see Article 20.3) and

(ii) a final report (see Article 20.4).

If the Agreement is terminated for breach of the obligation to submit the reports (see Articles 20.8 and 50.3.1(l)), the coordinator may not submit any reports after termination.

If the *Agency* does not receive the reports within the deadline (see above), only costs which are included in an approved periodic report will be taken into account.

The *Agency* will **calculate** the final grant amount (see Article 5.3) and the balance (see Article 21.4) on the basis of the reports submitted. Only costs incurred until termination takes effect are eligible (see Article 6). Costs relating to contracts due for execution only after termination are not eligible.

This does not affect the *Agency's* right to reduce the grant (see Article 43) or to impose administrative and financial penalties (Article 45).

The beneficiaries may not claim damages due to termination by the *Agency* (see Article 46).

After termination, the beneficiaries' obligations (in particular Articles 20, 22, 23, Section 3 of Chapter 4, 36, 37, 38 and 40) continue to apply.

(b) for **termination of the participation of one or more beneficiaries**:

The coordinator must — within 60 days from when termination takes effect — submit:

(i) a report on the distribution of payments to the beneficiary concerned;

(ii) a request for amendment (see Article 55), with a proposal for reallocation of the tasks and estimated budget of the beneficiary concerned (see Annexes 1 and 2) and, if necessary, the addition of one or more new beneficiaries (see Article 56). If termination is notified after the period set out in Article 3, no request for amendment must be submitted unless the beneficiary concerned is the coordinator. In this case the request for amendment must propose a new coordinator, and

(iii) if termination takes effect during the period set out in Article 3, a **termination report** from the beneficiary concerned, for the open reporting period until termination, containing an overview of the progress of the work, an overview of the use of resources,

the individual financial statement and, if applicable, the certificate on the financial statement (see Article 20).

The information in the termination report must also be included in the periodic report for the next reporting period (see Article 20.3).

If the request for amendment is rejected by the *Agency* (because it calls into question the decision awarding the grant or breaches the principle of equal treatment of applicants), the Agreement may be terminated according to Article 50.3.1(c).

If the request for amendment is accepted by the *Agency*, the Agreement is **amended** to introduce the necessary changes (see Article 55).

The *Agency* will **calculate** — on the basis of the periodic reports, the termination report and the report on the distribution of payments — if the (pre-financing and interim) payments received by the beneficiary concerned exceed the beneficiary's EU contribution (calculated by applying the reimbursement rate(s) to the eligible costs declared by the beneficiary and approved by the *Agency*). Only costs incurred by the beneficiary concerned until termination takes effect are eligible (see Article 6). Costs relating to contracts due for execution only after termination are not eligible.

- If the payments received **exceed the amounts due**:

  - if termination takes effect during the period set out in Article 3 and the request for amendment is accepted, the beneficiary concerned must repay to the coordinator the amount unduly received. The *Agency* will formally notify the amount unduly received and request the beneficiary concerned to repay it to the coordinator within 30 days of receiving notification. If it does not repay the coordinator, the *Agency* will draw upon the Guarantee Fund to pay the coordinator and then notify a debit note on behalf of the Guarantee Fund to the beneficiary concerned (see Article 44);

  - in all other cases, in particular if termination takes effect after the period set out in Article 3, the *Agency* will formally notify a **debit note** to the beneficiary concerned. If payment is not made by the date in the debit note, the Guarantee Fund will pay to the *Agency* the amount due and the *Agency* will notify a debit note on behalf of the Guarantee Fund to the beneficiary concerned (see Article 44);

  - if the beneficiary concerned is the former coordinator, it must repay the new coordinator the amount unduly received, unless:

    - termination takes effect after an interim payment and

    - the former coordinator has not distributed amounts received as pre-financing or interim payments (see Article 21.7)

    In this case, the *Agency* will formally notify a **debit note** to the former coordinator. If payment is not made by the date in the debit note, the Guarantee Fund will pay to the *Agency* the amount due. The *Agency* will then pay the new coordinator and notify a debit note on behalf of the Guarantee Fund to the former coordinator (see Article 44).

- If the payments received **do not exceed the amounts due**: amounts owed to the beneficiary concerned will be included in the next interim or final payment.

If the *Agency* does not receive the termination report within the deadline (see above), only costs included in an approved periodic report will be taken into account.

If the *Agency* does not receive the report on the distribution of payments within the deadline (see above), it will consider that:

- the coordinator did not distribute any payment to the beneficiary concerned, and that

- the beneficiary concerned must not repay any amount to the coordinator.

After termination, the concerned beneficiary's obligations (in particular Articles 20, 22, 23, Section 3 of Chapter 4, 36, 37, 38 and 40) continue to apply.

SECTION 4 FORCE MAJEURE

ARTICLE 51 — FORCE MAJEURE

'Force majeure' means any situation or event that:

- prevents either party from fulfilling their obligations under the Agreement,

- was unforeseeable, exceptional situation and beyond the parties' control,

- was not due to error or negligence on their part (or on the part of third parties involved in the action), and

- proves to be inevitable in spite of exercising all due diligence.

The following cannot be invoked as force majeure:

- any default of a service, defect in equipment or material or delays in making them available, unless they stem directly from a relevant case of force majeure,

- labour disputes or strikes, or

- financial difficulties.

Any situation constituting force majeure must be formally notified to the other party without delay, stating the nature, likely duration and foreseeable effects.

The parties must immediately take all the necessary steps to limit any damage due to force majeure and do their best to resume implementation of the action as soon as possible.

The party prevented by force majeure from fulfilling its obligations under the Agreement cannot be considered in breach of them.

CHAPTER 7 FINAL PROVISIONS

ARTICLE 52 — COMMUNICATION BETWEEN THE PARTIES

52.1 Form and means of communication

Communication under the Agreement (information, requests, submissions, 'formal notifications', etc.) must:

- be made in writing and
- bear the number of the Agreement.

Until the payment of the balance: all communication must be made through the electronic exchange system and using the forms and templates provided there.

After the payment of the balance: formal notifications must be made by registered post with proof of delivery ('formal notification on paper').

Communications in the electronic exchange system must be made by persons authorised according to the 'Terms and Conditions of Use of the electronic exchange system'. For naming the authorised persons, each beneficiary must have designated — before the signature of this Agreement — a 'Legal Entity Appointed Representative (LEAR)'. The role and tasks of the LEAR are stipulated in his/her appointment letter (see Terms and Conditions of Use of the electronic exchange system).

If the electronic exchange system is temporarily unavailable, instructions will be given on the *Agency and* Commission websites.

52.2 Date of communication

Communications are considered to have been made when they are sent by the sending party (i.e. on the date and time they are sent through the electronic exchange system).

Formal notifications through the **electronic** exchange system are considered to have been made when they are received by the receiving party (i.e. on the date and time of acceptance by the receiving party, as indicated by the time stamp). A formal notification that has not been accepted within 10 days after sending is considered to have been accepted.

Formal notifications **on paper** sent by **registered post** with proof of delivery (only after the payment of the balance) are considered to have been made on either:

- the delivery date registered by the postal service or
- the deadline for collection at the post office.

If the electronic exchange system is temporarily unavailable, the sending party cannot be considered in breach of its obligation to send a communication within a specified deadline.

52.3 Addresses for communication

The **electronic** exchange system must be accessed via the following URL:

https://ec.europa.eu/research/participants/portal/desktop/en/projects/

The *Agency* will formally notify the coordinator and beneficiaries in advance any changes to this URL.

Formal notifications on paper (only after the payment of the balance) addressed **to the *Agency*** must be sent to the following address:

Research Executive Agency (REA)
Safeguarding Secure Society
COV2 19/143
B-1049 Brussels Belgium

Formal notifications on paper (only after the payment of the balance) addressed **to the beneficiaries** must be sent to their legal address as specified in the 'Beneficiary Register'.

ARTICLE 53 — INTERPRETATION OF THE AGREEMENT

53.1 Precedence of the Terms and Conditions over the Annexes

The provisions in the Terms and Conditions of the Agreement take precedence over its Annexes.

Annex 2 takes precedence over Annex 1.

53.2 Privileges and immunities

Not applicable

ARTICLE 54 — CALCULATION OF PERIODS, DATES AND DEADLINES

In accordance with Regulation No 1182/71[28], periods expressed in days, months or years are calculated from the moment the triggering event occurs.

The day during which that event occurs is not considered as falling within the period.

ARTICLE 55 — AMENDMENTS TO THE AGREEMENT

55.1 Conditions

The Agreement may be amended, unless the amendment entails changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants.

Amendments may be requested by any of the parties.

55.2 Procedure

The party requesting an amendment must submit a request for amendment signed in the electronic exchange system (see Article 52).

[28] Regulation (EEC, Euratom) No 1182/71 of the Council of 3 June 1971 determining the rules applicable to periods, dates and time-limits (OJ L 124, 8.6.1971, p. 1).

The coordinator submits and receives requests for amendment on behalf of the beneficiaries (see Annex 3).

If a change of coordinator is requested without its agreement, the submission must be done by another beneficiary (acting on behalf of the other beneficiaries).

The request for amendment must include:

- the reasons why;
- the appropriate supporting documents;
- for a change of coordinator without its agreement: the opinion of the coordinator (or proof that this opinion has been requested in writing).

The *Agency* may request additional information.

If the party receiving the request agrees, it must sign the amendment in the electronic exchange system within 45 days of receiving notification (or any additional information the *Agency* has requested). If it does not agree, it must formally notify its disagreement within the same deadline. The deadline may be extended, if necessary for the assessment of the request. If no notification is received within the deadline, the request is considered to have been rejected

An amendment **enters into force** on the day of the signature of the receiving party.

An amendment **takes effect** on the date agreed by the parties or, in the absence of such an agreement, on the date on which the amendment enters into force.

ARTICLE 56 — ACCESSION TO THE AGREEMENT

56.1 Accession of the beneficiaries mentioned in the Preamble

The other beneficiaries must accede to the Agreement by signing the Accession Form (see Annex 3) in the electronic exchange system (see Article 52) within 30 days after its entry into force (see Article 58).

They will assume the rights and obligations under the Agreement with effect from the date of its entry into force (see Article 58).

If a beneficiary does not accede to the Agreement within the above deadline, the coordinator must — within 30 days — request an amendment to make any changes necessary to ensure proper implementation of the action. This does not affect the *Agency's* right to terminate the Agreement (see Article 50).

56.2 Addition of new beneficiaries

In justified cases, the beneficiaries may request the addition of a new beneficiary.

For this purpose, the coordinator must submit a request for amendment in accordance with Article 55. It must include an Accession Form (see Annex 3) signed by the new beneficiary in the electronic exchange system (see Article 52).

New beneficiaries must assume the rights and obligations under the Agreement with effect from the date of their accession specified in the Accession Form (see Annex 3).

ARTICLE 57 — APPLICABLE LAW AND SETTLEMENT OF DISPUTES

57.1 Applicable law

The Agreement is governed by the applicable EU law, supplemented if necessary by the law of Belgium.

57.2 Dispute settlement

If a dispute concerning the interpretation, application or validity of the Agreement cannot be settled amicably, the General Court — or, on appeal, the Court of Justice of the European Union — has sole jurisdiction. Such actions must be brought under Article 272 of the Treaty on the Functioning of the EU (TFEU).

If a dispute concerns administrative or financial penalties, offsetting or an enforceable decision under Article 299 TFEU (see Articles 44, 45 and 46), the beneficiaries must bring action before the General Court — or, on appeal, the Court of Justice of the European Union — under Article 263 TFEU. *Actions against enforceable decisions must be brought against the Commission (not against the Agency).*

ARTICLE 58 — ENTRY INTO FORCE OF THE AGREEMENT

The Agreement will enter into force on the day of signature by the *Agency* or the coordinator, depending on which is later.

SIGNATURES

For the coordinator

For the *Agency*

EUROPEAN COMMISSION

Research Executive Agency (REA)

Safeguarding Secure Society

ANNEX 1 (part A)

Innovation action

NUMBER — 653586 — SpeechXRays

Table of Contents

1.1. The project summary

Project Number [1]	653586	Project Acronym [2]	SpeechXRays

One form per project

General information	
Project title [3]	Multi-channel biometrics combining acoustic and machine vision analysis of speech, lip movement and face
Starting date [4]	The first day of the month after the signature by the Commission
Duration in months [5]	36
Call (part) identifier [6]	H2020-DS-2014-1
Topic	DS-02-2014 Access Control
Fixed EC Keywords	Complexity and cryptography, electronic security, privacy, biometrics, Security, Privacy
Free keywords	voice biometrics, face recognition, voice recognition

Abstract [7]

The SpeechXRays project will develop and test in real-life environments a user recognition platform based on voice acoustics analysis and audio-visual identity verification. SpeechXRays will outperform state-of-the-art solutions in the following areas:• Security: high accuracy solution (cross over accuracy1 of 1/100 ie twice the commercial voice/face solutions) • Privacy: biometric data stored in the device (or in a private cloud under the responsibility of the data subject)• Usability: text-independent speaker identification (no pass phrase), low sensitivity to surrounding noise• Cost-efficiency: use of standard embedded microphone and cameras (smartphones, laptops)The project will combine and pilot two proven techniques: acoustic driven voice recognition (using acoustic rather than statistical only models) and multi-channel biometrics incorporating dynamic face recognition (machine vision analysis of speech, lip movement and face).The vision of the SpeechXRays project is to provide a solution combining the convenience and cost-effectiveness of voice biometrics, achieving better accuracies by combining it with video, and bringing superior anti-spoofing capabilities.The technology will be deployed on 2000 users in 3 pilots: a workforce use case, an eHealth use case and a consumer use case. The project lasts 36 months and is coordinated by world leader in digital security solutions for the mobility space.

1.2. List of Beneficiaries

Project Number [1]	653586	Project Acronym [2]	SpeechXRays

List of Beneficiaries

No	Name	Short name	Country	Project entry month[8]	Project exit month
1	OBERTHUR TECHNOLOGIES SA	OT	France	1	36
2	HOROWITZ BIOMETRICS LIMITED	HB	United Kingdom	1	36
3	SIVECO ROMANIA SA	SIV	Romania	1	36
4	TECH INSPIRE LTD	INSP	United Kingdom	1	36
5	REALEYES OU	EYE	Estonia	1	36
6	Hellenic Telecommunications & Telematics Applications Company	FNET	Greece	1	36
7	INSTITUTUL NATIONAL DE CERCETARE -DEZVOLTARE PENTRU FIZICA SI INGINERIE NUCLEARA "HORIA HULUBEI" (IFIN-HH)	IFIN	Romania	1	36
8	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	FORTH	Greece	1	36
9	UNIVERSITY COLLEGE LONDON	UCL	United Kingdom	1	36
10	Institut Mines-Telecom	TSP	France	1	36

1.3. Workplan Tables - Detailed implementation

1.3.1. WT1 List of work packages

WP Number [9]	WP Title	Lead beneficiary [10]	Person-months [11]	Start month [12]	End month [13]
WP1	Requirement Specifications	3 - SIV	34.00	1	6
WP2	Multichannel Biometrics	2 - HB	110.00	4	14
WP3	User Security & Privacy	4 - INSP	72.00	4	18
WP4	HCI & Access Management	8 - FORTH	96.00	12	20
WP5	Biometrics Solution Integration, Portability & Interoperability	3 - SIV	71.00	16	24
WP6	Demonstrators & Evaluation	9 - UCL	67.00	18	36
WP7	Dissemination & Ecosystem Development	10 - TSP	40.00	1	36
WP8	Exploitation & Scaling Up	1 - OT	51.00	1	36
WP9	Standardization	9 - UCL	21.00	1	36
WP10	Management	1 - OT	37.50	1	36
		Total	599.50		

1.3.2. WT2 list of deliverables

Deliverable Number [14]	Deliverable Title	WP number [9]	Lead beneficiary	Type [15]	Dissemination level [16]	Due Date (in months) [17]
D1.1	Workforce use case specifications	WP1	7 - IFIN	Report	Confidential, only for members of the consortium (including the Commission Services)	6
D1.2	eHealth use case specifications	WP1	8 - FORTH	Report	Confidential, only for members of the consortium (including the Commission Services)	6
D1.3	Consumer use case specifications	WP1	6 - FNET	Report	Confidential, only for members of the consortium (including the Commission Services)	6
D1.4	System architecture	WP1	3 - SIV	Report	Public	4
D1.5	Workforce Use case Description	WP1	7 - IFIN	Report	Public	6
D1.6	eHalth use case description	WP1	8 - FORTH	Report	Public	6
D1.7	Consumer use case description	WP1	6 - FNET	Report	Public	6
D1.8	Workfoce use case recruitment	WP1	7 - IFIN	Report	Public	6
D1.9	eHealth use case Recruitment	WP1	8 - FORTH	Report	Public	6
D1.10	Consumer Use Case Recruitment	WP1	6 - FNET	Report	Public	6
D2.1	Voice acoustics recognition method	WP2	2 - HB	Other	Public	9
D2.2	Face identification method	WP2	2 - HB	Other	Public	10
D2.3	Audio-visual analysis method	WP2	2 - HB	Other	Public	12
D2.4	Validation report	WP2	9 - UCL	Report	Public	14
D3.1	Enrolment security and privacy implementation report	WP3	4 - INSP	Report	Confidential, only for members of the consortium (including the Commission Services)	15

Deliverable Number [14]	Deliverable Title	WP number [9]	Lead beneficiary	Type [15]	Dissemination level [16]	Due Date (in months) [17]
D3.2	Speaker recognition security and privacy recognition report	WP3	4 - INSP	Report	Confidential, only for members of the consortium (including the Commission Services)	15
D3.3	Security and privacy test reports	WP3	10 - TSP	Report	Confidential, only for members of the consortium (including the Commission Services)	18
D4.1	User physiology impact report	WP4	5 - EYE	Report	Public	18
D4.2	Context-dependent tuning framework	WP4	8 - FORTH	Demonstrator	Public	18
D4.3	User interface implementation report	WP4	8 - FORTH	Report	Public	20
D5.1	System release v1	WP5	3 - SIV	Demonstrator	Public	18
D5.2	System release v2	WP5	3 - SIV	Demonstrator	Public	20
D5.3	System release v3	WP5	3 - SIV	Demonstrator	Public	24
D5.4	System interoperability report	WP5	3 - SIV	Report	Public	24
D5.5	Test/QA report	WP5	3 - SIV	Report	Public	24
D6.1	Workforce pilot implementation report	WP6	7 - IFIN	Report	Public	34
D6.2	eHealth pilot implementation report	WP6	8 - FORTH	Report	Public	34
D6.3	Consumer pilot implementation report	WP6	6 - FNET	Report	Public	34
D6.4	Pilot Evaluation Report	WP6	9 - UCL	Report	Public	36
D7.1	Internal project repository	WP7	1 - OT	Websites, patents filling, etc.	Confidential, only for members of the consortium (including the Commission Services)	1
D7.2	External project website	WP7	1 - OT	Websites, patents filling, etc.	Public	2
D7.3	Dissemination plan	WP7	10 - TSP	Report	Confidential, only for members of the consortium	6

Deliverable Number [14]	Deliverable Title	WP number [9]	Lead beneficiary	Type [15]	Dissemination level [16]	Due Date (in months) [17]
					(including the Commission Services)	
D7.4	Dissemination report	WP7	10 - TSP	Report	Public	36
D7.5	Developer contest report	WP7	1 - OT	Report	Public	36
D7.6	Spoofing contest report	WP7	10 - TSP	Report	Public	36
D7.7	Ecosystem report	WP7	1 - OT	Report	Public	36
D7.8	Collaboration report	WP7	10 - TSP	Report	Public	36
D8.1	Exploitation plan	WP8	1 - OT	Report	Confidential, only for members of the consortium (including the Commission Services)	6
D8.2	Business cases	WP8	1 - OT	Report	Public	24
D8.3	IPR registry	WP8	2 - HB	Report	Confidential, only for members of the consortium (including the Commission Services)	36
D8.4	Reports on industry workshops	WP8	1 - OT	Report	Public	36
D9.1	Report on published standards	WP9	9 - UCL	Report	Public	12
D9.2	Compilation of standard contributions	WP9	1 - OT	Report	Public	36
D9.3	CEN Cenelec workshop agreement	WP9	9 - UCL	Websites, patents filling, etc.	Public	36
D10.1	First Periodic Report	WP10	1 - OT	Report	Confidential, only for members of the consortium (including the Commission Services)	18
D10.2	Second Periodic Report	WP10	1 - OT	Report	Confidential, only for members of the consortium (including the Commission Services)	36
D10.3	Final (Public) Report	WP10	1 - OT	Report	Public	36

Deliverable Number [14]	Deliverable Title	WP number [9]	Lead beneficiary	Type [15]	Dissemination level [16]	Due Date (in months) [17]
D10.4	Project Quality Handbook	WP10	1 - OT	Report	Confidential, only for members of the consortium (including the Commission Services)	3
D10.5	First Ethics Periodic Report	WP10	1 - OT	Report	Confidential, only for members of the consortium (including the Commission Services)	18
D10.6	Second Ethic periodic report	WP10	1 - OT	Report	Confidential, only for members of the consortium (including the Commission Services)	36

1.3.3. WT3 Work package descriptions

Work package number [9]	WP1	**Lead beneficiary** [10]	3 - SIV
Work package title	Requirement Specifications		
Start month	1	**End month**	6

Objectives

This work package covers the specification requirements for each of the use cases.
The objectives of this work package are:
• To specify the workforce use case (task 1.1)
• To specify the e-health use case (task 1.2)
• To specify the consumer use case (task 1.3)
• To design a flexible, modular system architecture that can support the 3 pilot scenarios (task 1.4)

Description of work and role of partners

WP1 - Requirement Specifications [Months: 1-6]
SIV, OT, FNET, IFIN , FORTH, TSP
Task 1.1: Specifying workforce use case (lead: IFIN)
The task will specify the requirements in the context of a research worker accessing sensitive scientific data (nuclear physics) over 3G/4G or WLAN, from a mobile device (laptop, tablet or smartphone). Scientists working on sensitive nuclear research projects will be able to access the secure information repository of the institute via remote biometrics-based identification through their mobile device. In addition, physical access to the research facility will be tested using the same biometrics-based identification. The recruitment procedure will be specified in a separate document to be approved by National Protection Authority (National Supervisory Authority for Personal Data Processing), REA and CSIO.
Task 1.2: Specifying e-health use case (lead: FORTH)
The task will specify the requirements in the context of a patient (or a medical expert) accessing personal health data over 3G/4G or WLAN, from a mobile device (laptop, tablet or smartphone). Patients and doctors will use the remote biometrics solution to access a collaboration platform developed by FORTH to support the prevention and management of a chronic condition (osteoarthritis). Patients will be able to remotely and securely report health data such as activity level, pain, etc. while general practitioners and specialists will be able to access the patient journals for decision-support. The recruitment procedure will be specified in a separate document to be approved by National Protection Authority (Hellenic Data Protection Authority), REA and CSIO.

Task 1.3: Specifying consumer use case (lead: FNET)
The task will specify the requirements in the context of a consumer accessing his internet service provider billing data over 3G/4G or WLAN, from a mobile device (laptop, tablet or smartphone). Customers will be able to access e-billing information, user profiling information, user accounts using an authorization service based on remote biometrics-based identification through a secure cloud connection.The recruitment procedure will be specified in a separate document to be approved by National Protection Authority (Hellenic Data Protection Authority), REA and CSIO.

Task 1.4: Designing the overall system architecture (lead: SIV)
The task will specify the information flow between the different system components and the integration requirements. The selected architecture will be flexible, so it can accommodate various types of networks and devices, and various authentication situations. The architecture will also be designed to support the latest security and privacy frameworks, and minimize the points of attack.

Task 1.1-1.3 will be implemented based on a user-centric innovation process. Each of the end-users (IFIN-HH, FORTH, FNET) will select super-users (users selected for their interest in new technologies and their communication skills) that will provide initial requirements in WP1 and iterative feedback during the development of the solution (in particular the user interfaces) in WP2-3-4.

SIV will lead this work package as it is in charge of the final integration and needs the most detailed level of knowledge of the use cases. SIV will be supported by consortium members in various parts of the work package:

• IFIN for the workforce use case
• FORTH for the eHealth use case
• FNET, OT for the consumer use case
• OT, TSP for the overall system architecture and TEC for latest security and privacy frameworks

Participation per Partner

Partner number and short name	WP1 effort
1 - OT	4.00
3 - SIV	12.00
6 - FNET	6.00
7 - IFIN	4.00
8 - FORTH	4.00
10 - TSP	4.00
Total	34.00

List of deliverables

Deliverable Number [14]	Deliverable Title	Lead beneficiary	Type [15]	Dissemination level [16]	Due Date (in months) [17]
D1.1	Workforce use case specifications	7 - IFIN	Report	Confidential, only for members of the consortium (including the Commission Services)	6
D1.2	eHealth use case specifications	8 - FORTH	Report	Confidential, only for members of the consortium (including the Commission Services)	6
D1.3	Consumer use case specifications	6 - FNET	Report	Confidential, only for members of the consortium (including the Commission Services)	6
D1.4	System architecture	3 - SIV	Report	Public	4
D1.5	Workforce Use case Description	7 - IFIN	Report	Public	6
D1.6	eHalth use case description	8 - FORTH	Report	Public	6
D1.7	Consumer use case description	6 - FNET	Report	Public	6

List of deliverables

Deliverable Number [14]	Deliverable Title	Lead beneficiary	Type [15]	Dissemination level [16]	Due Date (in months) [17]
D1.8	Workfoce use case recruitment	7 - IFIN	Report	Public	6
D1.9	eHealth use case Recruitment	8 - FORTH	Report	Public	6
D1.10	Consumer Use Case Recruitment	6 - FNET	Report	Public	6

Description of deliverables

Task 1.1: D1.1 Workforce use case specifications Lead IFIN Contributors: SIV D1.5 Workforce use case description Lead IFIN Contributors: SIV D1.8 Workforce use case recruitment specifications Lead IFIN Contributors: SIV Task 1.2: D1.2 eHealth use case specifications Lead FORTH Contributors: SIV D1.6 eHealth use case public description Lead FORTH Contributors: SIV D1.9 eHealth use case recruitment specifications Lead FORTH Contributors: SIV Task 1.3: D1.3 Consumer use case specifications Lead FNET Contributors: SIV, OT D1.7 Consumer use case description Lead FNET Contributors: SIV, OT D1.10 Consumer use case recruitment specifications Lead FNET Contributors: SIV, OT Task 1.4: D1.4 System architecture Lead SIV Contributors: OT, TSP

D1.1 : Workforce use case specifications [6]

Specifications of the requirements in the context of a research worker accessing sensitive scientific data (nuclear physics) over 3G/4G or WLAN, from a mobile device (laptop, tablet or smartphone).

D1.2 : eHealth use case specifications [6]

Specification of the requirements in the context of a patient (or a medical expert) accessing personal health data over 3G/4G or WLAN, from a mobile device (laptop, tablet or smartphone)

D1.3 : Consumer use case specifications [6]

Specification of the requirements in the context of a consumer accessing his internet service provider billing data over 3G/4G or WLAN, from a mobile device (laptop, tablet or smartphone).

D1.4 : System architecture [4]

Specification of the information flow between the different system components and the integration requirements.

D1.5 : Workforce Use case Description [6]

Public version of deliverable D1.1.

D1.6 : eHalth use case description [6]

Public Version of D1.2

D1.7 : Consumer use case description [6]

Public version of D1.3

D1.8 : Workfoce use case recruitment [6]

Specifications of recruitment procedure for Use Testing including the end user consent form and all procecedure set to ensure security and privacy.

D1.9 : eHealth use case Recruitment [6]

Specifications of recruitment procedure for Use Case Testing including the end user consent form and all procecedure set to ensure security and privacy.

D1.10 : Consumer Use Case Recruitment [6]

Specifications of recruitment procedure for Use Testing including the end user consent form and all procecedure set to ensure security and privacy.

Schedule of relevant Milestones

Milestone number [18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS1	Use cases ready	3 - SIV	6	All use cases documented

Work package number [9]	WP2	Lead beneficiary [10]	2 - HB
Work package title	Multichannel Biometrics		
Start month	4	End month	14

Objectives

This work package covers the implementation of the individual biometric modalities (voice, face, lip movement) and their combination (multi-channel speaker identification and verification).
The objectives of this work package are:
• To implement a speaker recognition method based on voice acoustics filtering and analysis (task 2.1)
• To implement a face recognition method based on feature extraction and statistical analysis (task 2.2)
• To implement an audio-visual analysis method based on lip movement and audio-visual synchrony analysis (task 2.2)
• To test a multichannel biometrics solution combining all of the above (task 2.3)

Description of work and role of partners

WP2 - Multichannel Biometrics [Months: 4-14]
HB, OT, INSP, UCL, TSP
Given the nature of the project (Innovation Action bringing components from TRL 5-6 to TRL8), the consortium does not aim to redevelop novel biometric modalities, but instead to use proven methods (voice, face), improve them (using acoustic analysis for voice and lip movement for face) and combine them (multi-channel biometrics) to deliver a solution that can outperform existing individual biometric modalities.
Task 2.1: Implementing voice acoustic-driven identification model (lead: HB)
The task will measure the acoustic correlates of voice quality and create a feature vector containing acoustic correlates of voice quality. Key issues will be to a) examine how the acoustic correlates of voice quality vary as a function of placement in the syllable nucleus paying particular attention to consonant (C) vowel (V) and VC transitions, b) pay particular attention to aspiration noise, and c) examine voice quality at the syllable nucleus, mid-stream in the vowel where there is less changes in the acoustics. The task will also evaluate low cost classifiers (dynamic threshholding, vector quantization and polynomial classifiers) and classical GMMs. Low cost classifiers are being evaluated because it has been shown that acoustic correlates of voice quality is robust (see section 1.4.2). GMMs are evaluated to as they are widely used in voice biometrics today.
Task 2.2: Implementing face recognition model (lead: HB)
The BioSecure face recognition reference system and its improvements will be used initially. These algorithms will be compared with other successful algorithms such as ‘Local Binary Patterns’ , SIFT and Active Shape and Appearance Models . Scores of these algorithms will be experimented in task 2.4. A 3D active shape model will be exploited for facial landmark tracking in the video sequence. In particular, the lips will be localized and modelled for task 2.3.
Task 2.3: Implementing audio-visual analysis model (lead: HB)
Features from the lips will be obtained by global descriptors such as eigenlips and DCT coefficients. These descriptors will be interpolated to match the speech spectrum sampling rate (100 Hz). Canonical correlation and co-inertia coefficients will be computed to capture the synchrony of speech and lips movements. In the text-dependent case, a measure of the correlation between the observed and the expected visemes for all the phone sequence will also be transmitted to the fusion module of task 2.4. Multi-stream HMMs will also be implemented if sufficient data is available for model adaptation.
Task 2.4: Validating and testing the multichannel biometrics solution (lead: UCL)
Validating and testing the multichannel biometrics solution will require a fusion engine which must, in some near optimal fashion, integrate the information from the two biometrics modules to make a decision of whether or not the user is who they claim to be. The fundamental approach that is being proposed is to incorporate as much of the discriminatory power of the underlying physical acoustics and face data as possible. The weakness of conventional machine learning approaches to the voice biometrics problem is that they do not capture the physical acoustics of the problem. They very early in the processing stream fundamentally cast the problem into a statistical classifier in a large dimensional vector space. We believe a simple Bayesian based decision rule can be employed, likely thresholding on Mahalanobis distance from the mean of the training set. We will select the most robust, highest performance approach to incorporate into our final design.
HB will lead this work package and will be responsible for all the software developments. HB will be supported by consortium members in various parts of the work package:

• TSP for anti-spoofing methods
• OT for the scalability and commercial feasibility of the selected solutions
• TEC for the security and privacy implications of the selected solutions
• UCL, TSP, OT for the validation and testing of the combined solution

Participation per Partner

Partner number and short name	WP2 effort
1 - OT	22.00
2 - HB	48.00
4 - INSP	12.00
9 - UCL	14.00
10 - TSP	14.00
Total	110.00

List of deliverables

Deliverable Number [14]	Deliverable Title	Lead beneficiary	Type [15]	Dissemination level [16]	Due Date (in months) [17]
D2.1	Voice acoustics recognition method	2 - HB	Other	Public	9
D2.2	Face identification method	2 - HB	Other	Public	10
D2.3	Audio-visual analysis method	2 - HB	Other	Public	12
D2.4	Validation report	9 - UCL	Report	Public	14

Description of deliverables

Task 2.1: D2.1 Voice acoustics recognition method Lead HB Contributors: TSP, OT, TEC Task 2.2: D2.2 Face identification method Lead HB Contributors: TSP, OT, TEC Task 2.3: D2.3 Audio-visual analysis method Lead HB Contributors: TSP, OT, TEC Task 2.4: D2.4 Validation report Lead UCL Contributors: HB, TSP, OT

D2.1 : Voice acoustics recognition method [9]

A feature vector containing acoustic correlates of voice quality

D2.2 : Face identification method [10]

A face recognition reference system

D2.3 : Audio-visual analysis method [12]

Descriptors of lips will be interpolated to match the speech spectrum sampling rate (100 Hz).

D2.4 : Validation report [14]

Results of validation and test of the multichannel biometrics

Schedule of relevant Milestones

Milestone number [18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS2	Core modules ready	2 - HB	14	Biometrics module ready and validated.

Work package number [9]	WP3	Lead beneficiary [10]	4 - INSP
Work package title	User Security & Privacy		
Start month	4	End month	18

Objectives

This work package covers the implementation of security and privacy mechanisms for the target multichannel biometric solution.
The objectives of this work package are:
• To implement a secure and privacy-preserving mechanism for user enrolment (task 3.1)
• To implement an end-to-end secure and privacy-preserving mechanism for speaker identification and verification (task 3.2)
• To test the strength of the solutions against template leakage and spoofing (task 3.3)

Description of work and role of partners

WP3 - User Security & Privacy [Months: 4-18]
INSP, OT, HB, FNET, IFIN , FORTH, TSP
Task 3.1: Implementing a secure and privacy-preserving mechanism for user enrolment (leader: TEC)
The task will implement a one-way cryptographic function to mitigate template leakage attacks on biometric module. In particular biometric cryptosystem and cancellable biometrics will be implemented and evaluated. Biometric features such as vocal tract physiology and lib movements are transformed into pseudo random values by cryptographic schemes such as biohashing, robust hashing, key binding, and key generation techniques. Each technique has its own merit and demerit and combining these techniques serially and in parallel will enhance the accuracy and security. Each of the combination will be evaluated in the following category:
• Diversity: the secure template must not allow cross matching across databases, thereby ensuring the user's privacy
• Revocability: it should be straightforward to revoke a compromised template and reissue a new one based on the same biometric data
• Security: it must be computationally hard to obtain the original biometric template from the secure template. This property prevents an adversary from creating a physical spoof of the biometric trait from a stolen template.
• Performance: the biometric template protection scheme should not degrade the recognition performance of the biometric system

Task 3.2 : Implementing secure and privacy-preserving mechanisms for speaker recognition (leader: TEC)
The task will implement end-to-end anonymous privacy-preserving authentication scheme in order to protect the user's biometric data during transmission and storage. This scheme is crucial when applications or organizations outsource the biometric authentication systems to third party such as cloud providers. A novel scheme will be developed to hide the biometric data from active eavesdroppers and malicious server who performs the matching process. This task will exploit cryptographic primitives such as Paillier Homomorphic encryption, secure multi-party computation and oblivious transfer to build a secure scheme to archive user privacy. Paillier cryptography is public-key cryptography and supports additive homomorphism. The user device will generate public key and secret key. The public key will be used to encrypt the user biometric data before transmission. The user device keeps the secret key and sends the encrypted biometrical data and public key to the matching server. Since the secret key resides at user end, no one including the matching server could be able to decrypt the user's biometric data to compromise the user's privacy. However, the matching server exploits the Homomorphic property of Paillier encryption to perform linear operation associated with authentication process. Any non-linear operations will be performed using secure multi-party computation between user and server. Oblivious transfer and privacy-preserving scalar multiplication will be exploited to reduce computational and communication overheads.
Task 3.3: Testing the selected solutions against template leakage and spoofing (leader: TSP)
The task will provide the evaluation frameworks related to template leakage and spoofing. Besides the classical biometric evaluation metrics (such as False acceptance, False Rejection) we will address the issues related to spoofing. We will propose evaluation schemes that will allow testing the biometric solutions developed during the SpeechXRays project for various spoofing attacks. In relation to cancellable biometrics, template diversity and template leakage will be tested. In order to prove that a cancellable biometric system adds template diversity, the task will propose a specific test. In this test, one biometric feature vector is transformed with 100,001 (or even more) transformation parameters.

This results in 100,001 different templates from a single feature vector. The first such cancellable template is compared with the remaining 100,000 cancellable templates. If the Hamming distance (or whichever distance is applicable) distribution of these comparisons is close to the impostor Hamming distance distribution, it indicates that a large number of independent templates can be obtained from a single biometric feature vector using the cancellable biometric system in consideration. The task will also address the biometric data protection issue, known also as template leakage, or how much the biometric cryptosystem templates are able to hide the biometric data that they represent. It will test if it is not computationally feasible to recover the original biometric feature vector from the biometric cryptosystem templates created in the context of SpeechXRays project.

TEC will lead this work package and will be responsible for the implementation of the security and privacy frameworks. TEC will be supported by consortium members in various parts of the work package:
• TSP, HB for the testing of the solution against template leakage and spoofing
• IFIN, FORTH, FNET, OT for the user validation of the privacy-preserving framework

Participation per Partner

Partner number and short name	WP3 effort
1 - OT	2.00
2 - HB	18.00
4 - INSP	35.00
6 - FNET	5.00
7 - IFIN	2.00
8 - FORTH	2.00
10 - TSP	8.00
Total	72.00

List of deliverables

Deliverable Number [14]	Deliverable Title	Lead beneficiary	Type [15]	Dissemination level [16]	Due Date (in months) [17]
D3.1	Enrolment security and privacy implementation report	4 - INSP	Report	Confidential, only for members of the consortium (including the Commission Services)	15
D3.2	Speaker recognition security and privacy recognition report	4 - INSP	Report	Confidential, only for members of the consortium (including the Commission Services)	15
D3.3	Security and privacy test reports	10 - TSP	Report	Confidential, only for members of the consortium (including the Commission Services)	18

Description of deliverables

Task 3.1: D3.1 Enrolment security and privacy implementation report Lead TEC Contributors: IFIN, FORTH, FNET, OT Task 3.2: D3.2 Speaker recognition security and privacy recognition report Lead TEC Contributors: IFIN, FORTH, FNET, OT Task 3.3: D3.3 Security and privacy test reports Lead TSP Contributors: TEC, HB

D3.1 : Enrolment security and privacy implementation report [15]

Results of test and validation of implementation of a one-way cryptographic function to mitigate template leakage attacks on biometric module

D3.2 : Speaker recognition security and privacy recognition report [15]

Results of test and validation of the implementation end-to-end anonymous privacy-preserving authentication scheme in order to protect the user's biometric data during transmission and storage.

D3.3 : Security and privacy test reports [18]

Evaluation frameworks related to template leakage and spoofing

Schedule of relevant Milestones

Milestone number [18]	**Milestone title**	**Lead beneficiary**	**Due Date (in months)**	**Means of verification**
MS2	Core modules ready	2 - HB	14	Biometrics module ready and validated.

Work package number [9]	WP4	Lead beneficiary [10]	8 - FORTH
Work package title	HCI & Access Management		
Start month	12	End month	20

Objectives

This work package covers the implementation of user interfaces of the biometrics solution (user enrolment, user identification and verification, user management including template revocation)
The objectives of this work package are:
• To research the impact of the user physiology on the solution performance (task 4.1)
• To develop a context-dependent framework in order to tune the solution performance to the criticality of the application accessed (task 4.2)
• To implement ergonomic human-computer interfaces (HCI) for end-users and administrators (task 4.3)

Description of work and role of partners

WP4 - HCI & Access Management [Months: 12-20]
FORTH, HB, SIV, INSP, EYE
Task 4.1: Researching the impact of the user physiology on the solution performance (lead: EYE)
Biometrics systems have different level of tolerance to individual physiological variations. Physical ageing (or sickness) is an important issue for practical biometrics, since it is known that the associated physiological changes can impair performance for most modalities. Similarly, the emotional state of the user may impair the performance of the audio-visual modalities. Understanding the effects of emotion is necessary, therefore both to optimise attainable performance but also to understand how to manage biometric templates. The impact of emotional status on speaker identification and verification may be a benefit in some cases. For example, a system that could identify a user that is attempting to authenticate under duress (threat) would be very useful. The task will define if emotional cues can be reliably gathered in order to prevent false reject or to authentication under duress (e.g. the system would authenticate a user that "looks" tired or sad, but reject a user that looks "stressed" or "under threat").
Task 4.2: Developing a context-dependent tuning framework (lead: FORTH)
The performance of biometric systems can be described by the Receiver Operating Characteristics (ROC) curve, a visual characterization of the trade-off between the False Acceptance Rate (FAR) and the False Rejection Rate (FRR). The matching algorithm performs a decision based on a threshold which determines how close to a template the input needs to be for it to be considered a match. If the threshold is reduced, there will be fewer false non-matches but more false accepts. Conversely, a higher threshold will reduce the FAR but increase the FRR. In general, high-security applications will favour a low FAR, at the expense of a high FRR (as it is better to deny access and ask for re-authentication if the system has any doubt). Conversely, low-security applications will favour a low FRR, at the expense of a high FAR (as it is more convenient to authenticate at the first attempt, even if there is a risk it was not a legitimate authentication). However, the level of security required by a user may change over time. The eHealth scenario highlights this well: a patient that is about to access his latest data about blood pressure and temperature may not require a high level of security to do so. However, the same user attempting to access the results of a HIV test would require a much higher level of security to ensure he is the legitimate owner of the data. The task will develop a framework in which the matching threshold can be adapted based on the level of security required by the service that the user is attempting to access.

Task 4.3: Implementing the human-computer interfaces (lead: FORTH)
This task will carry out the design, formative evaluation and implementation of the system's user interfaces, for both and users and administrators, following a user-centred design approach, based on the holistic consideration of the user experience and taking into account the outcomes of tasks 4.1 and 4.2. In order to achieve this, the use cases elaborated in WP1 will be analysed to extract user experience requirements. Based on this analysis several UI prototypes will be designed and assessed following a formative usability evaluation approach, in order to identify appropriate feedback modalities combinations and iteratively refine the designs. The user interface implementation will include an adaptation mechanism to support UI adaptations as required by the context-dependent tuning framework.

FORTH will lead this work package and will be responsible for the development of the context-dependent framework and the human-computer interfaces. FORTH will be supported by consortium members in various parts of the work package:
• EYE and HB for the emotional analysis
• HB and TEC for the context-dependent tuning framework
• SIV for the implementation of the human-computer interfaces

Participation per Partner

Partner number and short name	WP4 effort
2 - HB	18.00
3 - SIV	15.00
4 - INSP	14.00
5 - EYE	19.00
8 - FORTH	30.00
Total	96.00

List of deliverables

Deliverable Number [14]	Deliverable Title	Lead beneficiary	Type [15]	Dissemination level [16]	Due Date (in months) [17]
D4.1	User physiology impact report	5 - EYE	Report	Public	18
D4.2	Context-dependent tuning framework	8 - FORTH	Demonstrator	Public	18
D4.3	User interface implementation report	8 - FORTH	Report	Public	20

Description of deliverables

Task 4.1: D4.1 User physiology impact report Lead EYE Contributors: FORTH, HB Task 4.2: D4.2 Context-dependent tuning framework Lead FORTH Contributors: TEC, HB Task 4.3: D4.3 User interface implementation report Lead FORTH Contributors: SIV

D4.1 : User physiology impact report [18]

impact of the user physiology on the solution performance

D4.2 : Context-dependent tuning framework [18]

A framework in which the matching threshold can be adapted based on the level of security required by the service that the user is attempting to access

D4.3 : User interface implementation report [20]

Formative evaluation of the system’s user interfaces, for both and users and administrators.

Schedule of relevant Milestones

Milestone number [18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS3	Solution ready	3 - SIV	24	All components ready. Solution integration complete. Solution ready for trial deployment

Work package number [9]	WP5	Lead beneficiary [10]	3 - SIV
Work package title	Biometrics Solution Integration, Portability & Interoperability		
Start month	16	End month	24

Objectives

This work package integrates the components developed in WP2, WP3 and WP4. It is running at the end of the development period. The system integration will be done in two steps: a short 3 month (M16-M18, 1 iteration) integration phase overlapping with component development in order to generate iterative feedback to the component developers and a longer 6 month (M19-M24, 2 iterations) integration phase to make the system ready for full scale tests.
The objectives of this work package are:
• To integrate the multichannel biometric component and the security/privacy component in a coherent service (task 5.1)
• To integrate the multichannel biometric component and the user interfaces in a coherent service (task 5.2)
• To publish services of the integrated software platform (task 5.3)
• To test the system (task 5.4)

Description of work and role of partners

WP5 - Biometrics Solution Integration, Portability & Interoperability [Months: 16-24]
SIV, OT, HB, INSP, FORTH
Task 5.1: Integrating multichannel biometric component and security/privacy component (lead: SIV)
The aim of this task is to integrate the developed multichannel biometric component and the security/privacy component into a common software platform. This software platform will serve as the liaison between work that will be carried out during this project and future software systems that will be using the outcomes of this project. The activities carried out in order to develop the software integration platform refer to combining the individually developed and tested components (multichannel biometric component and the security/privacy component) into an integrated whole that will deliver added value for the entire software system. In this respect, independent capabilities of the individual software components will deliver cross-functional functionalities, enabling this way the deployment of the state of the art work carried out through the project. Therefore, the outcome of this task will refer to the following:
- Individual core assets developed in the project (such as multichannel biometric component and the security/privacy component) are integrated into the common core asset base of the project;
- Common core assets will enable cut-off, innovative, state of the art results that are linked to this project and beyond.
All carried out activities in other work packages that have delivered output such as requirements, architecture, processes and testing will serve as an input for this task and will contribute to the construction of the integrated software platform.

Task 5.2: Integrating multichannel biometric component and user interfaces (lead: SIV)
The aim of this task is to develop the capability of the integrated software platform to be visible and to create value to the outside world. The visibility to the outside world refers to users of the software platform and its services and other software systems that use certain functionalities of the platform. While the users of the software platform will access its functionalities trough a properly designed (usable) Graphical User Interface (GUI), other software systems may access functions trough software interface languages. In this respect, the integrated software platform will use SOA technology (Service Oriented Architecture) as means of communication to other software systems. As such, services that can be offered by the platform to other software systems will be visible through well-defined software interfaces, called services. This way, an outside software system will access functionalities delivered by the platform trough visible protocols.
Therefore, the results of this task focus on two outcomes: developing a usable GUI to the end users and deploying SOA technology that will be used as a communication channel to/from software systems.
Task 5.3: Publishing services of the integrated software platform (lead: SIV)
This task aims at having the integrated software platform interoperable with other software systems and/or external data sources. The developed services based on SOA technology will need to be discoverable by appointed software systems that need to user various functionalities. During this task, platform services will be deployed and tested individually in order to establish compliance and efficiency with needed standards of service. The interoperability infrastructure deployed during this task addresses the automation of flow between the source system (integrated software platform) and other software systems, or vice versa.

Task 5.4: Testing and QA (lead: SIV)

The aim of this task is to ensure that the developed software integration platform is fulfilling stakeholders' expectations. Moreover, the platform needs to be compliant with requirements as stated by requirements documentation. A testing specification document will be issued based on user requirements documentation. This testing specification documentation will aim to stress out platform capabilities in relation with the three use cases (workforce use case, e-health use case and consumer use case). In order to be able to fulfil stakeholders' expectations and to meet up with users standards a strict quality assurance methodology will be enforced. This QA methodology will ensure that defects in the software product (platform) are prevented and/or addressed in a timely manner. This way, possible shortcomings, mistakes or defects that may occur in the developed product (integrated software platform) may not only be prevented but also properly addressed may these occur.

SIV will lead this work package and will be responsible for the integration, testing and QA of all components. SIV will be supported by consortium members in various parts of the work package:
• HB, TEC, FORTH for the component integration
• HB, TEC, FORTH and OT for the system test & QA

Participation per Partner

Partner number and short name	WP5 effort
1 - OT	4.00
2 - HB	4.00
3 - SIV	55.00
4 - INSP	4.00
8 - FORTH	4.00
Total	71.00

List of deliverables

Deliverable Number [14]	Deliverable Title	Lead beneficiary	Type [15]	Dissemination level [16]	Due Date (in months) [17]
D5.1	System release v1	3 - SIV	Demonstrator	Public	18
D5.2	System release v2	3 - SIV	Demonstrator	Public	20
D5.3	System release v3	3 - SIV	Demonstrator	Public	24
D5.4	System interoperability report	3 - SIV	Report	Public	24
D5.5	Test/QA report	3 - SIV	Report	Public	24

Description of deliverables

Task 5.1-5.2: D5.1.1 System release v1 Lead SIV Contributors: HB, TEC, FORTH Task 5.1-5.2: D5.1.2 System release v2 Lead SIV Contributors: HB, TEC, FORTH Task 5.1-5.2: D5.1.3 System release v3 Lead SIV Contributors: HB, TEC, FORTH Task 5.3: D5.3 System interoperability report Lead SIV Contributors: HB, TEC, FORTH Task 5.4: D5.4 Test/QA report Lead SIV Contributors: HB, TEC, FORTH, OT

D5.1 : System release v1 [18]

system integrating multichannel biometric component and security/privacy component

D5.2 : System release v2 [20]

system integrating multichannel biometric component and user interface.

D5.3 : System release v3 [24]

system integrating multichannel biometric component and user interfaces

D5.4 : System interoperability report [24]

Evaluation report of the integrated software platform interoperable with other software systems and/or external data sources

D5.5 : Test/QA report [24]

The report will described how the developed software integration platform is fulfilling stakeholders' expectations.

Schedule of relevant Milestones

Milestone number [18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS3	Solution ready	3 - SIV	24	All components ready. Solution integration complete. Solution ready for trial deployment

Work package number [9]	WP6	Lead beneficiary [10]	9 - UCL
Work package title	Demonstrators & Evaluation		
Start month	18	End month	36

Objectives

This work package deploys the SpeechXRays platform on 2000 users in order to demonstrate the impact of the technologies developed in the course of the project on 3 different use cases.
The objectives of this work package are:
• To implement and evaluate the workforce pilot – 600 users (task 6.1)
• To implement and evaluate the eHealth pilot – 400 users (task 6.2)
• To implement and evaluate the consumer pilot – 1000 users (task 6.3)

Description of work and role of partners

WP6 - Demonstrators & Evaluation [Months: 18-36]
UCL, OT, SIV, FNET, IFIN , FORTH
Task 6.1: Implementing and evaluating workforce use case (lead: IFIN-HH)
The task will implement the solution on over 600 users of mobile devices (such as smartphones, tablets and laptops) used to access sensitive data over 3G/4G and WLAN and on-site, and on a physical access control device. All mobile equipment used for authentication will first be tested for compatibility with the access system (e.g. sufficient quality of sound and video recordings) and all approved equipment will be registered on the access platform. The on-site access system will implement most of the features of its mobile sibling plus an additional set of protection measures. These extra security measures are enforced to ensure the physical protection of the hardware infrastructure of IFIN-HH and rely on consolidating the above biometrics information with data obtained from the proximity cards (needed to enter the premises of IFIN-HH and each separate building), the perimetral video surveillance system (which can signal, for instance, unusual activities outside the standard working hours), and the Romanian Gendarmerie Detachment which monitors the compound. This scenario will test the level of security, threat remediation and adaptability of the solution to various application (online access, physical perimeter access). During implementation, evaluation and testing the workforce use case we will avoid any compromising of current environment of the users. Espacially the evatuation and testing will not take place in a classified environment.
Task 6.2: Implementing and evaluating eHealth use case (lead: FORTH)
This task will recruit 400 participants, perform the assessments, do the data entry and run the eHealth use case pilot. SpeechXRays will provide the required user identification services for secure access to the eHealth collaboration platform for all different stakeholder, to allow patients/citizens monitoring and medical expert collaboration. The secure collaboration platform enable by SpeechXRays will allow citizen to be informed if a high risk of developing exist, based on the available datasets and on the predictive models which are based on pattern recognition from the heterogeneous group of quantitative imaging data. It will also provide added value to the doctors/medical experts, with all the necessary information, properly visualized using multi-scale visualization techniques, to provide diagnostic collaboration opinions for better treatment. This scenario will test the security, privacy, usability and cost-effective features of the security platform. In particular, the scenario will test the context-dependent feature that allows administrators to modify the FAR/FRR trade-off in order to reduce the risk of false reject for low security data (e.g. physical examination) and reduce the risk of false accept for high security data (e.g. MRI/CT scans).
Task 6.3: Implementing and evaluating consumer use case (lead: FNET)
This trial will demonstrate the use of system on 1000 customers. Such an environment is typically very demanding since it involves interaction with users that are not accustomed to the provided interface while at the same time it provides a very good indication of the system's usability in a real world setting.
In this particular scenario the user verification system developed in the project will be used to enhance the user experience of FNET's customers, while accessing information and services offered by the company. Such services may involve e-billing information, user profiling information, access to the user's account, etc. Users from a selected consumer base, instead of following the typical access control procedure, will be able to use an authorization service based on remote biometrics-based identification through a secure cloud connection. This scenario will test ease of use, performance, security and the ability to target the actual user(s) of FNET services. While security is typically the primary consideration when incorporating user recognition technology, in this particular scenario security is necessary but is not as crucial as convenience or ease of use.

UCL will coordinate this work package and will be responsible of the evaluation of each use cases. UCL will be supported by consortium members in various parts of the work package:
• IFIN-HH for the workforce use case
• FORTH for the eHealth use case
• FNET and OT for the consumer use case
• SIV for all use cases

Participation per Partner

Partner number and short name	WP6 effort
1 - OT	3.00
3 - SIV	9.00
6 - FNET	17.00
7 - IFIN	10.00
8 - FORTH	10.00
9 - UCL	18.00
Total	67.00

List of deliverables

Deliverable Number [14]	Deliverable Title	Lead beneficiary	Type [15]	Dissemination level [16]	Due Date (in months) [17]
D6.1	Workforce pilot implementation report	7 - IFIN	Report	Public	34
D6.2	eHealth pilot implementation report	8 - FORTH	Report	Public	34
D6.3	Consumer pilot implementation report	6 - FNET	Report	Public	34
D6.4	Pilot Evaluation Report	9 - UCL	Report	Public	36

Description of deliverables

Task 6.1: D6.1 Workforce pilot implementation report Lead IFIN-HH, Contributors SIV, UCL Task 6.2: D6.2 eHealth pilot implementation report Lead FORTH, Contributors SIV, UCL Task 6.3: D6.3 Consumer pilot implementation report Lead FNET, Contributors SIV, UCL, OT, Task 6.1-6.3: D6.4 Pilot evaluation reports Lead UCL, Contributors IFIN-HH, FORTH, FNET, OT

D6.1 : Workforce pilot implementation report [34]

Report about the will implementation the solution on numerous users of mobile devices: level of security, threat remediation and adaptability of the solution to various application (online access, physical perimeter access).

D6.2 : eHealth pilot implementation report [34]

report about recruitment of participants, assessments, and execution of the eHealth use case pilot.

D6.3 : Consumer pilot implementation report [34]

report about recruitment of participants, assessments, and execution of the Consumer use case pilot.

D6.4 : Pilot Evaluation Report [36]

This report will gather the evaluation of each use case gathering the outputs about technology efficiency, security enforcement and user acceptance

Schedule of relevant Milestones

Milestone number [18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS3	Solution ready	3 - SIV	24	All components ready. Solution integration complete. Solution ready for trial deployment

Work package number [9]	WP7	Lead beneficiary [10]	10 - TSP
Work package title	Dissemination & Ecosystem Development		
Start month	1	End month	36

Objectives

This work package focuses in on the dissemination of project results and the development of an ecosystem of partners along the ATI value chain, in order to guarantee a sustainable impact to the project, once it is completed.
The objectives of this work package are:
• To develop the project communication infrastructure (task 7.1)
• To elaborate a successful dissemination plan, taken into account gender balance and open access (task 7.2)
• To conduct market dissemination and SpeechXRays ecosystem development (task 7.3)
• To collaborate with other EU projects (task 7.4)

Description of work and role of partners

WP7 - Dissemination & Ecosystem Development [Months: 1-36]
TSP, OT, HB, SIV, INSP, EYE, FNET, IFIN , FORTH, UCL
Task 7.1: Development of project website and intranet (OT)
This task will focus on the development of an external project website hosted at www.speechxrays.eu. The website will include a description of the project, the consortium and the industrial demonstrators. It will also contain a list of public deliverables from the project, together with relevant technology and industry related news. A mirror site will be included in the OT website. The traffic to the OT website will be a substantial means of driving attention to the project results. A partner-restricted information repository will be hosted at OT for project internal communication and collaboration.
Task 7.2: Development and implementation of a dissemination plan (TSP)
This task will implement the dissemination of project results through a variety of channels. At the beginning of this task, the project consortium will specify a dissemination plan which will be re-assessed and refined periodically, including individual and joint dissemination or communication activities. The efforts will start at project kick off with mentions on the partner website and a dedicated press release. During the course of the project, regular communications will be made towards the industry via newsletters or presence at industry events. Once the trials have been implemented, case studies will be created and published on the partner websites, as well as on industry and technology websites. In addition, the project will publish articles or white paper and make presentations at industry conferences etc. Peer-reviewed articles will be deposited within 6 months of their publication in open access databases. These will not constitute separate project deliverables (they are in any case public information), but regular progress reports produced in WP10 Management will list articles published.
Task 7.3: Market dissemination and ecosystem development (OT)
This task is to actively promote the project technologies and innovations to the market, and to create an ecosystem around the SpeechXRays solution. Various market dissemination activities will be organised such as an application development contest and a spoofing contest. In these contests, the developer (and hacker) community will be asked to develop new application ideas based on SpeechXRays or to attempt to spoof the system.
Task 7.4: EU collaboration (TSP)
The project aims to develop cross-fertilization activities with ongoing FP7-ICT or FP7-SECURITY projects and new Horizon 2020 projects focusing on similar challenges, based on TSP's experience leading the BioSecure NoE.

Although OT will provide a large effort in this WP, it will formally be led by TSP, who will be responsible for the dissemination and collaboration activities, supported by OT for the project website, communication infrastructure and ecosystem development, and generally by all partners.

Participation per Partner

Partner number and short name	WP7 effort
1 - OT	16.00
2 - HB	4.00

Partner number and short name	WP7 effort
3 - SIV	2.00
4 - INSP	2.00
5 - EYE	2.00
6 - FNET	1.00
7 - IFIN	1.00
8 - FORTH	2.00
9 - UCL	2.00
10 - TSP	8.00
Total	40.00

List of deliverables

Deliverable Number [14]	Deliverable Title	Lead beneficiary	Type [15]	Dissemination level [16]	Due Date (in months) [17]
D7.1	Internal project repository	1 - OT	Websites, patents filling, etc.	Confidential, only for members of the consortium (including the Commission Services)	1
D7.2	External project website	1 - OT	Websites, patents filling, etc.	Public	2
D7.3	Dissemination plan	10 - TSP	Report	Confidential, only for members of the consortium (including the Commission Services)	6
D7.4	Dissemination report	10 - TSP	Report	Public	36
D7.5	Developer contest report	1 - OT	Report	Public	36
D7.6	Spoofing contest report	10 - TSP	Report	Public	36
D7.7	Ecosystem report	1 - OT	Report	Public	36
D7.8	Collaboration report	10 - TSP	Report	Public	36

Description of deliverables

Task 7.1 D7.1.1 Internal project repository Lead OT Contributors All partners Task 7.1 D7.1.2 External project website Lead OT Contributors All partners Task 7.2 D7.2.1 Dissemination plan Lead TSP Contributors All partners Task 7.2 D7.2.2 Dissemination report Lead TSP Contributors All partners Task 7.3 D7.3.1 Developer contest report Lead OT Contributors All partners Task 7.3 D7.3.2 Spoofing contest report Lead TSP Contributors All partners

Task 7.3 D7.3.3 Ecosystem report Lead OT Contributors All partners Task 7.4 D7.4 Collaboration report Lead TSP Contributors All partners

D7.1 : Internal project repository [1]

A partner-restricted information repository will be hosted at OT for project internal communication and collaboration

D7.2 : External project website [2]

an external project website hosted at www.speechxrays.eu. The website will include a description of the project, the consortium and the industrial demonstrators

D7.3 : Dissemination plan [6]

Specification of a dissemination plan which will be re-assessed and refined periodically, including individual and joint dissemination or communication activities.

D7.4 : Dissemination report [36]

regular progress reports and list of articles published

D7.5 : Developer contest report [36]

Report of dissemination activities organised in support of application development contest

D7.6 : Spoofing contest report [36]

Report about dissemination activities organised to support a spoofing contest

D7.7 : Ecosystem report [36]

Report about activities that will promote the project technologies and innovations to the market, and intended to create an ecosystem around the SpeechXRays solution.

D7.8 : Collaboration report [36]

Report about cross-fertilization activities with ongoing FP7-ICT or FP7-SECURITY projects and new Horizon 2020 projects focusing on similar challenges.

Schedule of relevant Milestones

Milestone number [18]	**Milestone title**	**Lead beneficiary**	**Due Date (in months)**	**Means of verification**
MS4	Pilots completed	9 - UCL	36	All pilots and evaluation reports completed

Work package number [9]	WP8	Lead beneficiary [10]	1 - OT
Work package title	Exploitation & Scaling Up		
Start month	1	End month	36

Objectives

This work package will effectively support the exploitation of the project results. Its objectives are:
• To develop an effective exploitation strategy for the (post-project) market replication of project results (task 8.1)
• To create business cases and develop a business plan (task 8.2)
• To manage the IPR resulting from the project (task 8.3)
• To organise industry-specific workshops (task 8.4)

Description of work and role of partners

WP8 - Exploitation & Scaling Up [Months: 1-36]
OT, HB, SIV, INSP, EYE, FNET, IFIN , FORTH, UCL, TSP
Task 8.1: Developing the exploitation strategy and plan (OT)
This task focuses on the development of appropriate exploitation strategy and plan of the project results. The core strategy is to use the extensive contact network of each consortium members as a starting point to get in touch with new potential users of the project solutions. OT will lead this task with support from all project partners. The partners will also develop their own individual exploitation plans based on their contributions to the project and their business development strategy. This task will also be responsible to monitor similar development by third parties (competitive landscape analysis and monitoring).
Task 8.2: Developing business cases for exploitation (OT)
This task focuses on industrial business cases development for the targeted applications, including return on investment (ROI) and cost-benefit analyses (CBA). The data of these cases will be used to build a cost-benefit analysis for each targeted industry cluster.
Task 8.3: Managing project IPR (HB)
HB will document all project results in an IPR directory in order to clearly assign the ownership of the various pieces of software developed in the course of the project, and set up cross-licensing schemes between partners to be able to reuse non-public parts of the projects. This work will be coordinated with the development of industrial business cases to ensure that such activities can proceed without hindrances regarding disputes about ownership and exploitation rights.
Task 8.4: Organizing workshops (OT)
This task will also promote the project results to companies external to the consortium, by arranging 3 workshops in relation with the 3 pilots. The workshops will be full day events promoted at international level and specifically targeting SMEs (i.e. small and medium size organizations that could become customers or partners).

OT will lead this work package and all deliverables except the IPR registry (led by HB)
OT will be supported by all consortium members to maximize the exploitation outputs, and by the pilot leaders (IFIN-HH, FORTH, FNET) in order to build the business cases.

Participation per Partner

Partner number and short name	WP8 effort
1 - OT	24.00
2 - HB	12.00
3 - SIV	2.00
4 - INSP	2.00
5 - EYE	2.00
6 - FNET	2.00
7 - IFIN	1.00

Partner number and short name	WP8 effort
8 - FORTH	2.00
9 - UCL	2.00
10 - TSP	2.00
Total	51.00

List of deliverables

Deliverable Number [14]	Deliverable Title	Lead beneficiary	Type [15]	Dissemination level [16]	Due Date (in months) [17]
D8.1	Exploitation plan	1 - OT	Report	Confidential, only for members of the consortium (including the Commission Services)	6
D8.2	Business cases	1 - OT	Report	Public	24
D8.3	IPR registry	2 - HB	Report	Confidential, only for members of the consortium (including the Commission Services)	36
D8.4	Reports on industry workshops	1 - OT	Report	Public	36

Description of deliverables

Task 8.1: D8.1.x Exploitation plan Lead OT Contributors All partners Task 8.2: D8.2 Business cases Lead OT Contributors IFIN-HH, FORTH, FNET, Task 8.3: D8.3 IPR registry Lead HB Contributors All partners Task 8.4: D8.4 Reports on industry workshops Lead OT Contributors All partners

D8.1 : Exploitation plan [6]

Periodical report (6/18/36) of appropriate exploitation strategy and plan of the project results.

D8.2 : Business cases [24]

Description of industrial business cases development for the targeted applications, including return on investment (ROI) and cost-benefit analyses (CBA).

D8.3 : IPR registry [36]

document all project results in an IPR directory in order to clearly assign the ownership of the various pieces of software developed in the course of the project

D8.4 : Reports on industry workshops [36]

promote the project results to companies external to the consortium, by arranging 3 workshops in relation with the 3 pilots.

Schedule of relevant Milestones

Milestone number [18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification

Work package number [9]	WP9	Lead beneficiary [10]	9 - UCL
Work package title	Standardization		
Start month	1	End month	36

Objectives

Despite the growing interest in speaker identification and verification, the lack of standards is a market and technology barrier. Therefore, the consortium has elected to dedicate a full work package to certification and standardization activities. The objectives for this work package are:
• To analyse and re-use relevant published standards (task 9.1)
• To contribute to the development of ongoing standard drafts (task 9.2)
• To coordinate a CEN Cenelec workshop agreement (task 9.3)

Description of work and role of partners

WP9 - Standardization [Months: 1-36]
UCL, OT, HB, TSP
Task 9.1: Analysing published standards (UCL)
The domain of face biometrics has been addressed by recent standard updates, therefore the consortium will analyse, and develop the solution in accordance with, published standards such as ISO/IEC 19794-5:2011 and ANSI/NIST-ITL 1-2011.
Task 9.2: Contributing to upcoming standards (OT)
Unlike other biometric technologies (and unlike speech recognition and speech synthesis), there are no standards specifically governing the use of SIV. ISO/IEC 19784-1 (called "BioAPI") is a generic, biometric application programming language that was designed to support SIV in non-telephony deployments. Its utility for SIV Web-services applications has not yet been fully explored. The other SIV standards projects (IETF MRCP V2; INCITS 1821-D Speaker Recognition Format for Raw Data Interchange, NIST-ITL Type-11 Record and ISO/IEC 1.37.19794-13) are all still under development. The consortium therefore intends to make contributions to the development of the ISO/IEC 19794-13 standard, currently in Committee Draft status with target publication date 2016-01-04 (Table 12).
Task 9.3: Coordinating CEN Cenelec workshop agreement (UCL)
UCL will subcontract CEN Cenelec to develop a Workshop Agreement (also known as CWA) in the area of multichannel biometrics combining dynamic voice and face identification. The CWA will operate as a pre-standard which tests the applicability and value of standardization to rapidly changing and highly innovative sectors, that may see standardization as a hindrance to innovation and the topics that come under consideration are often ones in which it is unlikely that full consensus could be achieved in an acceptable timeframe. The CWA process will also be a key process to engage with new stakeholder communities. This process will be launched at the end of year 1 and will be open to other members outside of the consortium.
UCL will lead this work package and will be responsible for the analysis of existing standards and the coordination of the CEN Cenelec workshop agreement. UCL will be supported by OT, HB, TSP.

Participation per Partner

Partner number and short name	WP9 effort
1 - OT	5.00
2 - HB	3.00
9 - UCL	10.00
10 - TSP	3.00
Total	21.00

List of deliverables

Deliverable Number [14]	Deliverable Title	Lead beneficiary	Type [15]	Dissemination level [16]	Due Date (in months) [17]
D9.1	Report on published standards	9 - UCL	Report	Public	12
D9.2	Compilation of standard contributions	1 - OT	Report	Public	36
D9.3	CEN Cenelec workshop agreement	9 - UCL	Websites, patents filling, etc.	Public	36

Description of deliverables

Task 9.1: D9.1 Report on published standards Lead UCL Contributors HB, TSP Task 9.2: D9.2 Compilation of standard contributions Lead OT Contributors HB, TSP, UCL Task 9.3: D9.3 CEN Cenelec workshop agreement Lead UCL Contributors OT, HB, TSP

D9.1 : Report on published standards [12]

Analysing of published standards such as ISO/IEC 19794-5:2011 and ANSI/NIST-ITL 1-2011.

D9.2 : Compilation of standard contributions [36]

Report about contributions to the development of the ISO/IEC 19794-13 standard, currently in Committee Draft status with target publication date 2016-01-04 (Table 12).

D9.3 : CEN Cenelec workshop agreement [36]

UCL will subcontract CEN Cenelec to develop a Workshop Agreement (also known as CWA) in the area of multichannel biometrics combining dynamic voice and face identification

Schedule of relevant Milestones

Milestone number [18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification

Work package number [9]	WP10	**Lead beneficiary** [10]	1 - OT
Work package title	Management		
Start month	1	**End month**	36

Objectives

To carry out the management, co-ordination and reporting activities necessary to:
• Implement the project management principles described in the Project Management section
• Ensure effective implementation of the project in line with guidelines from the Commission, the Project Contract and the Consortium Agreement

Description of work and role of partners

WP10 - Management [Months: 1-36]
OT, HB, SIV, INSP, EYE, FNET, IFIN , FORTH, UCL, TSP
This work package covers the activities of the Project Coordinator (OT) in managing the consortium. Management activities must be adapted to the needs of the project as it evolves, but will include at least:
• Organize communication between the Consortium and the Commission concerning project progress and execution of the Contract.
• Set up and run financial accounting and budget reporting processes within the Consortium, and between the Consortium and the Commission.
• Coordinate progress reporting within the Consortium by Work package Leaders, and between the Coordinator and the Commission (see D10.1– D10.3).
• Monitor the progress of individual work packages, in terms of production of deliverables according to schedule, and other key indicators of progress.
• Continuously monitor significant project risks: identify, assess probability and consequences, and devise mitigation strategies.
• Deal with any conflicts which may arise between project participants (in accordance with the principles defined in the Project Management section
• Propose any modifications in the project plan which might be necessary in the light of experience in actually running the project, or due to factors external to the project. Carry out the formal steps needed to obtain approval by Consortium members and the Commission.
• Constitute and run the project management bodies defined in the Project Management section
• Organize and run Project Reviews.
• Monitor and ensure the gender balance in the consortium
• Ensure compliance with, and manage any changes to, the Consortium Agreement.
OT will be the primary contributor (and leader) of this work package and be responsible for producing the periodic reports and final report. OT will also be in charge of developing the project quality handbook. All other partners will allocate at least 1PM to the management activities required.

Participation per Partner

Partner number and short name	WP10 effort
1 - OT	24.00
2 - HB	1.50
3 - SIV	1.50
4 - INSP	1.50
5 - EYE	1.50
6 - FNET	1.50
7 - IFIN	1.50

Partner number and short name	WP10 effort
8 - FORTH	1.50
9 - UCL	1.50
10 - TSP	1.50
Total	37.50

List of deliverables

Deliverable Number [14]	Deliverable Title	Lead beneficiary	Type [15]	Dissemination level [16]	Due Date (in months) [17]
D10.1	First Periodic Report	1 - OT	Report	Confidential, only for members of the consortium (including the Commission Services)	18
D10.2	Second Periodic Report	1 - OT	Report	Confidential, only for members of the consortium (including the Commission Services)	36
D10.3	Final (Public) Report	1 - OT	Report	Public	36
D10.4	Project Quality Handbook	1 - OT	Report	Confidential, only for members of the consortium (including the Commission Services)	3
D10.5	First Ethics Periodic Report	1 - OT	Report	Confidential, only for members of the consortium (including the Commission Services)	18
D10.6	Second Ethic periodic report	1 - OT	Report	Confidential, only for members of the consortium (including the Commission Services)	36

Description of deliverables

D10.1 First Periodic Report Lead OT Contributors All partners D10.2 Second Periodic Report Lead OT Contributors All partners D10.3 Final (Public) Report Lead OT Contributors All partners D10.4 Project Quality Handbook Lead OT Contributors All partners D10.5 First Ethic Periodic Report Lead OT Contributors All partners D10.6 Second Ethic Periodic Report Lead OT Contributors All partners

D10.1 : First Periodic Report [18]

Monitor the progress of individual work packages, in terms of production of deliverables according to schedule, and other key indicators of progress

D10.2 : Second Periodic Report [36]

Monitor the progress of individual work packages, in terms of production of deliverables according to schedule, and other key indicators of progress.

D10.3 : Final (Public) Report [36]

Report communication between the Consortium and the Commission concerning project progress and execution of the Contract, financial accounting within the Consortium, and between the Consortium and the Commission. progress reporting within the Consortium by Work package.

D10.4 : Project Quality Handbook [3]

This handbook defines “quality” in the delivery of SpeechXRay project and provides clear consistent guidance on how “quality” project delivery is achieved

D10.5 : First Ethics Periodic Report [18]

First periodic report from the Ethic advisor of the consortium regarding the ethical concerns involved in this research.

D10.6 : Second Ethic periodic report [36]

Second periodic report from the Ethic advisor of the consortium regarding the ethical concerns involved in this research.

Schedule of relevant Milestones

Milestone number [18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification

1.3.4. WT4 List of milestones

Milestone number [18]	Milestone title	WP number [9]	Lead beneficiary	Due Date (in months) [17]	Means of verification
MS1	Use cases ready	WP1	3 - SIV	6	All use cases documented
MS2	Core modules ready	WP2, WP3	2 - HB	14	Biometrics module ready and validated.
MS3	Solution ready	WP4, WP5, WP6	3 - SIV	24	All components ready. Solution integration complete. Solution ready for trial deployment
MS4	Pilots completed	WP7	9 - UCL	36	All pilots and evaluation reports completed

1.3.5. WT5 Critical Implementation risks and mitigation actions

Risk number	Description of risk	WP Number	Proposed risk-mitigation measures
R1	A pilot is not completed, because of lack of resources and/or personnel changes at a project partner.	WP6	The coordinator will use the mechanisms described in section 2.1.8 and raise the issue urgently with the management in the partner organization, as losing one of the industrial pilot projects may decrease the quality of the outcome of the project. If no alternative pilot can be found within the company, in consultation with the commission, the consortium will consider whether a replacement partner (and pilot) can be sought
R2	A research, industrial or software development partner exits the consortium.	WP10	As the consortium was carefully assembled to represent complementary skills and expertise, exit of one of the partners would be a serious setback. Project management will undertake immediate acquisition actions to find a replacement partner. Potential candidates have been already been discussed as part of contingency planning.
R3	Insufficient performance of voice acoustic-driven recognition models	WP2	If the voice acoustic-driven models do not deliver the performance observed in the lab, they will be complemented by classical statistical methods (e.g. GMM) and possibly, text-dependent approaches. The combination of acoustic-driven and classical methods will still deliver marked improvements, notably in terms of usability (low sensitivity to surrounding noise).
R4	The results of the demonstrators are not as previously envisioned.	WP6	The requirements established early in the project should provide guidance on biometrics implementation strategy. The development of the

Risk number	Description of risk	WP Number	Proposed risk-mitigation measures
			pilots will be monitored throughout the project to ensure that decisions that may have a negative impact on the project outcome are registered and discussed, and where possible, amended.
R5	Solution too complex to be scaled up in real-life settings. This would severely limit the uptake of the project's results.	WP6, WP7, WP8	The partners will monitor the development of the platform continuously, to detect industrialization problems in an early phase. The experience of the partners X and Y with the development of successful commercial solutions will minimize this risk.
R6	Launch of a similar concept by third parties	WP9	The project partners are well networked and will be aware of similar developments in time to discuss potential collaboration or explore other synergies with third parties. Nevertheless, the partners will continuously screen the market and should an unexpected development occur, will adapt their exploitation plans as needed.

1.3.6. WT6 Summary of project effort in person-months

	WP1	WP2	WP3	WP4	WP5	WP6	WP7	WP8	WP9	WP10	Total Person/Months per Participant
1 - OT	4	22	2	0	4	3	16	24	5	24	104
2 - HB	0	48	18	18	4	0	4	12	3	1.50	108.50
3 - SIV	12	0	0	15	55	9	2	2	0	1.50	96.50
4 - INSP	0	12	35	14	4	0	2	2	0	1.50	70.50
5 - EYE	0	0	0	19	0	0	2	2	0	1.50	24.50
6 - FNET	6	0	5	0	0	17	1	2	0	1.50	32.50
7 - IFIN	4	0	2	0	0	10	1	1	0	1.50	19.50
8 - FORTH	4	0	2	30	4	10	2	2	0	1.50	55.50
9 - UCL	0	14	0	0	0	18	2	2	10	1.50	47.50
10 - TSP	4	14	8	0	0	0	8	2	3	1.50	40.50
Total Person/Months	34	110	72	96	71	67	40	51	21	37.50	599.50

1.3.7. WT7 Tentative schedule of project reviews

Review number [19]	Tentative timing	Planned venue of review	Comments, if any
RV1	20	Brussels	Location to be Confirmed
RV2	36	Brussels	Location to be Confirmed

1.4. Ethics Requirements

Ethics Issue Category	Ethics Requirement Description
HUMANS	- Details of how the 2,000 users will be recruited must be given (e.g. inclusion/exclusion criteria, direct/indirect incentives for participation, information on the risks and benefits for the participants etc.).
HUMANS	- Copies of examples of Informed Consent Forms and Information Sheets must be sent to REA.
OTHER ETHICS ISSUES	- An external independent Ethics advisor must be appointed to oversee the ethical concerns involved in this research. A report by the Ethics advisor should be submitted to the European Commission with the Periodic Reports.
MISUSE	- The applicants must describe how the pilot involving the use of biometric security measures in a nuclear plant will minimize any risks for illegitimate access, either to data or to the plant.
PROTECTION OF PERSONAL DATA	- To cover the pilots involving personal data, copies of ethical approvals by the competent legal local/national Ethics Boards/ Bodies/administrations must be submitted to the REA prior to the commencement of the research.
PROTECTION OF PERSONAL DATA	- Applicants must confirm whether they will use secondary personal data. If so, applicants have to show that the original consent procedure included approval for secondary use or that an ethics committee released the data for such use.
PROTECTION OF PERSONAL DATA	- A Chief Information Security Officer (CISO) must be appointed.

1. Project number

The project number has been assigned by the Commission as the unique identifier for your project. It cannot be changed. The project number **should appear on each page of the grant agreement preparation documents (part A and part B)** to prevent errors during its handling.

2. Project acronym

Use the project acronym as given in the submitted proposal. It can generally not be changed. The same acronym **should appear on each page of the grant agreement preparation documents (part A and part B)** to prevent errors during its handling.

3. Project title

Use the title (preferably no longer than 200 characters) as indicated in the submitted proposal. Minor corrections are possible if agreed during the preparation of the grant agreement.

4. Starting date

Unless a specific (fixed) starting date is duly justified and agreed upon during the preparation of the Grant Agreement, the project will start on the first day of the month following the entry into force of the Grant Agreement (NB : entry into force = signature by the Commission). Please note that if a fixed starting date is used, you will be required to provide a written justification.

5. Duration

Insert the duration of the project in full months.

6. Call (part) identifier

The Call (part) identifier is the reference number given in the call or part of the call you were addressing, as indicated in the publication of the call in the Official Journal of the European Union. You have to use the identifier given by the Commission in the letter inviting to prepare the grant agreement.

7. Abstract

8. Project Entry Month

The month at which the participant joined the consortium, month 1 marking the start date of the project, and all other start dates being relative to this start date.

9. Work Package number

Work package number: WP1, WP2, WP3, ..., WPn

10. Lead beneficiary

This must be one of the beneficiaries in the grant (not a third party) - Number of the beneficiary leading the work in this work package

11. Person-months per work package

The total number of person-months allocated to each work package.

12. Start month

Relative start date for the work in the specific work packages, month 1 marking the start date of the project, and all other start dates being relative to this start date.

13. End month

Relative end date, month 1 marking the start date of the project, and all end dates being relative to this start date.

14. Deliverable number

Deliverable numbers: D1 - Dn

15. Type

Please indicate the type of the deliverable using one of the following codes:

R	Document, report
DEM	Demonstrator, pilot, prototype
DEC	Websites, patent fillings, videos, etc.
OTHER	

16. Dissemination level

Please indicate the dissemination level using one of the following codes:

PU	Public

CO Confidential, only for members of the consortium (including the Commission Services)
CI Classified, as referred to in Commission Decision 2001/844/EC

17. Delivery date for Deliverable

Month in which the deliverables will be available, month 1 marking the start date of the project, and all delivery dates being relative to this start date.

18. Milestone number

Milestone number:MS1, MS2, ..., MSn

19. Review number

Review number: RV1, RV2, ..., RVn

20. Installation Number

Number progressively the installations of a same infrastructure. An installation is a part of an infrastructure that could be used independently from the rest.

21. Installation country

Code of the country where the installation is located or IO if the access provider (the beneficiary or linked third party) is an international organization, an ERIC or a similar legal entity.

22. Type of access

VA if virtual access,
TA-uc if trans-national access with access costs declared on the basis of unit cost,
TA-ac if trans-national access with access costs declared as actual costs, and
TA-cb if trans-national access with access costs declared as a combination of actual costs and costs on the basis of unit cost.

23. Access costs

Cost of the access provided under the project. For virtual access fill only the second column. For trans-national access fill one of the two columns or both according to the way access costs are declared. Trans-national access costs on the basis of unit cost will result from the unit cost by the quantity of access to be provided.

HISTORY

Document version #	Date (yyyy/mm/dd)	Remarks
v1.0	2015/03/16	First ever submitted document

Terminology and Abbreviations

To aid readability, we have we have followed a policy of providing an expansion of acronyms at many places in the body of the text. But there is a small set of key terms & concepts that are central to the understanding of the project. We provide an explanation of these here, for the benefit of readers who may be unfamiliar with them.

Term/abbreviation	Explanation
FAR (False Acceptance Rate)	The FAR is the probability that the system incorrectly matches the input pattern to a non-matching template in the database (random imposture). A low FAR will increase the level of security of the authentication mechanism.
FRR (False Rejection Rate)	The FRR is the probability that the system fails to detect a match between the input pattern and a matching template in the database. A low FRR will increase the convenience of the authentication mechanism (reducing authentication attempts).
ROC (Receiver Operating Characteristic)	The ROC plot is a visual characterization of the trade-off between the FAR and the FRR. The matching algorithm performs a decision based on a threshold which determines how close to a template the input needs to be for it to be considered a match. If the threshold is reduced, there will be fewer false non-matches but more false accepts. Conversely, a higher threshold will reduce the FAR but increase the FRR. This means that the FAR/FRR trade-off can be modified for a given system.
EER (Equal Error Rate)	The EER is the rate at which both acceptance and rejection errors are equal, as obtained from the ROC curve. The EER is a quick way to compare the accuracy of devices with different ROC curves (better systems have lower EERs)

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1. Excellence

1.1 Objectives

There are several biometric modalities that may be used for access control purposes. Low cost solutions based on existing embedded sensors (camera-based face recognition) are now provided as standard features of laptops and smartphones but their accuracy is low.

New sensors (fingerprint readers) can be embedded in laptops and smartphones, however they generate additional costs (as they are only used for identification purposes). Iris recognition is a promising technology as it is extremely accurate and is not sensitive to ageing, however it is not easily applicable to mobile devices (all publicly deployed iris recognition systems acquire images of an iris in the near infrared wavelength band of the electromagnetic spectrum and cannot use standard cameras). Worse, all these systems (fingerprint, face, and iris) can be spoofed by fake biometrics as simple as high resolution colour printouts[2].

The SpeechXRays project will **develop** and **test** in real-life environments a user recognition platform based on voice acoustics analysis and audio-visual identity verification. SpeechXRays will **outperform** state-of-the-art solutions in the following areas:

- **Security**: high accuracy solution (cross over accuracy[1] of 1/100 i.e. twice the commercial voice/face solutions)
- **Privacy**: biometric data stored in the device (or in a private cloud under the responsibility of the data subject)
- **Usability**: text-independent speaker identification (no pass phrase), low sensitivity to surrounding noise
- **Cost-efficiency:** use of standard embedded microphone and cameras (smartphones, laptops)

The most convenient and cost-effective biometric modality is voice, which can be easily captured on a mobile device using its embedded microphone. Voice is noise robust to the human ear. However, today's commercial solutions in voice biometrics fail to deliver the required accuracy levels and are very sensitive to ambient noise, because they rely mostly on machine learning techniques employing statistical analysis and, unlike the human ear, do not consider the acoustic correlates of voice quality. At the 2014 NIST i-vector challenge, the best system performance had a cross-over accuracy of 3%[3], which is not sufficient enough to warrant market adoption.

In order to overcome these limitations, the project will combine and pilot two proven techniques: acoustic driven voice recognition (using acoustic rather than statistical only models) and multi-channel biometrics incorporating dynamic face recognition (machine vision analysis of speech, lip movement and face).

	Accuracy	Spoofing	Convenience	Cost	Sensor size
Fingerprint (capacitive)	4	3	**5**	4	**5**
Fingerprint (optical)	**5**	4	**5**	4	4
Voice	1	3	**5**	**5**	**5**
Face	2	2	3	4	3
Hand	3	4	3	2	2
Iris	**5**	3	2	3	3
SpeechXRays	**5**	**5**	**5**	**5**	**5**

Table 1: Performance comparison of various biometric solutions[4]

[1] The crossover accuracy (also called equal error rate or EER) is the rate at which both acceptance and rejection errors are equal. In currently available commercial system, it is typically around 1/50 for voice recognition, 1/500 for fingerprint recognition and 1/100,000 for iris scan recognition.

[2] Pradnya M. Shende et al (2014). A Survey Based on Fingerprint, Face and Iris Biometric Recognition System, Image Quality Assessment and Fake Biometric. Int. Journal of Computer Science Engineering and Technology (IJCSET) Vol 4, Issue 4,129-132

[3] Greenberg C. S et al., (2014), The NIST 2014 Speaker Recognition i-Vector Machine Learning Challenge, Odyssey 2014, The speaker and language recognition workshop, June 2014, Finland

[4] Data compiled from the evaluation of available commercial systems, on a scale 1 to 5 (5 is the lowest cost and highest accuracy whereas 1 is the highest cost and lowest accuracy). Not that iris recognition accuracy is of an order of magnitude superior to fingerprint recognition, however both are scored at 5 in this table for simplification purposes.

In short, the ambition of the SpeechXRays project is to provide a solution combining the convenience and cost-effectiveness of voice biometrics, achieving better accuracies by combining it with video, and bringing superior anti-spoofing capabilities.

The project's objectives have been structured in 4 key areas (Table 2).

Objective 1: Develop and test a cost effective, convenient, privacy preserving multimodal biometrics solution based on acoustic and machine vision analysis of speech, lip movement and face		
1.1	Acoustic driven voice analysis	Combine acoustic analysis of the speech spectrogram with classical statistical analysis of the soundwave patterns.
1.2	Audio-visual identification	Combine several biometric modalities: speech, face and synchrony between speech and lips movements
Objective 2: Implement the novel biometrics solution in a broadband network, giving access to smart services running over networks with state-of-the-art security, avoiding single points of failure		
2.1	Corporate use case	Demonstrate a secure information sharing network for corporate users requiring a high level of security, based on the requirement of IFIN-HH[5]
2.2	eHealth use case	Apply the solution to the requirement of hospitals providing telemedicine services, based on the requirement of Greek hospitals recruited by FORTH
2.3	Consumer use case	Apply the solution to the requirement of consumers, based on the requirement of user groups recruited by FNET and OT
Objective 3: Guarantee interoperability and portability between systems and services		
3.1	Text-independency	Compare both text dependent (based on statistical models) and text independent (based on acoustic analysis) solutions.
3.2	Device- and network independency	Develop the client-side implementation of the solution using cross-platform technologies such as HTML5 and network-independent protocols such as SOAP or REST.
3.3	Standard compatibility	Apply existing standards such as ISO/IEC 19784-1 (BioAPI), NIST SP500-288 (WS-BD protocol) and OASIS BIAS SOAP Profile to audio-visual identification
Objective 4: Develop a vibrant application and service ecosystem		
4.1	User community	Stimulate the uptake of the solution by internet and telecom service providers by delivering high quality dissemination and training material, and organizing dedicated workshops
4.2	Developer community	Stimulate the uptake of the solution by application developers by delivering a high quality development SDK, and organizing application development contests
4.3	Hacking contest	Establish credibility by challenging the developer community to try to hack or spoof the solution

Table 2: Project specific objectives

Table 3 present the project key performance indicators (KPIs) supporting the project objectives, that will be assessed at 3 different points in time: M12 (start of the demonstrators), M24 (at mid-point of the demonstrators) and M36 (end of project).

[5] IFIN-HH, the Romanian Institute of Physics and Nuclear Engineering, handles sensitive research data related to nuclear physics and is engaged in strategic science on behalf of national security.

Objectives				Project KPI	M12	M24	M36	WPs
1	2	3	4					
X				False Reject Rate	10%	5%	2%	WP2
X				False Acceptance Rate[6]	5%	2%	0.5%	WP2
X				Equal Error Rate (cross over accuracy)	1/50	1/75	1/100	WP2
X	X			Sensitivity to surrounding noise	medium	low	low	WP2 WP4
X	X			Sensitivity to individual variations (sickness, ageing, stress)	medium	low	low	WP2 WP4
X			X	Resistance to spoofing	partial	high	high	WP2 WP3
X			X	User convenience[7] (scale 1-5)	3	4	5	WP4 WP6
X			X	Compliance with Data Protection Directive (Directive 95/46/EC)	partial	full	full	WP4
		X		Demonstration of cross-platform compatibility	Android	Android +iOS	Android +iOS +Win8	WP2 WP5
		X		Demonstration of standard compatibility	ISO/IEC 19784-	OASIS BIAS SOAP Profile	NIST SP500-288	WP5 WP9
	X		X	Number of pilot users	50	500	2000	WP6
			X	Number of developers in the ecosystem	0	5	20	WP7
			X	Number of pilot service providers	1	2	5	WP8

Table 3: Project output indicators in relation to project timeline

1.2 Relation to the Work Programme

Table 4 describes how the project contributes to the DS-02 topics and the Secure Societies Work Programme.

DS-02 Topic	Contribution of the Project
The focus is on the development and testing of usable, economic and privacy preserving access control platforms based on the use of biometrics, smart cards, or other devices	The project is focusing on the use of multi-channel biometrics for access control purpose. The choice of audio-visual analysis to perform identity verification can deliver high usability and low cost (based on the use of standard cameras embedded in smartphones, tablets and laptops).
The solutions are to be installed and tested in a broad-band network, giving access to smart services running over networks with state-of-the-art security, avoiding single points of failure	The project will test the solution in 3 real-life use cases requiring various degrees of security: consumer use case (low security), eHealth use case (medium security) and workforce use case (high security). All scenarios will demonstrate an authentication over a secure broadband network giving access to specific services.

[6] Assuming random impostures and not spoofing attempts

[7] Measured by surveying the pilot end-users before, during and after the pilot, taking in account easiness of use, the identification speed and overall user experience

Proposed work should include the management of the access rights in particular for the service providers, ensure the security and privacy of the databases, facilitate a timely breach notification and remediation to the user, and reduce the insider threat.	The project will implement privacy-preserving mechanisms in order to protect the biometric templates, which will be stored encrypted in the mobile device. The solution will include the possibility to revocate biometric templates when spoofing attempts are detected. The solution will also recognize user emotions such as fear (to prevent authentication under duress).
The proposed solutions have to guarantee interoperability and portability between systems and services, sparing the user to have to install a platform, service or country specific technology.	The solution will follow a hybrid architecture combining a native container (for local encrypted of the biometric template) and HTML5 user interfaces (for greater cross-portability across operating systems). The native container can be downloaded from a public app store and will not require any other software installation. The voice biometrics component will be text-independent and therefore language-agnostic.
Proposed work could assist the objective of implementing a secure information sharing network.	The project will implement a secure information network in two of the three use cases: in the workforce scenario, IFIN-HH staff performing research in sensitive fields of research (e.g. nuclear physics) will use the biometrics solution to access a secure information repository; in the eHealth scenario, patients affected by osteoarthritis and medical specialists will be able to interact via a secure collaborative eHealth space.

Secure Societies Work Programme	**Contribution of the Project**
The call will focus on demonstrating the viability and maturity of state-of-the-art security, privacy and trust solutions that have been tested in a laboratory environment. The intention is that after this validation phase they will find a wide up take in the market.	The project takes biometrics modalities (acoustics-driven voice biometrics, audio-visual analysis, privacy frameworks) that have been tested in the lab, and combine them in a robust, low cost, user friendly multi-channel biometrics solution. The biometrics modalities have been chosen for their low cost and high market acceptance potential.
Proving that the security concepts, processes and solutions work in a real life environment, in large scale demonstrators and directly involving end users who would ultimately benefit the most from the outcome, should increase the prospects for an ICT security market and demonstrate the validity and effectiveness of security.	The solution will be validated by industrial partners in large-scale (2000+) real life use cases in order to prepare a solution market launch after the end of the project. The project will demonstrate high accuracy solution (cross over accuracy of 1/100 or more, i.e. twice the commercial voice/face solution)
This call addresses the technology to secure the infrastructure (e.g. networks), hardware (e.g. access devices), services (e.g. cloud computing), components (e.g. RFID), software (e.g. operating systems, web-browsers), etc… against accidental or malevolent use.	The technology developed in the project is versatile and can be used to provide secure access to networks as well as physical locations (the workforce use case will include a physical access control demonstration). The technology is designed to be portable across a wide range of operating systems: the portability will be demonstrated on iOS, Android and Windows.
As cybersecurity is cross-domain the call will provide cybersecurity whatever the application or domain (mobile, eCommerce…), or societal challenge (e.g. health, energy, smart cities …).	The use case scenarios have been selected to cover a wide range of societal challenges: consumer use case (ICT/networks), eHealth use case (health), workforce use case (energy research)

Table 4: Project relation to the Work Programme topic

1.3 Concept and approach

1.3.1 Overall concept

The SpeechXRays project applies biometric processes (Figure 1) to audio-visual information captured from the user, as follows:

- Enrolment: audio-visual biometric information from an individual is captured, processed and stored as a biometric template. In subsequent uses, biometric information is captured and compared with the biometric template. SpeechXRays enables convenient enrolment via a smartphone, tablet or laptop equipped with a standard camera.
- Biometric verification mode: one-to-one comparison of the captured biometric sample with a stored biometric template (or model) to verify that the individual is who he claims to be. The result of verification is a yes / no response. SpeechXRays enables robust speaker verification capabilities based on audio-visual information analysis. The generic term of recognition (meaning verification or identification[8]) is also used in this document.
- Authentication: in addition to verifying the identity of a person based on his credentials (such as biometrics or password based), a secure session is opened between the two parties (generally a client and a server). SpeechXRays enables the authentication of a user via a smartphone, tablet or laptop equipped with a standard camera, in order to access specific resources over a wireless broadband network.
- Revocation: ability to cancel specific credentials. SpeechXRays can remediate security issues such as template leakage, spoofing attempts, etc. by cancelling credentials that are deemed at risk.

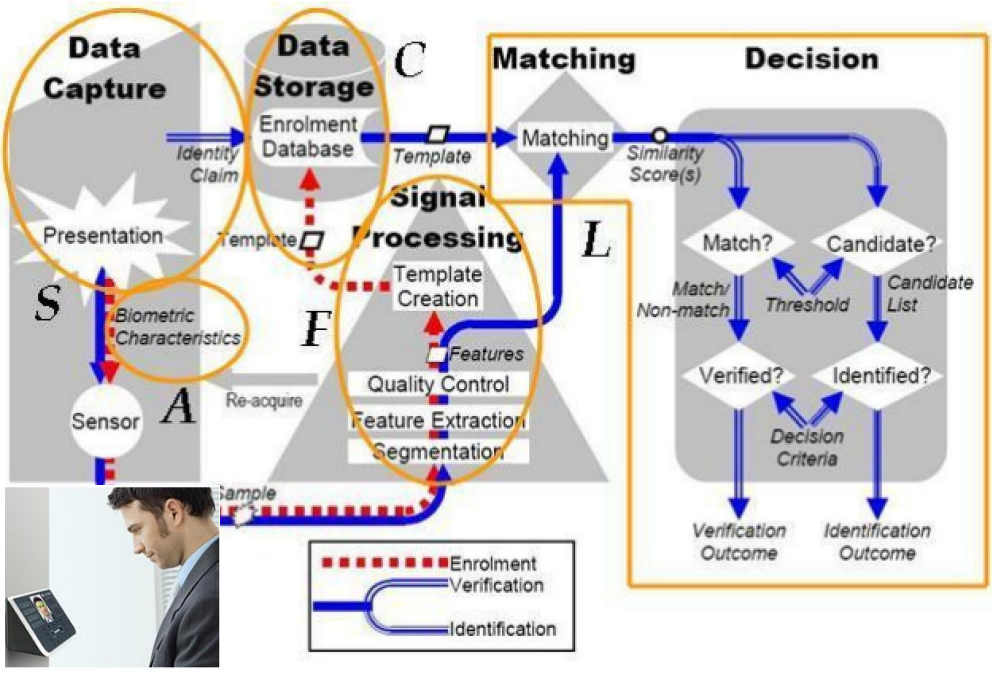


Figure 1: Biometrics Processes

The consortium created for this 36 month project assembles inter-disciplinary skills from 5 industrial/SME partners and 4 research/academic organizations. Please refer to section 3.3 for the consortium as whole and section 4 for partner descriptions.

[8] The biometric identification mode is a one-to-many comparison of the captured biometric sample against a biometric database in an attempt to identify an unknown individual. The result of identification in the closed-set scenario the identity of a user; in an open-set identification scenario the result is either the most probable identity of the identification set, or an probable identity outside this set. SpeechXRays is not focusing on speaker identification, although the technology could be used for law enforcement purposes as part of the (post-project) exploitation activities.

1.3.2 Main project results in relation to Technology Readiness Levels

The project addresses the so-called "implementation gap" (Table 5) between research projects (TRL 1-4) and industrial applications (TRL 9). This bridge requires new styles of consortiums with a strong focus on applied interdisciplinary research, industry-driven requirement (pull) and knowledge/technology transfer.

The results are categorized in 5 main groups:

- A set of algorithms/methods for voice analysis, face analysis and audio-visual analysis
- A security and privacy framework applied to voice/face biometrics
- An end-to-end speaker verification solution, including enrolment, authentication, revocation
- A set of applications implemented in 3 real-life scenarios
- A development environment allowing third party developers to build new applications and service on top of the end to end speaker verification solution (and the related developer ecosystem)

Technical results in relation to the TRLs	Project start	Project end
Voice analysis (acoustic-driven) algorithms	5	8
Face analysis algorithms	6	8
Audio-visual analysis (lip movement) algorithms	5	8
Security framework	7	8
Privacy framework	6	8
End-to-end biometrics solution (including applications and development environment)	5	8

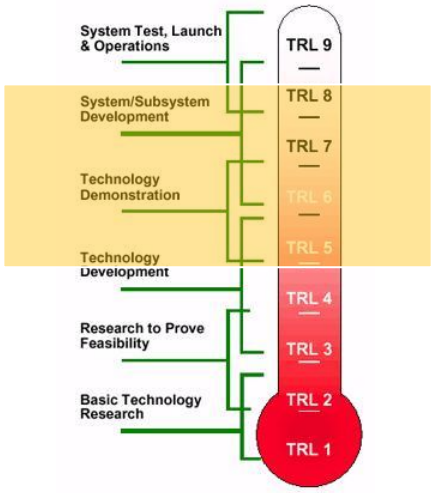


Table 5: Project focus in relation to Technology Readiness Levels (TRLs)

1.3.3 Linked research & innovation activities

Listed below are national and international research projects where there are already concrete opportunities for synergy, or adoption of project results, because of existing contacts from the consortium.

- BEAT is a Collaborative Project under FP7-SEC (2012-2014) that aims to propose a framework of standard operational evaluations for biometric technologies. This will be achieved by (1) developing an online and open platform to transparently and independently evaluate biometric systems against validated benchmarks, (2) designing protocols and tools for vulnerability analysis, and (3) developing standardization documents for Common Criteria evaluations. **TSP will interface with the BEAT project so the BEAT framework can be used to assess the standard operational characteristics of the SpeechXRays solution.** TSP will combine the achievements of the BioSecure NoE (listed below) with the BEAT and other EU projects. This will allow to re-use already developed and funded work.
- SIIP is a Collaborative Project under FP7-SEC (2014-2018) that aims to develop a break-through Suspect Identification (SI) solution based on a novel SI engine fusing multiple speech analytic algorithms (e.g. voiceprints recognition, Gender/Age/Language/Accent ID, Keyword/ Taxonomy spotting and Voice cloning detection). This Fused Speaker Identification will result in significantly higher true-positive speaker identification, reduced False-Positives/Negatives while increasing reliability and confidence. **HB will interface with the SIIP project in order to understand which of the speech analytic algorithms could be used (if any) in the SpeechXRays project.**
- Tabularasa was a Collaborative Project under FP7-ICT (2010-2013) analysing the effectiveness of direct attacks to a range of biometrics, thus providing an insight as to how vulnerable the different biometric traits are to these attacks. The first line of work proposed to combine multiple biometric traits to build a single

system that is robust to direct attacks and the second line of work proposed to examine novel methods to perform aliveness detection. Finally, novel biometrics which might be inherently robust to direct attacks, such as gait (the manner in which someone walks), vein or electro-physiological signals (such as the heart beat) were explored to determine their advantages and limitations. **HB and TSP will review the output of the Tabularasa project in order to improve the resistance of the SpeechXRays solution to spoofing.**

- MOBIO was a Collaborative Project under FP7-ICT (2008-2010) that aimed to study, develop and evaluate bi-modal (face and voice) biometric technologies in the context of portable and networked devices. The project carried out research on joint bi-modal biometry under various realistic conditions and investigated the following technologies: robust face localisation and speech segmentation in noisy environments, video-based face authentication (in order to avoid replay attacks using pictures of the face we should perform face authentication over the video), speaker authentication, bi-modal authentication (both expert fusion and joint face/speaker authentication to take full advantage of the correlation between modalities) and unsupervised model adaptation thought time. **TSP has already worked with the MOBIO database and protocols, and will evaluate the project speech and face algorithms on this database.** For example, TSP participated to the ICB-2013 speaker challenge on the MOBIO data and obtained the best results with a single system on female speech data.
- BioSecure was a Network of Excellence **led by TSP** under FP6 (2004-2007) providing the biometric R&D community with resources such as evaluation platforms including databases, reference systems (baseline algorithms), assessment protocols for 8 well-established modalities (fingerprints, iris, dynamic signature, hand shape, speech, 2D face, 3D face, and talking faces), educational material (repository of texts and presentations related to different assets of biometrics) and handbook on standards and a guide to biometric reference systems and performance evaluation[9]. **TSP will re-use the NoE resources** as part of the dissemination activities of WP7, in order to stimulate the SpeechXRays ecosystem development.
- SecurePhone was a Collaborative Project under FP6-IST (2002-2004) developing a new mobile communication system (the "SecurePhone") enabling biometrically authenticated users to deal m-contracts during a mobile phone call in an easy yet highly dependable and secure way. SecurePhone's biometric recogniser was based on an original combination of non-intrusive, psychologically-neutral biometric methods such as audio-visual and handwritten signature identification techniques. **TSP was a partner** in Securephone and will share the lessons learned from this early project.

More projects (currently about to start but not public yet) will be identified as part of the WP7 activities.

1.3.4 Methodology

The project will take a new scientific approach to voice biometrics by applying the scientific basis of human voice physiology, which produces precise acoustic cues of perceptual salience unique to each individual speaker. The precise vocal tract physiology is directly derived from the feature analysis of the speech spectrogram. The scientific basis that is the foundation of this project is based upon the modelling techniques of human voice quality and characteristics that emulate the manner in which the human auditory system identifies a speaker's voice. The project will model these acoustic cues of the voice physiology and detects them in the first pass of a speaker (voice) authentication system in a deterministic discrete time signal processing architecture.

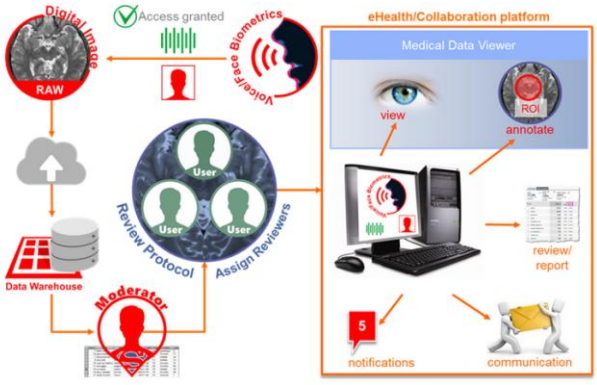
In addition, multi-channel biometrics will further enhance the system's performance. Just like the human being uses all of his or her senses in combination to identify an individual, the project uses multi-channel biometrics to improve the accuracy of human identity performance. The solution will combine voice acoustic analysis with dynamic face recognition (including lip movement and facial analysis)

The technology will be combined into a solution capable of running the speaker recognition process

- either locally on the device (cancellable biometric template created by binding keys with biometric data and securely stored on the device for example on the SIM card)
- or remotely, via a secure cloud connection (cancellable biometric template securely stored on a private cloud under the responsibility of the data subject and not on the service provider's servers)

The technology will be piloted in 3 real-life use case scenarios on 2000 users (Table 6

[9] Guide to Biometric Reference Systems and Performance Evaluation; Publisher Springer-Verlag, London, p. 1-394, 2009.

Workforce Pilot	
Location	Horia Hulubei National Institute of Physics and Nuclear Engineering, Bucharest, Romania (IFIN)
Users	**689** researchers and Ph.D. students
Description	Scientists working on sensitive nuclear research projects will be able to access the secure information repository of the institute via remote biometrics-based identification through their mobile device. In addition, physical access to the research facility will be tested using the same biometrics-based identification. The multi-channel biometrics system will be implemented on mobile devices (such as smartphones, tablets and laptops) used to access sensitive data over 3G/4G and WLAN and on-site, on the premises of IFIN-HH, at an access point to one of the data centres. All mobile equipment used for authentication will first be tested for compatibility with the access system (e.g. sufficient quality of sound and video recordings) and all approved equipment will be registered on the access platform. Repeated inconclusive biometrics results the platform will have a user-blocking mechanism. The on-site access system will implement most of the features of its mobile sibling plus an additional set of protection measures. These extra security measures are enforced to ensure the physical protection of the hardware infrastructure of IFIN-HH and rely on consolidating the above biometrics information with data obtained from the proximity cards (needed to enter the premises of IFIN-HH and each separate building), the perimetral video surveillance system (which can signal, for instance, unusual activities outside the standard working hours), and the Romanian Gendarmerie Detachment which monitors the compound. For repeated negative and/or inconclusive biometrics results the access system should be able to send warning the Gendarmerie Detachment and lock-down the building where the fraudulent entry was forced (e.g., by automatically cancelling the proximity card of the user and blocking all doors). Similarly, in case of hardware failures of the perimetral video surveillance system and that of the proximity cards, both of them constantly monitored by the Gendarmerie Detachment located in the compound, the on-site access system should be automatically/manually blocked.
Focus	This scenario will test the level of security, threat remediation and adaptability of the solution to various application (online access, physical perimeter access)
e-Health Pilot	
Location	3 Greek hospitals working with FORTH and their patients
Users	**400** medical specialist and patients
Description	Patients and doctors will use the remote biometrics solution to access a collaboration platform developed by FORTH to support the prevention and management of a chronic condition (osteoarthritis). Patients will be able to remotely and securely report health data such as activity level, pain, etc. while general practitioners and specialists will be able to access the patient journals for decision-support.  Osteoarthritis is a disabling degenerative joint disease leading to joint pain, stiffness and loss of function predominantly in the knees, hips, hands, and spine that can partially overcome by losing weight and by exercising. Many of the patients have reduced mobility and may live in remote rural areas in Greece. Therefore, they need to exchange remotely information about their health

	status and level of physical activity, in order for their general practitioner to provide a personalized chronic disease management program. Osteoarthritis management requires interactive multi-scale visualization of heterogeneous data (medical imaging such as MRI/CT scans, physical reports) where different experts visualize the complete data as an ensemble and to navigate between the individual datasets, changing spatial and temporal scale as required, and provide feedback and consultation. Therefore, various medical experts need to access sensitive patient data on their own devices (laptop or tablet).
Focus	This scenario will test the security, privacy, usability and cost-effective features of the security platform. In particular, the scenario will test the context-dependent feature that allows administrators to modify the FAR/FRR trade-off in order to reduce the risk of false reject for low security data (e.g. physical examination) and reduce the risk of false accept for high security data (e.g. MRI/CT scans).
e-Health Pilot	
Location	A triple play internet service provider (FNET) serving customers all around Greece
Users	**1000** customers of FNET
Description	Customers will be able to access e-billing information, user profiling information, user accounts using an authorization service based on remote biometrics-based identification through a secure cloud connection. User of this trial scenario is to demonstrate the use of system in a consumer environment. Such an environment is typically very demanding since it involves interaction with users that are not accustomed to the provided interface while at the same time it provides a very good indication of the system's usability in a real world setting. In this particular scenario the user verification system developed in the project will be used to enhance the user experience of FNET's customers, while accessing information and services offered by the company. Such services may involve e-billing information, user profiling information, access to the user's account, etc. Users from a selected consumer base, instead of following the typical access control procedure, will be able to use an authorization service based on remote biometrics-based identification through a secure cloud connection. The motivation for using a biometrics-based user identification system in this scenario is twofold: • To provide access control to restricted information through a natural and unobtrusive way. As with other biometric-based approaches, SpeechXRays verification may replace or augment PINs and passwords with something that cannot be forgotten lost or stolen. • To improve user experience by personalizing each user session. Most of FNET's triple play solutions target consumer households (broadband internet based on ADSL technology and PayTV services mainly SAT but OTT as well). The authentication of such services is performed at the router and STB level and not at the individual one. Part of the company's strategic planning involves developing the infrastructure to enable it to target the individual members of each household that use its services. The goal is to be able to provide recommendations and suggestions based on an individual's habits, behaviour, and lifestyle or automatically adjust the interaction device (Web interface, set-top-box, mobile phone) to the user's unique preferences (e.g. enforcing parental control settings).
Focus	This scenario will test ease of use, performance, security and the ability to target the actual user(s) of FNET services. While security is typically the primary consideration when incorporating user recognition technology, in this particular scenario security is necessary but is not as crucial as convenience or ease of use.

Table 6: SpeechXRays pilots

1.3.5 Sex/gender analysis

Base on the biometric technology used in the project (face and voice analysis), the consortium has not identified any sex/gender-related issues related to the type of activities to be carried out, the resulting technology and its potential applications. However, in carrying out the project activities, the consortium will promote gender equality. The project is committed to the strategy of European Commission for equal promotion of women and men.

The SpeechXRays project addresses the cybersecurity sector where the low percentage of women in boardroom or leading positions has been identified as problematic in both academia and industry. The consortium pledges to follow the European strategy for gender equality for getting more women into the labour market and into high decision-making positions.

Specifically, the consortium will include women as technology end-users in leading positions in the demonstrators, as scientists involved in leading research and as prominent speakers actively involved in project dissemination (for example Dijana Petrovska as leading anti-spoofing expert).

Finally, women and men differ in their needs for and experience with technology. Therefore, it is important to include both women and men in technology considerations. Analysing sex and gender as well as including both female and male users in technology development is a planned action of this project that can lead to better designs and improved marketability of SpeechXRays solutions.

1.4 Ambition

Speaker or voice recognition is a biometric modality that uses an individual's voice for recognition purposes. It is a different technology than "speech recognition", which recognizes words as they are articulated. The speaker recognition process relies on features influenced by both the physical structure of an individual's vocal tract and the behavioural characteristics of the individual.

A popular choice for remote authentication due to the availability of devices for collecting speech samples (e.g., telephone network and computer microphones) and its ease of integration, speaker recognition is different from some other biometric methods in that speech samples are captured dynamically or over a period of time, such as a few seconds. Analysis occurs on a model in which changes over time are monitored, which is similar to other behavioural biometrics such as dynamic signature, gait, and keystroke recognition.

Speaker recognition has co-evolved with the technologies of speech recognition and speech synthesis because of the similar characteristics and challenges associated with each. In 1960, Gunnar Fant published a model[10] describing the physiological components of acoustic speech production, based on the analysis of x-rays of individuals making specified phonic sounds (which incidentally provided the inspiration for the project name). In 1969, Dr. Joseph Perkell used motion x-rays[11] and included the tongue and jaw to expand upon the Fant model.

Original speaker recognition systems used the average output of several analogue filters to perform matching, often with the aid of humans "in the loop". In 1976, Texas Instruments built a prototype system[12] that was tested by the U.S. Air Force and The MITRE Corporation. In the mid-1980s, the National Institute of Standards and Technology (NIST) developed the NIST Speech Group to study and promote the use of speech processing techniques.

Advances in voice biometrics, face biometrics and audio-visual (lip movement) analysis are now making it possible to use a combination of voice and face analysis for speaker recognition purposes, especially as high performance microphones and cameras are nowadays available on commercial smartphones, tablets and personal computers.

The SpeechXRays project will develop and test a platform based on voice acoustics analysis and audio-visual identity verification. SpeechXRays will outperform state-of-the-art solutions in the following areas:

[10] Fant, Gunnar. *Acoustic theory of speech production: with calculations based on X-ray studies of Russian articulations*. Vol. 2. Walter de Gruyter, 1971.
[11] Perkell, J. S. (1969). *Physiology of speech production: Results and implications of a quantitative cineradiographic study* (No. 53). MIT Press.
[12] Haberman, W., & Fejfar, A. (1976, May). Automatic identification of personnel through speaker and signature verification—system description and testing. In*Proc. 1976 Carnahan Conf. on Crime Countermeasures* (pp. 23-30).

- Security: high accuracy solution (cross over accuracy of 1/100 or better), lower vulnerability to fraud than other methods based on physical tokens, PIN/password or challenge question (Table 7).
- Privacy: biometric data securely stored in the device (or in a private cloud under the responsibility of the data subject)
- Usability: text-independent speaker identification (no pass phrase), low sensitivity to surrounding noise
- Cost-efficiency: use of standard embedded microphone and cameras (smartphones, laptops)

	Physical Tokens	PIN/PWD	Challenge Questions	Voice Biometrics
Theft	High	Medium	Medium	Low
Discovery/Guessing	Low	High	High	Low
Brute Force	Low	High	High	Low
Eavesdropping	Low/Medium	High	High	Low
Hacking/Cracking	Low/Medium	Medium	Medium	Low
Phishing	Low	Medium	Medium	Low
Vishing	Low	High	High	None
Smishing	None	High	High	None
Credential Sharing	Med	High	High	Low
Social Engineering	None	Medium	High	None

Table 7: Vulnerability to fraud of various security methods

1.4.1 Competitive and patent landscape

The consortium analysed 59 patents related to speaker recognition technologies. The most relevant patents are listed in Table 8.

The analysis is used to determine the "freedom to operate" (i.e. avoiding developing technologies or methods which are already protected) and to map the competitive landscape (i.e. refining the exploitation strategy of the project by identifying possible competitors or partners).

Not surprisingly, the patent landscape is dominated by major companies such as AT & T, Google, Apple, Blackberry, MasterCard, etc., A few emerging players such as Speechpro and Auraya have developed specific patents related to voice biometrics. The patents listed in Table 8 mostly rely on machine learning techniques whereas the proposed technique in this project is based on acoustics driven voice biometrics.

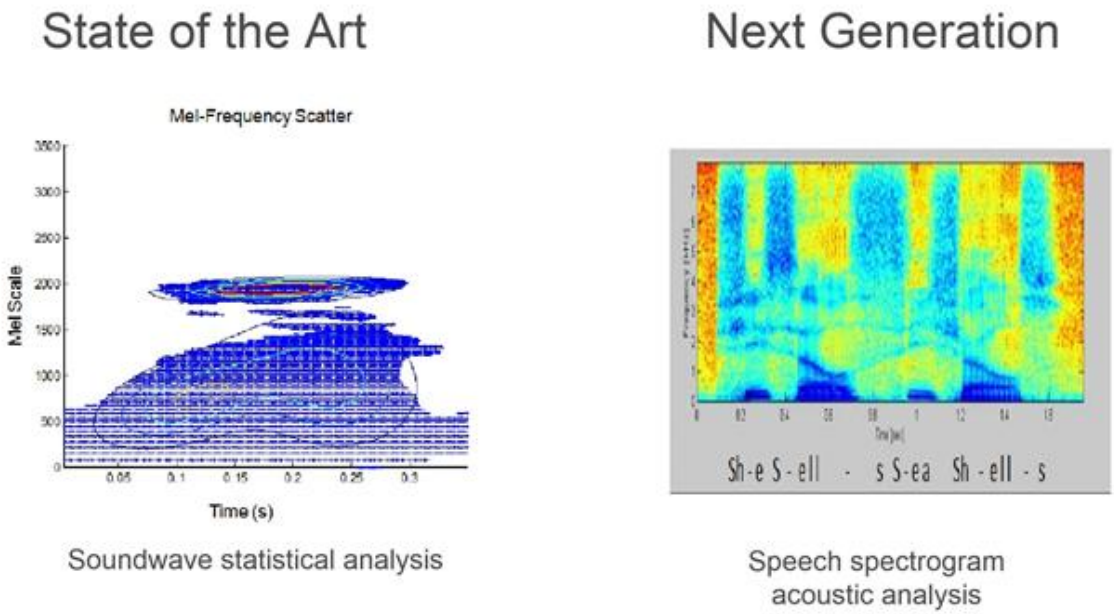
Patent no	Assignee	Subject
US 8,775,187 B2	**Auraya Pty Ltd, Sydney (AU)**	**Voice Authentication System and Methods**
US 8,510,104 B2	Research In Motion Limited, Waterloo (Canada)	System and Method for low overhead frequency domain voice authentication
US 8,555,358 B2	MasterCard International Incorporated, Purchase, N.Y. (US)	System and Method for Secure Telephone and Computer Transactions using Voice Authentication
US 8,543,834 B1	Google Inc., Mountain View, Calif. (US)	Voice authentication and command
US 8,694,314 B2	Yamaha Corporation, Hamamatsu-shi (JP)	Voice authentication apparatus
US 8,676,579 B2	BlackBerry Limited, Waterloo, Ontario (Canada)	Dual microphone voice authentication for mobile device
US 8,571,867 B2	Porticus Technology, Inc., Needham, Mass. (US)	Method and system for bio-metric voice print authentication
US 8,620,666 B1	West Corporation, Omaha, Nebr. (US)	System, method, and computer-readable medium that facilitate voice biometrics user authentication
US 8,615,219 B2	AT&T Intellectual Property I, L.P., Atlanta, Ga. (US)	Voice over IP based biometric authentication

US 8,645,137 B2	Apple Inc., Cupertino, Calif. (US)	Fast, language-independent method for user authentication by voice
US 8,712,790 B1	Robert Bosch GmbH, Stuttgart, Germany	Multi-user remote health monitoring system with biometrics support
US 8,583,498 B2	Face It Corp., San Diego, Calif. (US)	System and method for biometrics-based fraud prevention
US 8,731,251 B2	Precise Biometrics AB, Lund, (SE)	Method of matching, biometric matching apparatus, and computer program
US 8,804,918 B2	International Business Machines Corporation, Armonk, NY (US)	Method and system for using conversational biometrics and speaker identification/verification to filter voice streams

Table 8: Identified patents

To the knowledge of the consortium, there are no available patents for voice biometrics based on acoustic correlates of voice quality as opposed to machine learning techniques. The proposed technique in this project offers major opportunities to own various intellectual properties for European industrial and research organizations.

1.4.2 Voice Analysis



State of the art

Speaker recognition systems work on the principle that every user has a unique set of speech features which can be used to discriminate one user from another. During enrolment or training phase, the speech features are extracted and stored along with speaker's reference. Then during recognition phase the user's speech features are extracted and compared with the stored ones. These systems can be categorised into text dependent (when the same text is spoken during enrolment and recognition phases) and text independent (unconstrained mode). Text-independent systems are more commercially attractive than text-dependent systems because it is harder to mimic an unknown phrase than a known one.

Most "text dependent" speaker verification systems use the concept of Hidden Markov Models (HMMs), random models that provide a statistical representation of the sounds produced by the individual[13]. Most "text independent" applications use the Gaussian Mixture Model (GMM), a state-mapping model closely related to HMM. These methods are often combined with Support Vector Machines (SVM) and Maximum-Likelihood Linear Regression (MLLR) methods. In recent National Institute of Standards and Technology (NIST) 2014

[13] Springer handbook of speech processing, Edt. Jacob Benesty, M. M. Sondhi and Yiteng Huang, Springer – Verlag Berlin 2008, ISBN : 978-3-540-49125-5

speaker recognition challenge, techniques based on i-Vectors (fixed-length feature vector projected into a low-dimensional space) and probabilistic linear discriminant analysis (PLDA) have shown relative improvement of approximately 38% over the baseline system[14]. Despite this small increase, these techniques remain insufficient in accuracy.

These statistical methods compare the similarities and differences between the input speech features and the stored speech features to produce a recognition decision. After enrolment, during the recognition phase, the same quality/duration/loudness/pitch features are extracted from the submitted sample and compared to the model of the claimed or hypothesized identity and to models from other speakers. The other-speaker (or "anti-speaker") models contain the "states" of a variety of individuals, not including that of the claimed or hypothesized identity. The input speech features (freshly acquired during the verification phase) and enrolled models are compared to produce a "likelihood ratio," indicating the likelihood that the input sample came from the claimed or hypothesized speaker. If the voice input belongs to the identity claimed or hypothesized, the score will reflect the sample to be more similar to the claimed or hypothesized identity's model than to the "anti-speaker" model.

The seemingly easy implementation of speaker recognition systems contributes to their process's major weakness: susceptibility to transmission channel and microphone variability and noise. Systems can face problems when end users have enrolled on a clean land line phone and attempt verification using a noisy cellular phone. The inability to control the factors affecting the input system can significantly decrease performance. Speaker verification systems, except those using prompted phrases, are also susceptible to spoofing attacks through the use of recorded voice. Anti-spoofing measures that require the utterance of a specified and random word or phrase are being implemented to combat this weakness. Most of the statistical approaches require huge training data and computational resources for reliable performance.

Innovation 1: Acoustic-driven Voice Biometrics

In this project, an acoustics driven voice biometrics is proposed which enhances the speaker verification performance with minimum training data and is also computationally less intensive. The project will implement auditory models validating a user's claimed identity using the acoustic correlates of human vocal-tract physiology. Whereas conventional approaches "wash out" the acoustics in the system's first pass, the project approach looks in detail at acoustic correlates of vocal tract physiology. Reliance on a specific text for voice authentication is not necessary; rather, the distinctive features of speech and voice quality are identified. Because the project approach measures several more parameters of voice quality than the current state-of-the-art, even imposters are not expected to generate a false accept, as their vocal tracts physiology differ from that of the true speaker. The reason is that the degree of measurable difference in the acoustics of each speaker is greater than the sensitivity of the auditory system.

The project aims to deliver the first voice (speaker) authentication system based on well-proven science of the acoustic correlates of vocal tract physiology, resulting in the ability to better identify individual characteristics of a speaker. These acoustic correlates have been shown to improve accuracy and noise-robustness in up to 77% relative to speech recognition systems based solely on short-term pitch and energy features[15,16]. The application of physiologically-based models of speech acoustics to a voice authentication system is anticipated to have dramatic impact.

Taking account of vocal tract physiology allows advances in these regards. The vocal tract is essentially a tube that changes to produce different speech sounds. The sounds can be modelled as a perfect acoustic tube with perturbations attributed to the articulators along the length of the tube, resulting in a changing area as a function of vocal tract length. Constrictions along the length of the vocal tract correspond to consonants, while an open vocal tract corresponds to vowels. During a vowel, formant frequencies, or resonances, are remarkable. The

[14] Greenberg C. S et al., (2014), The NIST 2014 Speaker Recognition i-Vector Machine Learning Challenge, Odyssey 2014, The speaker and language recognition workshop, June 2014, Finland

[15] Hasegawa-Johnson, M., Cole, J., Shih, C., Chen, K., Cohen, A., Chavarria, S., ... & Choi, J. Y. (2004, May). Speech recognition models of the interdependence among syntax, prosody, and segmental acoustics. In Proceedings of HLT/NAACL (pp. 56-63).

[16] Reynolds, D., Andrews, W., Campbell, J., Navratil, J., Peskin, B., Adami, A., ... & Xiang, B. (2003, April). The SuperSID project: Exploiting high-level information for high-accuracy speaker recognition. In Acoustics, Speech, and Signal Processing, 2003. Proceedings.(ICASSP'03). 2003 IEEE International Conference on (Vol. 4, pp. IV-784). IEEE.

shape and location (in the frequency domain) of these resonances (amplitude as a function of frequency) correspond to speech sounds. It is in these patterns that the acoustic attributes corresponding to the speaker's underlying physiology may be found. It has been proven that the ear represents subtlety of these patterns faithfully as high in the auditory processing chain as the auditory nerve, showing that the ear has evolved to detect the subtle changes of voice quality (source).

Sound vibration during speech occurs at the glottis, is composed of two vocal folds that vibrate as air passes through them. Voice quality is primarily due to glottal behaviour and vocal tract characteristics. Moreover, there are subtle changes in how the voice produces a word as a function of time: while voice quality is mistakenly thought to be a perceptual constant, phonation is not. As phonation is the source of voice quality, therefore, voice quality is not a constant attribute. For example the project will examine micro-change in phonation, which can be measured at least 2000 times a second; while a window is applied to allow for variability in timing, the spectral characteristics due to the glottal source are prominent during vowels and consonant vowel transitions[17]. Even professional imposters or voice imitators cannot vary the vocal tract, for example, to a degree that would lead to mistaken authentication of the speaker.

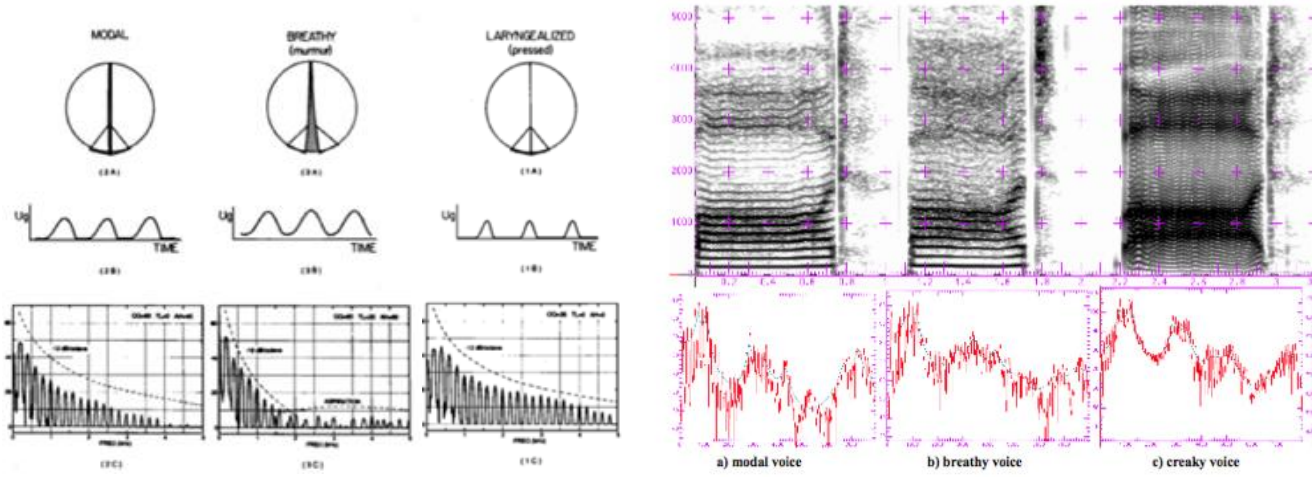


Figure 2: Acoustic data in different glottal configurations (adapted from Klatt and Klatt)

Figure 2 (left) shows as circles three different glottal configurations. Below the glottal configuration is a depiction of the amplitude of airflow through the glottis as a function of time. At the bottom is the short time Fourier transform of the signal, which indicates a slice in time of the spectrum.

Figure 2 (right) show the full acoustic spectrogram in the same three glottal configurations, demonstrating the richness of the acoustic information available (in comparison to the simple statistical analysis of the signal).

The three glottal configurations correspond to modal voice, breathy voice and pressed/creaky voice, three primary voice quality categories that may be used to describe the type of voice a speaker has. These figures are shown to depict the broad categories of speech quality, but there will nonetheless be subtle variations across different metrics corresponding to the speaker's vocal physiology and resultant acoustic signal.

The project will develop novel speech authentication system based on spectro prominences a.k.a formant frequencies and individual discreet harmonics along with a low computational classifier such as polynomial classifier. The acoustic properties based system will improve the accuracy performance and noise robustness while being less computationally intensive to be portable onto the small footprint devices such as tablets and mobile phones.

Another issue is text independence. Voice biometric solutions may be based on the voice modality only and use text-dependent statistical models'. Companies may also be offering text-independent solutions. It seems that text-independence may not necessarily be a desired feature in cases where a text-dependent (and text-prompted) solution may offer better accuracy and anti-spoofing with a shorter speech utterance than a text-independent approach. Detailed voice acoustic quality measures may also use segmental knowledge (for example, which phone is uttered) and that is easier to control with a text-dependent approach. This project will compare both text dependent and text independent solutions.

[17] Klatt, D. H., & Klatt, L. C. (1990). Analysis, synthesis, and perception of voice quality variations among female and male talkers. Journal of the Acoustical Society of America, 87(2), 820-857.

Innovation 2: Context-Dependent Matching Threshold Tuning

Any biometrics system can be described by its ROC (Receiver Operating Characteristics) curve, a visual characterization of the trade-off between the FAR and the FRR, as the matching algorithm performs a decision based on **a threshold** which determines how close to a template the input needs to be for it to be considered a match.

In practice, if the threshold is reduced, there will be fewer false non-matches but more false accepts. Conversely, a higher threshold will reduce the FAR but increase the FRR. This means that the FAR/FRR trade-off can be « tuned » for a given biometrics system.

In order to optimize the convenience of the biometrics system, the project will implement a mechanism in which the matching threshold can adapt to the criticality of the application that the user is trying to access (Figure 3).

- An application with low security requirement will have a lower threshold, in order to reduce the FRR (but therefore increasing the FAR)
- An application with high security requirement will have a higher threshold, in order to reduce the FAR (but therefore increasing the FRR)

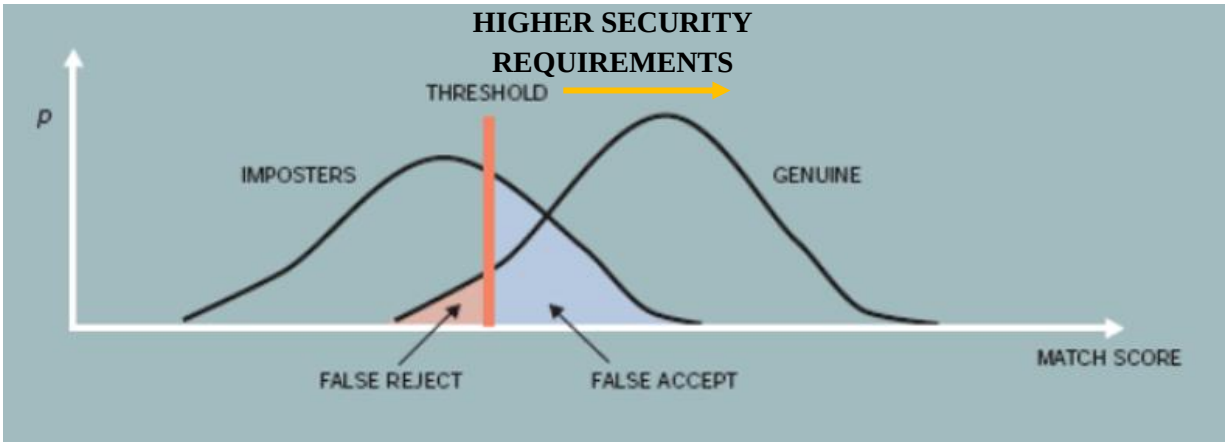


Figure 3: ROC plot and impact of the selected matching threshold on FAR and FRR

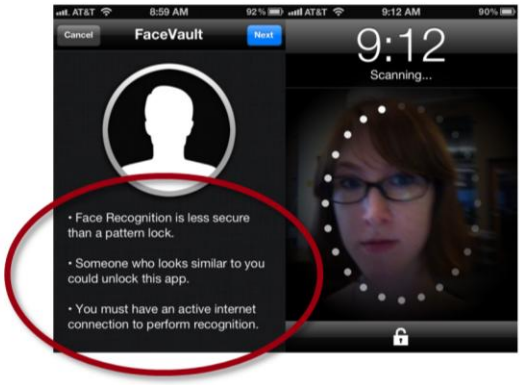
1.4.3 Audio-Visual Identity Verification

Mobile phones, tablets and personal computers are equipped with microphones and cameras. This allows for an economical verification of identity from a talking face. A talking face combines several biometric modalities: speech, face and synchrony between speech and lips movements. This combination makes spoofing attacks quite challenging. Fusion can be achieved at parametric, score and/or decision levels. As the face modality is sensitive to illumination and pose variations, and the voice modality is sensitive to noise, we take the assumption that a talking face offers more robust identity verification than either face or speech alone.

In the context of this project, speech is produced by a user in front of a camera. Such a recording offers an acoustic signal and a sequence of images in synchrony with speech. Verifying the identity of the user can therefore be performed on these two modalities (voice and face). In addition, the *synchronisation* of face movement (primarily lips movements) with the speech signal provides the dual benefit of ascertaining the "aliveness" of the face (preventing spoofing attempts using fake biometrics) and providing an extra set of co-inertial features[18]

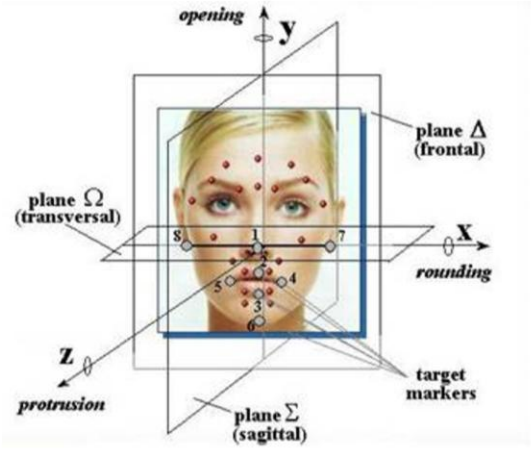
[18] Bredin, H., Mayoue, A., & Chollet, G. (2009). Talking-face Verification. In Guide to Biometric Reference Systems and Performance Evaluation (pp. 297-326). Springer London.

State of the Art



Facial recognition algorithms identify static facial features by extracting landmarks, or features, from an image of the subject's face. They can be spoofed by a presenting a picture to the screen.

Next Generation



Next gen algorithms can identify dynamic lip/face movements and measure the synchrony between voice and audio images

State of the art

Face verification includes two steps: face detection and face identification. In the context of our project, the user is assumed to be cooperative and will position his face at the centre of the image mirrored on the display of the smartphone, tablet or PC. Therefore the focus of this section will be on face identification, rather than face detection. Face identification algorithms can be divided into several categories[19,20]:

- Geometric-feature-based methods are based on human knowledge of the typical human face geometry and facial features arrangement. A related method is the feature invariant approach, that aims to find structural features that exist even when the viewpoint or lighting conditions vary and then use these to locate faces ;
- Template-based methods represent the most popular technique used to recognize and detect faces. Unlike the geometric feature based approaches, they use feature vectors that represent the entire face template rather than the most significant facial features. Template matching methods can also be based on predefined templates are sensitive to scale, shape and pose variations.
- Appearance-based methods are using a pattern classification problem with two classes: “face” and “non-face” and statistical analysis / machine learning to discover the statistical properties or probability distribution function of the pixel brightness patterns of images belonging in the two classes. Numerous algorithms have been developed to support this approach, among which Support Vector Machine (SVM) methods, Karhunen-Loeve expansion based methods (e.g. eigen face approach), neural networks (e.g. fuzzy hybrid learning algorithm), Hidden Markov Models (HMM), etc.

Such approaches can be combined with other methods tracking specific elements of the face, such as lips.

Castrillon-Santana et al[21] (open source framework based on the work of Viola & Jones[22] taking into account the localisation of the eyes, nose, mouth, chin, ears), Werda et al[23] (Automatic Lip Feature Extraction prototype) as

[19] Tsalakanidou, F., Malassiotis, S., & Strintzis, M. G. (2008). Face Recognition. In Encycl. of Multimedia (pp. 239-244). Springer US.

[20] Vijayakumari, V. (2013). Face Recognition Techniques: A Survey. World Journal of Comp. Application and Technology, 1(2), 41-50.

[21] Castrillón-Santana, M., Déniz-Suárez, O., Antón-Canalís, L., & Lorenzo-Navarro, J. (2008). Face and facial feature detection evaluation performance evaluation of public domain haar detectors for face and facial feature detection.

[22] Viola, P., & Jones, M. J. (2004). Robust real-time face detection. International Journal of Computer Vision, 57(2), 137-154.

well as Bregler et al[24] (eigen face approach to lip movement detection dubbed « eigenlips ») have successsfully developed systems focusing on lip movement detection for speech recognition. Sanchez et al[25] demonstrated that a similar approach can be used for speaker recognition. In fact, the synchrony of speech and lips movements can be adequately captured with canonical correlation, co-inertia and/or HMMs [26,27,28,29]

Commercial systems using face recognition are not very secure. Hadid[30] reports that for instance, some laptops of Lenovo, Asus and Toshiba come with built-in webcams and embedded biometric systems that authenticate users by scanning their faces. However, in 2009, the Security and Vulnerability Research Team of the University of Hanoi (Vietnam) demonstrated at Black Hat 2009 conference, the world's premier technical security conference, how to easily spoof and bypass these systems (Lenovo's Veriface III, Asus' SmartLogon V1.0.0005, and Toshiba's Face Recognition 2.0.2.32 - each set to its highest security level) using fake facial images of the legitimate user, thus gaining access to the laptops. This vulnerability is now listed in the National Vulnerability Database of the National Institute of Standards and Technology (NIST) in the US.

Innovation 1: Audio-Visual Synchrony Analysis

The SpeechXRays project will use multi-channel speech and face biometrics and their correlations, in order to provide a secure, privacy preserving (revocable) biometrics and spoofing resistant (anti-spoofing) solution.

The key to this will be the dynamic analysis of the face (in particular lip movements and how they relate to the acoustic data).

One of the major drawbacks of biometrics is that the biometric traits (characteristics) can be faked. In such cases the challenge, called aliveness detection, is to be able to detect if the biometric sample belongs to a "live" person or is an artificial replica (such as a previously recorded speech of a speaker, a 2D photo of a face, etc.). When dealing with uni-modal biometrics systems, the anti-spoofing consists of developing an associated aliveness detection module to the biometric comparison module.

Because it is difficult to find a perfect uni-modal biometrics that can suit different applications, has high accuracy, does not require expensive sensors, is easy to use, and cannot be spoofed, SpeechXRays will combine information from multiple biometric sources, with the following advantages:

- A multi-biometric system will substantially improve the matching accuracy of the system compared to a voice-only or face-only modality.
- When multiple biometric traits are involved, it becomes more difficult for an impostor to spoof the system.

The information fusion can be carried out at different levels of the biometric system, such as sensor, feature, score, decision, or rank level. Most multimodal systems that rely on score fusion in order to combine the unimodal biometric scores unimodal aliveness detection methods for anti-spoofing. Therefore standard audio-visual systems are very vulnerable to spoofing attacks (the presentation of pre-recorded audio clip together with

[23] Werda, S., Mahdi, W., & Hamadou, A. B. (2013). Lip localization and viseme classification for visual speech recognition. arXiv preprint arXiv:1301.4558.

[24] Bregler, C., & Konig, Y. (1994, April). "Eigenlips" for robust speech recognition. In Acoustics, Speech, and Signal Processing, 1994. ICASSP-94., 1994 IEEE International Conference on (Vol. 2, pp. II-669). IEEE.

[25] Sanchez, U. R., & Kittler, J. (2006, May). Fusion of talking face biometric modalities for personal identity verification. In Acoustics, Speech and Signal Processing, 2006. ICASSP 2006 Proceedings. 2006 IEEE International Conference on (Vol. 5, pp. V-V). IEEE.

[26] Chollet, G., Landais, R., Hueber, T., Bredin, H., Mokbel, C., Perrot, P., & Zouari, L. (2007). Some experiments in audio-visual speech processing. In*Advances in Nonlinear Speech Processing* (pp. 28-56). Springer Berlin Heidelberg.

[27] Faraj, M. I., & Bigun, J. (2007). Audio–visual person authentication using lip-motion from orientation maps. *Pattern recognition letters*, *28*(11), 1368-1382.

[28] Abboud, B., Bredin, H., Aversano, G., & Chollet, G. (2007). Audio-visual identity verification: an introductory overview. In *Progress in nonlinear speech processing* (pp. 118-134). Springer Berlin Heidelberg.

[29] Rúa, E. A., Mateo, C. G., Bredin, H., & Chollet, G. (2007). Aliveness detection using coupled hidden markov models. In *Proc. Spanish Workshop on Biometrics*.

[30] Hadid, A. (2014). Face Biometrics under Spoofing Attacks: Vulnerabilities, Countermeasures, Open Issues, and Research Directions. In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition Workshops (pp. 113-118).

a still photograph is enough to fool the system[31])

In contrast, SpeechXRays will exploit the **natural correlation** between speech and face biometrics to improve accuracy and to detect spoofing.

Joint analysis of face and voice biometrics (usually referred to as "talking face"), exploiting the synchronization between the speech signal and the corresponding lip motion, provides a unique advantage over ordinary multi-modal fusion techniques. Hence, this synchronization property can be utilized as a "third cue" in addition to the individual voice and face modalities.

The project will measure the synchrony of speech with lips movements both globally and at the segmental level, using canonical correlation and co-inertia as a global measure[32] and using pseudo-phones and visemes associations at the segmental level[33].

The information fusion can be carried out at different levels of the biometric system, such as sensor, feature, score, decision, or rank level. Most multimodal systems that rely on score fusion in order to combine the unimodal biometric scores unimodal aliveness detection methods for anti-spoofing. Therefore standard audio-visual systems are very vulnerable to spoofing attacks (the presentation of pre-recorded audio clip together with a still photograph is enough to fool the system[34])

Innovation 2: Emotional Analysis

The project will also use the video-based face analysis to perform emotion recognition, using existing technologies provided by consortium partner EYE.

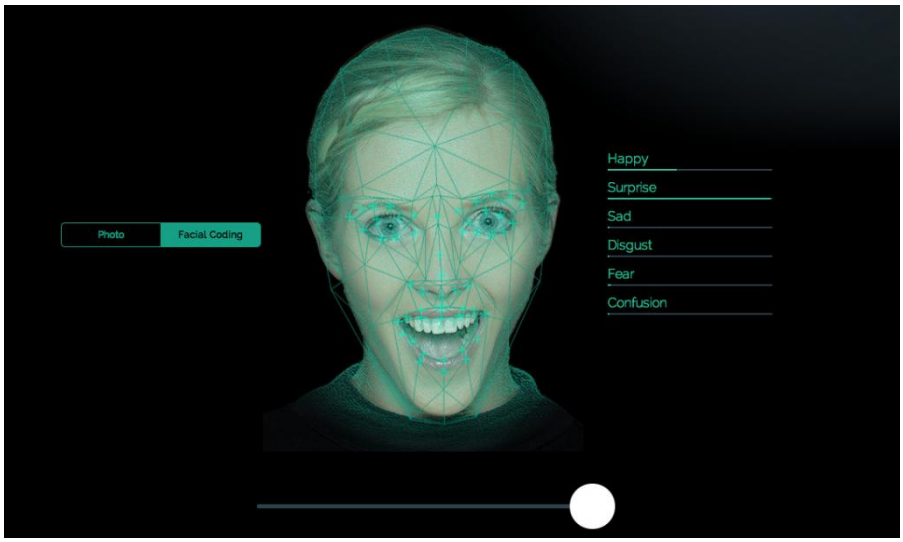


Figure 4: Realeyes emotional analytics solution

The project will develop specific face analytics classifiers as follows:

- Evaluation of the impact of user physiological or behavioural changes on system accuracy : the project will evaluation of impact of different emotional states on accuracy of identification systems used in this project and develop classifiers capable of recognising chewing or face occlusion. This will prevent situations where the user is not able to authenticate because of his emotional state (tired, sad) or behaviour (eating a chewing-gum).
- Duress detection: the project will develop improved emotion classifiers focusing on fear in order to identify if an individual is being « forced » to authenticate against his will. This will make the system even more useful in high security applications scenarios.

[31] Bredin, H., & Chollet, G. (2008, April). Making talking-face authentication robust to deliberate imposture. In ICASSP (pp. 1693-1696).

[32] H. Bredin, G. Chollet Audio-Visual Speech Synchrony Measure for Talking-Face Identity Verification. IEEE-ICASSP (2007)

[33] T.J. Hazen Visual Model Structures and Synchrony Constraints for Audio-Visual Speech Recognition. IEEE Trans on ASLP (2005)

[34] Bredin, H., & Chollet, G. (2008, April). Making talking-face authentication robust to deliberate imposture. In ICASSP (pp. 1693-1696).

- False reject optimization: the project will develop classifiers to detect more complex cognitive states, such as boredom or frustration. This will prevent the scenario where an initial false rejection triggers counterproductive emotional reactions with the user (anger, frustration) that make it even more difficult for the user to be authenticated in subsequent attempts. Therefore, the system could be able to take in account a « frustration factor » for a user not able to authenticate (which is unlikely to be similar in the case of an impostor).

1.4.4 Security and Privacy in Biometric based Authentication

Traditional authentication methods such as passwords and identity documents can be easily forgotten, lost, guessed, stolen, or shared. However, authentication using anatomical traits such as fingerprint, face, palm print, iris and voice are very difficult to forge since they are physically linked to the user. Biometric systems prevent non-repudiation and can also detect whether an individual has multiple identities. Thus, biometric systems impart higher levels of security and seen a rapid proliferation in a wide variety of government and commercial applications around the world in the last two decades[35]. However, various security and privacy challenges deter the public confidence in adopting biometric based authentication systems.

State of the art

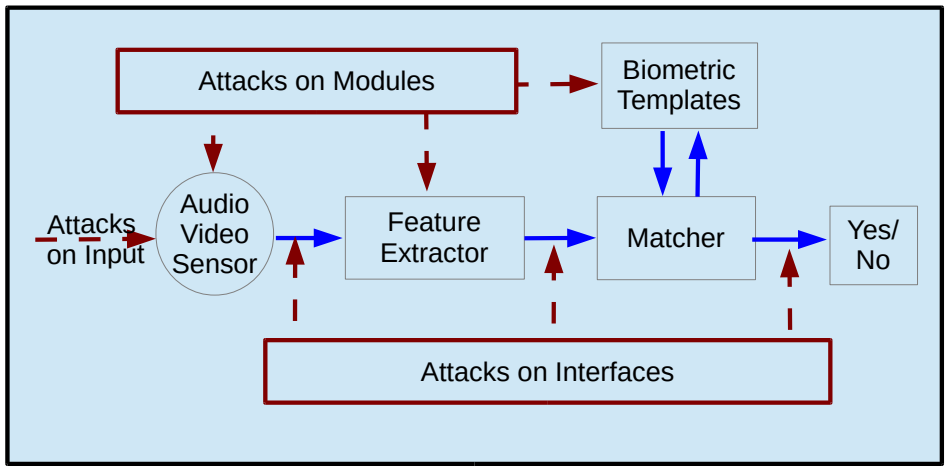


Figure 5: Biometrics points of attacks

A biometric system may fail due to manipulation by adversaries. Such manipulations can be carried out via insiders or by directly attacking the system infrastructure (Figure 5). An adversary can avoid a biometric system by colluding with insiders or fraudulently manipulating the procedures of enrolment and exception processing, originally designed to help authorized users. External adversaries can also cause a biometric system to fail through direct attacks on the user interface (sensor), the feature extractor and matcher modules, the interfaces between the modules, and the template database e.g., Trojan horse, man-in-the-middle, and replay attacks. However, there several countermeasures like cryptography, timestamps, and mutual authentication that are available to minimize their impact.

Adversary scans for vulnerability in inputs, interfaces, and modules. Attack at user interface is mostly due to the presentation of a spoof biometric trait. If the sensor is unable to distinguish between fake and genuine biometric traits, the adversary easily intrudes the system under a false identity. Multimodal biometric systems are robust enough to mitigate spoofing attacks. Aliveness testing (vitality detection) methods have also been suggested among feasible counteractions against spoof attacks. Aliveness testing, which aims to detect whether the submitted biometric trait is live or artificial, is performed by either software module based on signal processing or hardware module embedded into the input device itself. But, so far, the literature review states that no effective method exists yet[36].

[35] Jain, A. K., & Nandakumar, K. (2012). Biometric Authentication: System Security and User Privacy. *IEEE Computer*, *45*(11), 87-92.

[36] Schuckers, S., Hornak, L., Norman, T., Derakhshani, R., & Parthasaradhi, S. (2002). Issues for liveness detection in biometrics. In Proceedings of Biometric Consortium Conference. IEEE, New York.

Otherwise adversary compromises the database of enrolled identities, known as template leakage attack, gains access to the enrolment biometric. This is a major security threat and allows the attacker to use the enrolment biometric to gain repeated access to the system, and to any other biometric systems. This is also a privacy breach where the attacker has gained access to the user's physical identity information and can henceforth illegally impersonate the user. The seriousness of this threat is greatly increased by the fact that biometrics are inherent properties of the human body and cannot be revoked and then re-issued[37]. ISO/IECFCD 24745 standard recommends the following three features in any biometric systems to mitigate template leakage attacks[38] 1) the data stored on the database should provide little or no information about the actual biometric 2) the stored data should not allow an attacker to gain unauthorized access to the system successfully 3) if the user's stored data is known to have been compromised, then it should be possible to revoke it and issue a new set of biometric credential[39]. There are two well-known schemes known as biometric cryptosystems and cancellable biometrics satisfies the three recommendations. Biometric cryptosystems are designed to securely bind a digital key to a biometric. Cancellable biometrics consists of intentional, repeatable distortions of biometric signals based on transforms which provide a comparison of biometric templates in the transformed domain. In contrast to templates protected by standard encryption algorithms, transformed templates are never decrypted since the comparison of biometric templates is performed in transformed space which is the very essence of cancellable biometrics[40].

Project innovations

Innovation of the project in terms of security and privacy is on development and implementation of secure template and revocable biometric techniques to preserve the privacy of user's unique anatomical traits used for combined voice acoustic analysis with dynamic face recognition. When people use biometric services for authentication, they must allow the service to have access to their biometrics credentials. This exposes the user to abuse, with security, privacy and economic implications. For instance, the service could extract information such as gender, ethnicity, and even the emotional state of the user from the recording – factors not intended to be exposed by the user – and use them for undesired purposes. Moreover, due to the recent trends toward Cloud computing, it is imaginable that the biometric authentication systems will also be outsourced to potentially untrusted servers in the Internet. These servers could be malicious itself or vulnerable to passive and active attacks by intruders. Hence it is crucial to preserve the privacy of the user's biometric data without compromising or altering the system performance. Any private information that can be gleaned by inspecting a user's interaction with a system must be protected from prying eyes.

Innovation 1: Cryptobiometrics

The system should enable voice and dynamic face recognition processing tasks subject to no party, including the users, the system, or a snooper, can derive undesired or unintended information from the transaction. This would imply, for instance, that a user may enrol for authentication without fear that an intruder or even the system itself could capture and abuse his voice or statistical models derived from it. This will be achieved by incorporating biometric cryptosystem and cancellable biometrics technologies[41].

We will develop and implement a one-way cryptographic function tailored for voice acoustic and dynamic face recognition to transform the user biometric data into a template with the following features:

- the template used for the authentication, generated from the biometric data, cannot be reverse engineered to reveal the true biometric data
- the user will be able to generate different ''templates'' for different applications with the same biometric data, whilst ensuring that these different identities cannot be linked to each other

[37] Wang, Y., Rane, S., Draper, S. C., & Ishwar, P. (2012). A theoretical analysis of authentication, privacy, and reusability across secure biometric systems. Information Forensics and Security, IEEE Transactions on, 7(6), 1825-1840.

[38] Simoens, K., Bringer, J., Chabanne, H., & Seys, S. (2012). A framework for analyzing template security and privacy in biometric authentication systems. Information Forensics and Security, IEEE Transactions on, 7(2), 833-841.

[39] Breebaart, J., Yang, B., Buhan-Dulman, I., & Busch, C. (2009). Biometric template protection. Datenschutz und Datensicherheit-DuD, 33(5), 299-304.

[40] Ratha, N. K., Connell, J. H., & Bolle, R. M. (2001). Enhancing security and privacy in biometrics-based authentication systems. IBM systems Journal, 40(3), 614-634.

[41] Jain, A. K., Nandakumar, K., & Nagar, A. (2008). Biometric template security. EURASIP Journal on Advances in Signal Processing, 2008, 113.

This will preserve the privacy of the user's biometric data from template leakage. In case of leakage, the system could simply revoke the enrolled template with freshly generated template. In general the following four different types of cryptographic techniques are used to protect the template: 1. salting (e.g. biohashing) 2. noninvertible transform (e.g. robust hashing) 3. key binding (e.g. fuzzy vault, fuzzy commitment) 4. key generation (e.g. secure sketch, fuzzy extractor)[42]. Each technique has its own advantages and disadvantages and have been exploited in several biometric authentication systems in the past. However, a single technique cannot be used to satisfy all the security and privacy requirements. Moreover, these techniques have only been implemented and tested on traditional biometrics such as fingerprints, Iris and face based authentication systems. This project will implement and investigate the cryptographic techniques for combined voice acoustic and lip based face authentication system individually and jointly. Each scheme will be evaluated in terms of false acceptance rate and false rejection rate.

Innovation 2: Homomorphic public-key encryption scheme

We develop an end-to-end privacy-preserving biometric authentication system to protect users vocal tract physiology derived from the feature analysis of the speech spectrogram and dynamic face features such as lip movement during the authentication from the authentication server as well as passive eavesdroppers. The end-to-end anonymous protocol is crucial when the biometric system is outsourced to third party such as cloud computing paradigm. In literature, there have been several privacy preserving biometric recognition systems such as the face recognition that are developed based on the cryptographic primitives such as homomorphic encryption, secure multiparty computation and oblivious transfer. However, developing a private tool to analyse the speech spectrogram and dynamic face recognition in encrypted domain in order to derive the precise vocal tract physiology and lip movement have not been done to-date. Moreover, the model of the acoustic cues of the voice physiology combined with lip movement of face for an individual is unique like his fingerprint. Hence it is crucial to keep it secure during transmission and storage. We will achieve this by implementing secure two-party protocol using Paillier cryptography to perform authentication in the encrypted domain. The Paillier cryptosystem is an additively homomorphic public-key encryption scheme, whose provable semantic security is based on the decisional composite residuosity problem. Additive homomorphic property supports addition and scaling operations in the encrypted domain. Hence the user's biometric inputs will be encrypted using the Paillier cryptography and the authentication will be performed by the server in the encrypted domain[43, 44, 45].

[42] Rathgeb, C., & Uhl, A. (2011). A survey on biometric cryptosystems and cancelable biometrics. EURASIP Journal on Information Security, 2011(1), 1-25.

[43] Luo, Y., Cheung, S. C. S., & Ye, S. (2009, June). Anonymous biometric access control based on homomorphic encryption. In Multimedia and Expo, 2009. ICME 2009. IEEE International Conference on (pp. 1046-1049). IEEE.

[44] Upmanyu, M., Namboodiri, A. M., Srinathan, K., & Jawahar, C. V. (2009). Efficient biometric verification in encrypted domain. In Advances in Biometrics (pp. 899-908). Springer Berlin Heidelberg.

[45] Rahulamathavan Y, Phan R, Veluru S, Cumanan K and Rajarajan M, Privacy preserving multi-class support vector machine for outsourcing the data classification in cloud, IEEE Transactions in Dependable and Secure Computing, 10.1109/TDSC.2013.51, 2014.

2. Impact

2.1 Expected impacts

2.1.1 Results, impact and KPIs

Table 9 describes how the project results outlined in Section 1 support the expected impact of the call.

DS-02 expected impact	Relationships between project results and expected impact
Impact 1: *actions will deliver secure, but user-friendly, access to ICT systems, services and infrastructures, resulting in a consumerisation of devices for access control.*	The SpeechXRays algorithms and methods for speaker recognition and audio-visual recognition can be used in a variety of consumer devices (smartphones, tablets, laptops). The sensors used (camera and microphone) in the context of the project are already embedded in these devices, facilitating the consumerisation of these biometric methods. The modalities used (voice and face) make the system extremely user-friendly, and the multi-channel approach increases its security (accuracy, resistance to spoofing)
Impact 2: *The level of security of online services and critical infrastructures protected by these access systems should be demonstratably higher than by the state-of-the-art approach.*	The level of security achieved by the SpeechXRays solution will be higher than existing commercial systems based on voice or face recognition (or both). The analysis of the synchrony between face (lips) and voice will provide aliveness assessment (to avoid spoofing) and increased recognition accuracy. In addition the system will use cancellable (revocable) templates and cryptobiometrics for increased security and privacy.
Impact 3: *The proposed solutions are expected to support the creation of commercial services making use of electronic identification and authentication.*	The SpeechXRays solution will be deployed to support real-life authentication services in 3 use case scenarios: workforce, e-health and consumer. The solution will include development environment allowing third party developers to build new applications and service on top of the core technology. The consortium partners will dedicate efforts to the development of a developer community.

Table 9: Project contribution to the call topic's expected impacts

Table 10 presents the project key performance indicators (KPIs) related to the project expected impacts, at project end, as well as 5 years after project end and 10 years after project end.

Impact			Project impact indicator (Europe-wide)	End of project	End + 5 years	End + 10 years
1	2	3				
X			Biometric solution cost (software cost per user)	2 EUR	1 EUR	0.5 EUR
X			Biometric solution reach (total addressable market)	1M+[46]	10M+	50M+
X		X	Biometric solution user-friendliness	high	very high	very high
	X		Biometric solution performance (equal error rate)	1/100	1/150	1/200
	X		Biometric solution performance (resistance to spoofing)	high	high	high
	X		Biometric solution performance (template leakage)	none	none	none
X	X	X	Number of application developers or device suppliers	10	80	200
X	X	X	Number of commercial services	5	40	100
X		X	Number of users	2,000	5M	35M

Table 10: Project outcome indicators in relation to project timeline

[46] Based on the 3 project trials (Forthnet alone has 1.08M subscribers that could use the SpeechXRays solution)

2.1.2 Market analysis

The total biometric market is expected to grow to $23.54 billion by 2020 at an estimated CAGR of 17.6%[47] and include a wide variety of biometric modalities (fingerprint, palm, face, iris, vein, voice & signature). Leading companies include 3M (U.S.), Cross Match Technologies (U.S.), Facebanx (U.K.), Fingerprint Cards AB (Sweden), Fujitsu Ltd (Japan), Fulcrum Biometrics (U.S.), NEC Corporation (Japan), RCG Holdings LTD. (Hong Kong), Safran SA (France), Siemens Ag (Germany), Suprema Inc. (South Korea), Thales Group SA (France), Validsoft (U.K.). However, it is important to differentiate the consumer products (e.g. capacitive fingerprint reader embedded in an iPhone) from the industrial-grade products (e.g. high resolution optical fingerprint reader used in law enforcement).

SpeechXRays is clearly addressing the consumer-side of the market, in alignment with the call objectives.

According to Goode Intelligence[48], growth in the consumer market will initially be driven by the integration of fingerprint sensors in high-end smartphones and tablets. Growth will then be rapidly followed by other innovative biometric technologies deployed as part of either FIDO (Fast Identity Online)-enabled solutions, proprietary-device OEM led initiatives such as Touch ID, and integration into multi-factor authentication platforms.

Biometrics Group[49] projects that the inclusion of biometrics in mobile devices will generate about 7.2Bn EUR worth of revenue by 2018 for the biometrics industry, not just through unlocking mobile devices through security applications, but also through multi-factor authentication services and the approval of instant electronic payments. Surveys analysed by this research firm have found that consumers prefer voice recognition technology. According to a survey conducted by IT provider Unisys, the biometric modalities ranked by consumer preference are: voice recognition (32 percent), fingerprints (27 percent), facial scan (20 percent), hand geometry (12 percent), and iris scan (10 percent). As a result, the firm projects that voice recognition will be widely adopted.

The voice verification segment of this market is in its nascent stages of development, but growth is anticipated as voice biometrics and speech recognition become more widely used. The major end-user segments of voice biometrics is in verticals such as financial services, healthcare, telecommunications, and government (three of which are represented in the SpeechXRays pilots). The major applications include transactional authentication and verification systems, wireless security device, computer/network security and physical access control.
Early leaders in voice biometrics included Diaphonics (acquired by Ivrnet in 2010) and Persay (acquired by Nuance in 2011). Newcomers include Sensory, Victrio, Agnitio, among other. Nuance is the current market leader with 35M voiceprints in use by their customers.

Oberthur has started to develop a voice biometrics offering under the tagline "My Voice is My Password" based on technologies from Agnitio (Figure 6). However, the technologies developed by Agnitio are based on voice modality only and use text-dependent statistical models. Oberthur plans to incorporate the multichannel biometric solution developed by the consortium in their voice biometrics product line, in order to bring more advanced audio-visual recognition models to consumer devices.

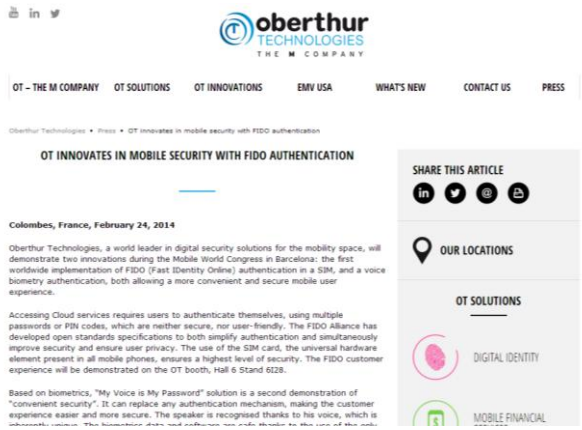


Figure 6: Oberthur launched "My Voice is My Password" at the Mobile World Congress 2014

[47] Next Generation Biometric Market by Technology (Fingerprint, Palm, Face, Iris, Vein, Voice & Signature), Function, Application (Government, Defense, Travel & Immigration, Home Security, Banking, Consumer Electronics & so on) & by Geography - Forecasts & Analysis 2014 – 2020. Markets & Markets (2014).

[48] Mobile and Wearable Biometric Authentication Market Analysis and Forecasts (2014-2019). Goode Intelligence. June 2014

[49] "Special Report: Mobile Biometric Authentication". Biometrics Research Group Inc, June 2014. Accessed at http://www.biometricupdate.com/201408/special-report-mobile-biometric-authentication

2.1.3 Barriers / obstacles and activities required to achieve the expected impacts

The drivers in the voice biometric market includes the increasing popularity of voice verification in mobile phone solutions, no dependency on infrastructure, easy implementation and low initial investment. However factors posing a challenge to the growth of this market are a lack of standards, lack of awareness among end-user industries and regulatory bodies and confusion created between voice biometrics and speech recognition. Table 11 lists the barriers/obstacles to impact and required activities in order to achieve the expected impacts.

Expected impact	Barriers / obstacles	Steps needed to achieve the impact	WPs
Consumerisation of devices for access control	Sensor size and cost can limit the incorporation of biometric technologies in consumer devices	The project takes an approach focusing on voice and face modalities, both of which can be captured by existing sensors embedded in consumer devices	WP2
	Privacy concerns may lead consumer to disregards biometrics solutions that required a voice or face recording	The solution will generate cancellable biometric templates created by binding keys with biometric data and securely storing them on the device	WP3
	Confusion between voice biometrics and speech recognition may lead consumers to question the accuracy of speaker identification	The project dissemination activities will place an emphasis on end-user awareness, clearly making a difference between speech recognition and speaker recognition (and the difference in performance/accuracy)	WP7
	Lack of standards for voice biometrics	The consortium will dedicate substantial effort to standardization activities	WP9
Higher security than state-of-the-art	High sensitivity to background noise or low-light conditions may render the authentication inoperable	The project technology will use acoustic driven approaches to voice biometrics (which are not sensitive to noise) and audio-visual synchronization analysis (which is not sensitive to lighting conditions)	WP2
	Spoofing	The project multichannel approach makes spoofing more difficult.	WP2
Creation of commercial services	Lack of awareness among end-user industries	The project dissemination activities will target early adopter verticals such as banking who have successfully adopted voice biometrics.	WP8
	Lack of awareness among regulatory bodies	The project will target regulatory authorities in new segments such as healthcare, where biometrics is needed to curb healthcare fraud and to provide increase patient care while protecting patient privacy	WP8

Table 11: Barriers/obstacles to impact and activities required to overcome them

2.1.4 Industrial, scientific and societal impact

The project industrial impact is driven by industrial partners (OT, SIV) and end-users (IFIN, FNET) that will allocate substantial resources (50 PM) to community building, exploitation and activities. The call will focus on demonstrating the viability and maturity of state-of-the-art security, privacy and trust solutions that have been tested in a laboratory environment. The intention is that after this validation phase they will find a wide up take in the market. The project will develop an industrial ecosystem of end-user and application developers deriving benefits from the use of the platform. The SpeechXrays solution will allow third party application developers to build new applications based on the technologies developed in the project. The project industrial impact will be measured by the number of third party developers (or device suppliers) relying on the SpeechXrays solution for authentication.

The project scientific impact is driven by 3 research partners (FORTH, TSP, UCL) and 3 research-performing SMEs (HB, EYE, TEC) and rests on a rich set of scientific dissemination activities described in Section 2.2.7. The project will influence the biometrics community by focusing attention on the use of acoustic-driven voice recognition and audio-visual synchronization analysis. Proving that the security concepts, processes and solutions work in a real life environment, in large scale demonstrators and directly involving end users who would ultimately benefit the most from the outcome, should increase the prospects for an ICT security market and demonstrate the validity and effectiveness of the scientific foundations of the project. However, the lack of long-lasting cooperation between industry and research (whose timelines and objectives are rarely aligned) is a serious obstacle to the scientific impact of a project where industrial partners and SMEs are dominant. In order to prevent the project to focus too heavily on short-term industrial impact and not enough on longer-term scientific impact, the project coordinator will enforce a simple rule: any peer-reviewed article develop in the course of the project will have to include at least one industrial partner or end-user. The project scientific impact will therefore be measured by the number of peer-reviewed articles published *in collaboration* between industry and research.

The project societal impact results from addressing specific challenges listed in the Secure Societies Work Programme. As cybersecurity is cross-domain, the project is able to provide benefits to many application domains supporting various societal challenges. Therefore the project societal impact will be measured by the flexibility of the solution and its applicability to various industrial domains. The workforce pilot will have impact on industries with high security requirements such as energy, transportation, military/law enforcement. The eHealth pilot will have an impact on healthcare sector where biometrics is needed to curb healthcare fraud and to provide increase patient care while protecting patient privacy. The consumer pilot will have an impact on other sectors such as banking, e-commerce, etc.

2.1.5 Contribution to European innovation capacity and integration of new knowledge

The challenge-based third pillar of Horizon 2020 emphasizes the need to take the societal problems themselves as a starting point for corporate and university research and innovation work. The technical work of the project involves a wide range of challenging task and the interdisciplinary approach of the project (voice acoustics, face recognition, audio-visual analysis, biometrics, security, privacy) requires a unique combination of skills that can only be provided by the best European scientists (France, Estonia, Greece, Romania, UK)

One of the main purposes of the project is to create a developer community and a user community that can support innovative biometric applications supported by a knowledge triangle of education, research and business inspired from the EIT ICT Labs model (Figure 7).

Several concepts have emerged in recent decades to interpret and illustrate the process of knowledge creation, in particular the non-linear nature of innovation and the multiple input and feedback loops required between the actors in an innovation system. For example, new knowledge on voice acoustic-driven recognition created by the SpeechXRays research is the source of improvement for all voice biometrics commercial providers and in return, new market prospects for innovation identified by SpeechXRays end-users can point towards new avenues for audio-visual analysis.

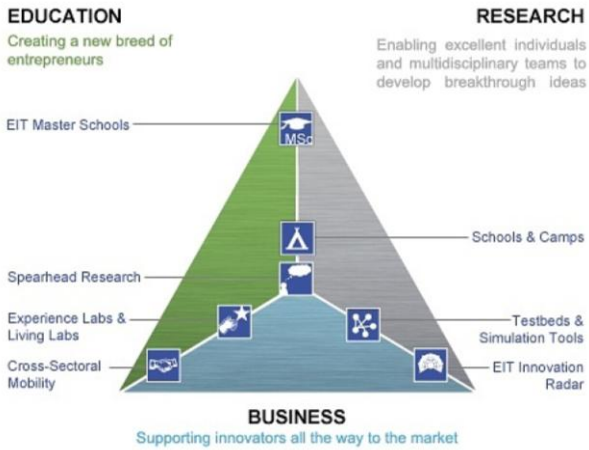


Figure 7: The EIT ICT Labs knowledge triangle

In particular, since the project will use cancellable and unleakable templates (biometrics cryptosystems), it will be possible to release such databases for the research community. **It will be the first time that such biometric databases are made publicly available for further research evaluation.**

2.1.6 Contribution to standards

As part of the standardization activities of WP9, The SpeechXRays consortium will interface with the standardization bodies that have been the most active in the area of voice biometrics and face biometrics, specifically the NIST Information Technology Laboratory (ITL) and the ISO/IEC Joint Technical Committee 1, Subcommittee 37- Biometrics (Figure 8).

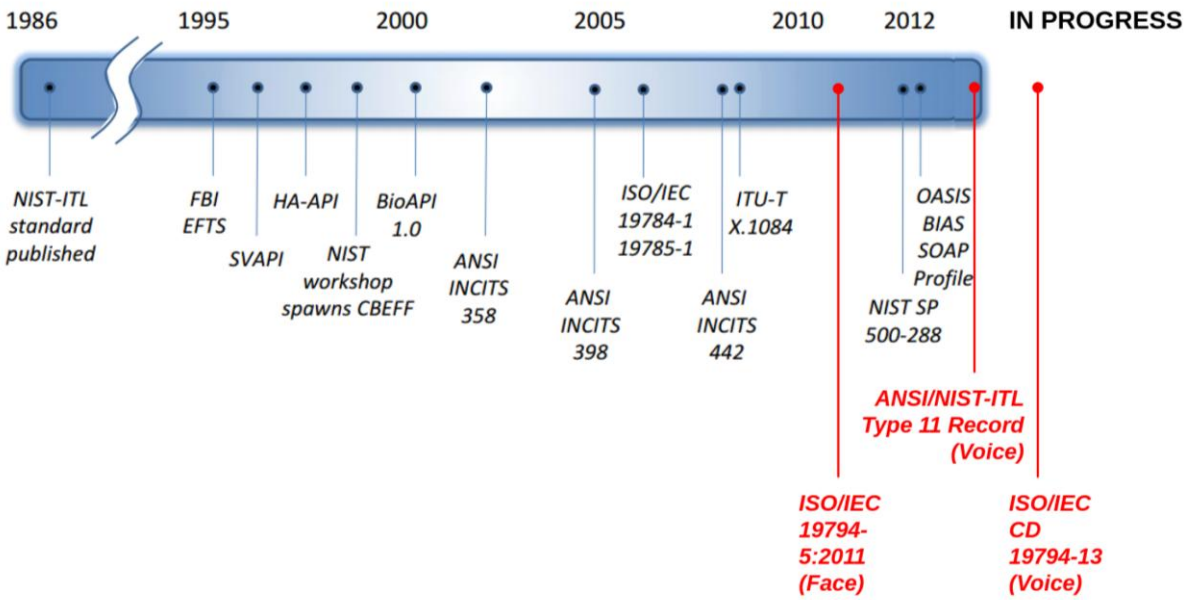


Figure 8: Development timeline of the biometrics standards

The domain of face biometrics has been addressed by recent standard updates, therefore the consortium will develop the solution in accordance with published standards such as ISO/IEC 19794-5:2011 and ANSI/NIST-ITL 1-2011.

There are renewed efforts to develop standards supporting secure access to the Web and Web services using biometric, speaker identification and verification (SIV). Interest in SIV is growing in both the private and public sector. That interest is motivated by a variety of factors, primarily cost and labour issues; convenience; and the growing number of regulations/laws governing data privacy and security that have been put in place exist at international, national, local, and industry levels.

Despite the growing interest in SIV, the lack of standards is a market and technology barrier

Unlike other biometric technologies (and unlike speech recognition and speech synthesis), there are no standards specifically governing the use of SIV. ISO/IEC 19784-1 (called "BioAPI") is a generic, biometric application programming language that was designed to support SIV in non-telephony deployments. Its utility for SIV Web-services applications has not yet been fully explored. The other SIV standards projects (IETF MRCP V2; INCITS 1821-D Speaker Recognition Format for Raw Data Interchange, NIST-ITL Type-11 Record and ISO/IEC 1.37.19794-13) are all still under development.

The consortium therefore intends to make contributions to the development of the ISO/IEC 19794-13 standard, currently in Committee Draft status with target publication date 2016-01-04 (Table 12). However,

Published Standards	Description
ANSI/NIST-ITL 1-2011	Data Format for the Interchange of Fingerprint, Facial & Other Biometric Information. In addition to the exchange of fingerprint, latent, face, and iris biometric data, the 2011 version of the standard includes new modalities such as forensic image mark-ups for **face** and iris; images of all body parts, new metadata fields such as geoposition of sample collection; biometric data hashing and information assurance; and data handling logs.
NIST SP500-288	New protocol, called WS-Biometric Devices (WS-BD), allowing desktops, laptops, tablets and smartphones to access sensors that capture biometric data such as fingerprints, iris images and **face images** using web services. The WS-Biometric Devices protocol enables interoperability by adding a device-independent web-services layer in the communication protocol between biometric devices and systems.
ISO/IEC 19784-1	Biometric application programming interface -- Part 1: **BioAPI** spec.
ISO/IEC 19794-5:2011	Biometric data interchange formats -- Part 5: **Face image** data
ISO/IEC 29109-5:2014	Conformance testing methodology for biometric data interchange formats defined in ISO/IEC 19794 -- Part 5: **Face image** data
ISO/IEC TR 29794-5:2010	Biometric sample quality -- Part 5: **Face image** data
OASIS BIAS SOAP Profile	The Biometric Identity Assurance Services (BIAS) profile specifies how to use the eXtensible Markup Language (**XML**) defined in ANSI INCITS 442-2010 – Biometric Identity Assurance Services to invoke Simple Object Access Protocol (**SOAP**) -based services that implement BIAS operations. These SOAP-based services enable an application to invoke biometric identity assurance operations remotely in a Services Oriented Architecture (SOA) infrastructure.
Standards in development	**Description**
IETF Media Resource Control Protocol Version 2 (MRCPv2)	Protocol allowing client hosts to control media service resources such as speech synthesizers, **recognizers, verifiers and identifiers residing in servers on the network**. MRCPv2 is not a "stand-alone" protocol - it relies on other protocols, such as Session Initiation Protocol (SIP) to rendezvous MRCPv2 clients and servers and manage sessions between them, and the Session Description Protocol (SDP) to describe, discover and exchange capabilities.
INCITS 456-2010, Information technology - Speaker Recognition Format for Raw Data Interchange (SIVR-1)	This standard specifies a concept and data format for **representation of the human voice at the raw-data level** with optional inclusion of non-standardized extended data. It does not address handling of data that has been processed to the feature or voice model levels. This standard contains definitions of relevant terms, a description of the basic speaker-recognition session, a data format for containing the data, and conformance information.
Draft Voice Supplement to the ANSI/NIST-ITL 1-2011	Joint effort between FBI and NIST to conduct research supporting the creation of **voice** biometric standards for the U.S. Government. The Investigatory Voice Biometrics Committee worked to produce a functional draft of the Type-11 Record aimed to seed a Voice Supplement to the ANSI/NIST-ITL 1-2011 standard. However, the focus of this document is on speaker identification for **law enforcement purposes** (and not access control).
ISO/IEC CD 19794-13	Biometric data interchange formats -- Part 13: **Voice** Data

Table 12: List of relevant standards

2.2 Measures to maximize impact

2.2.1 Joint Dissemination Plan

In order for SpeechXRays to have a far-reaching impact on the development of voice biometrics consumers systems, the dissemination strategy will encompass all stakeholders of value chain (Table 13).

Category	Target Audience	Why them?	What's in it for them?
Industry	Service providers (consumers)	They want to provide remote authentication services to decrease their costs and increase their level of service	SpeechXRays will provide them with a secure and convenient alternative to PIN/password, tokens and challenge questions.
	IT managers (workforce)	They want high security solutions that are adopted by their users (i.e. convenient)	
	Software developers	They need robust authentication modules for their applications	SpeechXRays will provide them with core services that can be re-used to develop their solutions
	Mobile device manufacturers (OEMs)	They ship devices carrying biometric sensors	SpeechXRays will provide them with a secure alternative to low-cost capacitive sensors
	Biometrics solutions suppliers	They develop biometrics solution for OEMs, service providers and consumers	SpeechXRays will provide new technology foundation for voice biometrics
Research	Biometrics researchers	They develop the next generation authentication methods	SpeechXRays will advance the state of the art in voice biometrics
	IT security and privacy researchers	They develop the next generation IT security and privacy frameworks	SpeechXRays will advance the state of the art in crypto-biometrics
Individuals	Consumers	They want convenient authentication solutions that preserve their privacy	SpeechXRays will use cancellable biometrics templates securely stored on the user device
	Workers	They want convenient authentication solutions that provide high security	SpeechXRays will provide them with a secure and convenient alternative to PIN/password, tokens and challenge questions.

Table 13: Targeted audience of the SpeechXRays project

2.2.2 Exploitation Plan Outline

WP8 Leader OT will use a specific exploitation methodology for EU-funded collaborative projects that will be the cornerstone of the project exploitation strategy. The method (Figure 9) is particularly well suited for Horizon 2020, as it has a major focus on market impact and is fully integrated with the compulsory periodic reviews, milestones, deliverables defined in the project

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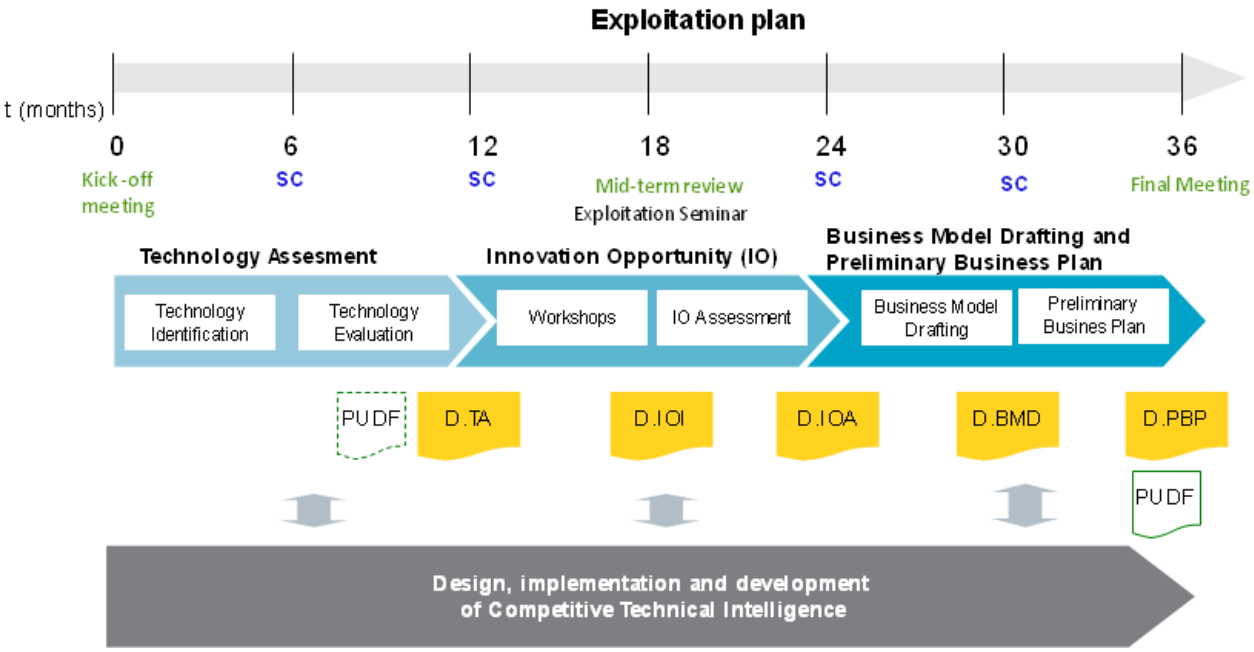


Figure 9: Overview of the exploitation methodology

The method is organized along two tracks. The first track is the elaboration process of a successful exploitation plan based on 3 discrete modules: Technology Assessment (TA), Innovation Opportunities (IO) and Business Plan (BP). The second track, running in parallel, is the development of a Competitive Technical Intelligence (CTI) that will interact with the 3 modules at all stages of the process.

The SpeechXRays Exploitation Manager is responsible for developing the exploitation plan and implementing the methodology, with the support of all project partners.

Technology Assessment (TA) Module
The module starts with the identification of technologies described in the DoW and extends it with in-depth technology evaluations including alternative technologies, markets, competitors, IPRs and related information.

Innovation Opportunities (IO) Module
The module defines the market segments targeted by the technologies listed at the previous stage. Therefore it must explore the applications and potential uses meeting the needs of a particular customer segment. This approach requires structured workshops where cross-domain expertise is required. It also includes interactions (focus groups, one to one meetings, and tradeshows) with target customer customers and industry experts.

Business Model Draft (BMD) and Business Plan (PBP) Module
The module start with generating a Business Model Canvas, a visual chart with elements describing the value proposition, infrastructure, customers, and financial elements of each Innovation Opportunity identified at the previous stage. The module also identifies the best exploitation form based on the nature of the results and its ownership structure (creation of spin-offs, products producing and sailing, licensing of products/services, patenting, etc.). IPR management is of crucial importance in this stage. Once the best Business Model Canvas have been selected, a Preliminary Business Plan is developed.

Depending on project result type, the partners foresee different exploitation strategies listed in Table 14.

Exploitation Strategy[50]	Voice recognition models	Face recognition models	Audio-visual synchrony models	Revocable encrypted templates	End-to-end Biometrics solution	Applications
OT	M,U,L,P	M,U,L,P	M,U,L,P	M,U,L,P	M,U,L,P	U,P
HB	M,U,L,P	M,U,L,P	M,U,L,P	M,U,L,P	M,U,L,P	U,P
SIV	U,P	U,P	U,P	U,P	U,P	U,P
TEC	U,P	U,P	U,P	M,U,L,P	U,P	U,P
EYE	U	M,U,L,P	M,U,L,P	U	U	U
FNET	M,U	M,U	M,U	M,U	M,U,L,P	U,P
IFIN	U,P	U,P	U,P	U,P	U,P	U,P
FORTH	U,P	M,U,L,P	M,U,L,P	U,P	U,P	M,U,L,P
UCL	U,L,P	U,L,P	U,L,P	U,L,P	U,P	U,P
TSP	U,L,P	U,L,P	U,L,P	U,L,P	U,P	U,P

Table 14: Exploitation strategy by partner in relation to the project result type

The SpeechXRays consortium has carefully selected industrial pilots that provide opportunities for technical and business *cross-fertilization*, either via business development activities, project dissemination or synergies with other research projects. Industries targeted for the pilots are not only interesting for their technical relevance, they also constitute springboards for a wider deployment and use of the technology:

- The pilots address large markets therefore the pilots have the potential to generate significant *interest from other stakeholders of these industries:* for example the e-Health pilot is focusing on a collaboration platform to manage osteoarthritis but can generate interest to support the patient-doctor interaction in any other healthcare domain.
- The industrial partners have significant international network therefore the pilots have the potential *to address other geographies* with the support of the relevant consortium member: for example OT is a market leader in security solutions for mobile devices and already serves 5,000 banks, 300 mobile operators and more than 100 governments, which will become prospects for the SpeechXRays technology.
- UCL is the Demonstrator leader allowing for more efficient *cross-fertilization* between the demonstrators.

2.2.3 Business Plan Outline

Preliminary business-plans have already been developed for the SpeechXRays technology (Table 15). Since voice biometrics solutions are not widely deployed in the industry targeted by the pilots, the consortium has analysed data from other industries where voice biometrics has already been deployed: banking.

The following data is extracted from a case study on Barclays supplied by Nuance[51]. Prior to the deployment of voice biometrics, more than 10% of legitimate clients were failing and 25% of fraudulent attempts were successful, using the legacy authentication process (PIN + security questions). Once voice biometrics was introduced, no fraudulent attempts were successful (note that transactions above 10,000 GBP still required security question in addition to the voice authentication). The successful authentication rate with passive voice biometrics was 95%, generating a 15% reduction in call times and a 3-4% reduction in operating costs for the bank.

SpeechXRays technologies can provide even higher benefits, with a successful authentication rate of 98% and no security question required due to a higher accuracy (EER of 1/100 or better)

[50] M=Making and selling results, U=Using results internally, L=Licensing results to third parties, P=Providing Services, Consultancy

[51] Barclays' voice biometrics case study accessed at http://www.nuance.com/for-business/by-solution/customer-service-solutions/solutions-services/customer-success/barclays-infographic/index.htm

GENERIC BUSINESS PLAN	
Products The solution will be declined in 3 variations • An end to end solution for turnkey implementation with customers • A development environment for customized implementation • A white label version for OEMs	**Product positioning** The solution will be positioned as an alternative to consumer-grade biometrics solutions embedded in mobile devices (face, voice, low-resolution fingerprint). It will not compete with industrial-grade biometrics used for law enforcement, border control (high-resolution fingerprint, iris, palm veins, etc.)
Market size and segmentation Goode Intelligence predicts that by 2017, there will be more than 990 M mobile devices shipped with fingerprint sensors, and 5.5 Bn users of mobile and wearable biometric technology around the globe (including other technologies than fingerprint sensors). The market for SpeechXRays is therefore comprised between 2Bn Euros (size of the consumer fingerprint biometrics) and 11Bn Euros (size of the total consumer biometrics market), with banking applications representing the largest category, and new applications emerging such as e-health.	**Go to market** The SpeechXRays solution will be marketed via three main channels: • Direct sales: technology providers (e.g. HB) will sell a turnkey end to end solutions to small and medium size customers • Channel sales: system integrators (e.g. SIV) will propose a customize solutions (and additional service) to large service providers and corporate customers • OEM sales: industrial partners (e.g. OT) will propose an OEM version of the solutions to mobile device manufacturers and telecom service providers
Competition Market leader: Nuance Emerging players: Sensory, Victrio, Agnitio	**Revenue forecast** The solution should be available at a cost of 2 EUR per user per year and reach 35M users within 10 years of project end, i.e. a turnover of 70M Euros per year, representing 4% of the size of the consumer fingerprint biometrics and 1% of the total consumer biometrics market.

Table 15: Generic (joint) business-plan for SpeechXRays

SPECIFIC BUSINESS PLAN FOR OTRTHUR TECHNOLOGIES	
Exploitable result description	Mobile Biometric Secure Authentication including: • Secure Element (eSE, SIM) • Biometric software for secure element • Biometric software for mobile • Credential management solutions.
Target market	Identity and Access Management (IAM) market, starting with • eHealth • Corporate Access Control • Government applications
Market size	The Identity and Access Management (IAM) market reached $4.4 billion in 2012, up from $4 billion in 2011 IDC anticipates that the overall market will increase to $6.9 billion in 2017, representing a 2012 – 2017 CAGR of 9.4%,
List of activities ad timetable for commercial use	End of project + 1 year: launch at “Cartes” or “Mobile World Congress”
	End of project + 2 years: early adoption by large customers and OEMs
	End of project + 5 years: mass market selling
Patents, trademarks	Support the branding of “My Voice is My Password”

Table 16: Specific (individual) business-plan for SpeechXRays

2.2.4 Knowledge Management and IPR

Dissemination and use of knowledge generated in the project is governed by the terms of the Grant Agreement and the terms of the Consortium Agreement. In order to make sure that these terms are followed, to avoid disputes and to facilitate business planning, the Steering Committee will maintain an IPR Directory throughout the lifetime of the project. This document will list all items of knowledge relating to the work of the project (both background know-how and results developed in the project), and make explicit for each item its owner, nature, status and dissemination and protection measures. The directory will be regularly updated, and distributed to all partners. It will form a key tool to enable knowledge management.

An initial version of the IPR directory will be created at the start of the project. However, at the stage of producing the proposal, the consortium has already considered what kind of strategy should be followed concerning IPR issues for the main results of the project, and reached preliminary agreement on this. The basic principle on which we are agreed is that research and development results must be available to a large audience to facilitate wide adoption of project results, while in the meantime having options in place for rewarding those that invested. The consortium's preliminary agreement is described in Table 17.

Initial agreement on IP and use rights	**Contributing partners**	**Consortium partners**
Encrypted biometric template database	Public (open access)	
Security and privacy mechanisms	Public (open access)	
Voice recognition models	IPR	Use rights
Face recognition models	IPR	Use rights
Audio-visual synchrony models	IPR	Use rights
End-to-end biometrics solution	IPR	Use rights

Table 17: IPR strategy related to result type

2.2.5 Open Access Strategy

SpeechXRays will fully embrace the open access policy of Horizon 2020 by providing on-line access to scientific information that is free of charge to the end-user and that is re-usable. In the context of this project, scientific information refers to peer-reviewed scientific research articles (published in scholarly journals) and research data (data underlying publications, curated data and/or raw data).

Open access to scientific peer reviewed publications has been anchored as an underlying principle in the Horizon 2020 and is explained in the Regulation and the Rules of Participation as well as through the relevant provisions in the grant agreement. The SpeechXRays consortium will use the OpenAire repository for peer-reviewed articles published by the consortium will ensure the largest possible impact among researchers, policy-makers and businesses. AS of March 2014, OpenAire already hosts over 19,000 open access publications, including 1147 for FP7-ICT and 73 for FP7-SECURITY, and is currently visited by over 1000 researchers per day.

Each consortium partner commits to deposit as soon as possible and at the latest on publication. Each partner will ensure open access to the deposited publication (via the repository) at the latest on publication, if an electronic version is available for free via the publisher, or within six months of publication (twelve months for publications in the social sciences and humanities) in any other case. Partner will also ensure access to the bibliographic metadata that identify the deposited publication (including the terms European Union (EU) and Horizon 2020; the name of the action, acronym and grant number; the publication date, and length of embargo period if applicable, and a persistent identifier). However, the partners will retain their copyright and grant adequate licences to publishers, based on Creative Commons licenses.

The project is not participating to the Pilot on Open Data, however, in the context of the digital era, the notion of publication increasingly includes the data underpinning the publication and results presented, also referred to as "underlying data". Partners will aim to deposit at the same time the research data needed to validate the results presented in the deposited scientific publications, into a data repository, and aim to make open access to this data. The SpeechXRays consortium will publish on already publicly available databases (such as Mobio, BioSecure, and NIST speaker data). Since the project will use cancellable and unleakable templates (biometrics cryptosystems), it will be possible to release such databases for the research community. **It will be the first time that such biometric databases are made publicly available for further research evaluation.**

2.2.6 Individual Dissemination & Exploitation Activities

To complement the join dissemination plan (section 2.2.1) and the join exploitation plan (section 2.2.2), Table 18 provides a **non-exhaustive list** of the **individual activities** planned by each partner.

Partner	Activities during project phase	Activities after project completion
OT	Present the project output at Cartes or Mobile World Congress where OT is exhibiting. Promote and evangelize during technical or scientific conference like the WorldID Congress. Support the standardization efforts towards ETSI or FIDO.	Sell the solutions to OT customers proving the efficiency of a model based on an end to end security reinforced by a management system allowing openness to other services. Build close commercial relationship between SpeechXRays partners and OT and act as an integrator or reseller for the consortium partners, leveraging OT's global presence.
HB	Publish 1 journal paper per year, and 2 conference papers or presentations per year for example in IEEE Transactions on Signal Processing and IEEE Transactions on Pattern Analysis and Machine Intelligence	Develop and sell a productized version of the SpeechXRays prototype to various end-users. Build close relationship with OT in order to leverage their worldwide network of customers and partners.
SIV	Present the project results to national cyber-security event such as DefCamp (annual event in Romania). Organize executive meetings with key Central European public authorities to evaluate their commercial interest.	Provide integration services for the SpeechXRays turnkey solution and develop a portfolio of public government customers in Central Europe. Establish a concept showroom for Central Europe at IFIN-HH.
TEC	Publish 1 Journal paper per year in top IEEE/Elsevier journal such as IEEE Knowledge and Data Engineering and 2 conference papers in major IEEE/ACM conferences. Involve at least 1 PhD and 1 MSc student.	Including the project findings in a book (to be published). Incorporate the project results in case studies presented in the Under Graduate and Post Graduate modules of City University London, where TEC personnel is teaching. Build a specific consultancy offering around the project results.
EYE	Involve 1 PhD candidate in the project. Publish 1 conference paper, for example at Mobile World Congress. Publish one article in relevant online industrial magazine per year, for example Multimedia tools and applications Journal.	Broaden academic presence of Realeyes as an industrial researcher in the field of emotion recognition. Include new improved emotion and cognitive state classifiers in main business product. Draw additional insights of advertisement performance from the newly developed classifiers and improve the business proposition for existing customers.
FNET	Disseminate the project results internally within FNET, as well as externally towards FNET customer (1.08M subscribers). Present the project results are relevant industry tradeshows, such as Digital Service Congress.	Investigate mid- and long- term commercial exploitation of the integrated platform will be investigated, as well as the exploitation of the individual software modules. Surveys selected subset of existing customers to refine go to market.
IFIN	Publish one journal paper during the period of the project and one conference paper per year. Involve at least one PhD student and one Master student in the project. Publish project news on IFIN website and websites of all projects which benefit directly from the improved security access system.	Depending on the results of the testing and calibration, roll-out the solution permanently within IFIN-HH for an installation with stringent security requirements. Serve as a demonstration environments towards other government organizations.
FORTH	Publish 1 journal paper per year, and 2 conference papers or presentations per year in	Evaluate spin-off possibilities for the commercial exploitation of the technology as

Partner	Activities during project phase	Activities after project completion
	relevant ICT/health open access (or hybrid) publications such as Journal of Medical Internet Research, Healthcare — Open Access Journal, International Journal of Health, Wellness and Society, International Journal of Medical Informatics.	part of the family of innovative products from FORTH (the Integrated Care Solutions - ICS) which are today in the process of commercialization and exploitation through participation in a number of National competitive tenders from Health and Social Care authorities in Greece.
UCL	Publish 1 journal paper per year, and 2 conference papers or presentations per year. Involve at least 1 PhD candidate in the project. Present at IEEE International Conference on Acoustics, Speech, and Signal Processing. This annual conference has about 1000 attendees.	Incorporate the project results in the training cursus of UCL and the Defence Academy of Cranfield University.
TSP	Publish 1 journal paper per year, and 2 conference papers or presentations per year, for example in Pattern Recognition and Machine Learning. IET Biometrics. Involve at least 1 PhD candidate in the project.	Include the project results in the institute's Master education programme (reaching 100 students per year)

Table 18: Individual dissemination and exploitation activity examples

2.2.7 List of communication and collaboration activities

The project will encourage the uptake of project results and the development of a partner ecosystem based on the communication and collaboration activities described below.

Academic dissemination

The dissemination of the project results to the scientific and academic audience will be done by publications in technical journals. The research project partners (FORTH, UCL, TSP) and some of the industrial partners (OT, HB) to publish articles in major open access technical journals related to signal processing (e.g. IEEE Transactions on Signal Processing biometrics. IEEE Transactions on Pattern Analysis and Machine Intelligence) and biometrics (e.g. IET Biometrics, International Journal of Biometrics). Peer-reviewed articles will be deposited within 6 months of their publication in European open access databases such as OpenAire (www.openaire.eu) and national open access databases such as Fraunhofer-Publica. The consortium will also favour journals part of the Directory of Open Access Journals. In total the project aims to publish 15 quality journal papers documenting the key project innovations and submit them to major open access scientific journals. An effective and natural way for academic dissemination is the use of project results in teaching and in the material of courses in universities. The project will generate course material regarding biometrics. The project will also provide subjects for thesis (Ph.D. and M.Sc.) at the research institutes involved.

Collaboration with other research projects or working groups

The project will seek cross fertilization with other European research projects. Please refer to section 1.3.3 for a list of national and international projects where there are already concrete opportunities for synergy, or adoption of project results, because of existing contacts from the consortium.

Industry events and scientific conferences

The outputs of the project will be also introduced to industry conferences as speaking engagements or booth exhibits, for example at World e-ID Congress Identity Services for Government, Mobility & Entreprise, Salon Cartes or Mobile World Congress where consortium partners have already scheduled activities (or concrete plans to do so). The consortium will also submit papers at various scientific conferences, such as IEEE International Conference on Acoustics, Speech, and Signal Processing, IEEE Global Conference on Signal and Information Processing (GlobalSIP), International Conference on Information Fusion, International Biometric Conference, IEEE International Conference of the Biometrics Special Interest Group (BIOSIG) and the Odyssey Speaker

Industry associations

The partners of the project belong to several industry associations (for example OT is part of the FIDO Alliance) and will be able to use them to disseminate the project results via newsletters, magazines and presence in international conferences not covered by the consortium partners. FIDO Alliance (Fast IDentity Online) is a non-profit organization formed in July 2012 to address the lack of interoperability among strong authentication devices as well as the problems users face with creating and remembering multiple usernames and passwords.

Specific activities targeting infrastructure operators

A further useful way forward to overcome these barriers is to encourage interest groups for the ecosystem who can share knowledge/ know-how and give information on support required. The consortium intends to pursue a series of activities focusing on ecosystem dissemination: online webinars organized to raise the awareness of various industries about the applications of the project results, and **industry-specific workshops** that will present the demonstrators and emphasize the various alternatives to access/license technology and knowhow develop in the project. In organizing these workshops and conferences, gender balance will be taken into account when selecting speakers, as we believe that this is an excellent means to reach out to both female and male participants.

Internet and social media

A project web site hosted at www.speechxrays.eu [52] will be developed where all public reports, project deliverables, events and articles will be published in order to stimulate dissemination. A specific area of the website will be dedicated to white papers. The project will leverage social medias (LinkedIn, twitter, other) to communicate the project results and will also target popular science programs and publications and mass media (TV, radio and newspapers) to present the project progress and results in a didactic way, in order to facilitate their publishing in the technology sections of general-interest media. The consortium will set up a dedicated LinkedIn Group and Twitter account for the project, in addition to the accounts already managed by the consortium partners.

Dissemination to the broader public

The project will also target the mainstream media as it is especially important to raise the public awareness around resource-efficient manufacturing. The consortium will also issue regular press releases at key milestones of the project and will make use of the CORDIS Wire service for major project result announcements.

[52] The domain names speechxrays.eu has been reserved on behalf of the consortium

3. Implementation

3.1 Work plan — Work packages, deliverables and milestones

3.1.1 Overall work plan structure

The work plan will be implemented by a multidisciplinary, gender-balanced team of scientists and entrepreneurs. Figure 10 summarizes the project structure, showing the names of the work packages (rounded rectangles) and key items exchanged between them (rectangles).

- **Technical Foundations (WP1-4):** conceive, design, implement and test the core technological components of the SpeechXRays approach.
- **Enabling Industrial Acceptance (WP5-6):** transform core technical results to a state suitable for deployment in an operational environment.
- **Exploitation, Dissemination, Standardization (WP7-9):** Carry out activities during the project, and planning activities beyond the project, to prepare for and bring about the promised impact (the use of separate WPs for different aspects of this reflects the importance placed on these activities; they will of course be carefully coordinated).

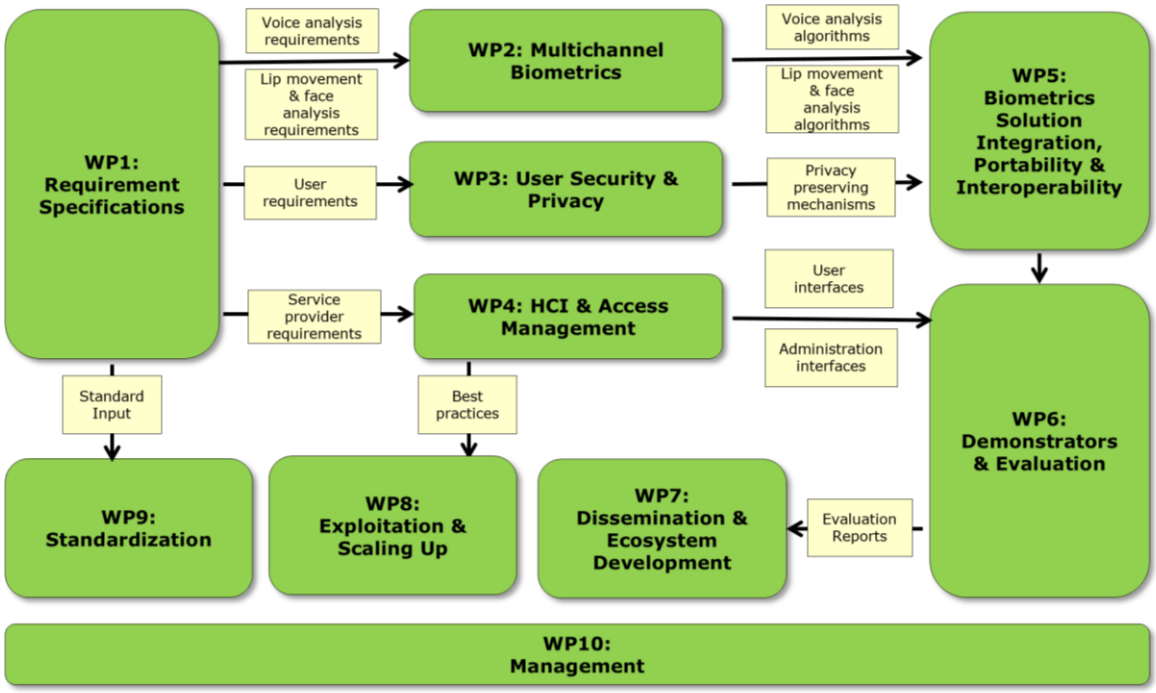


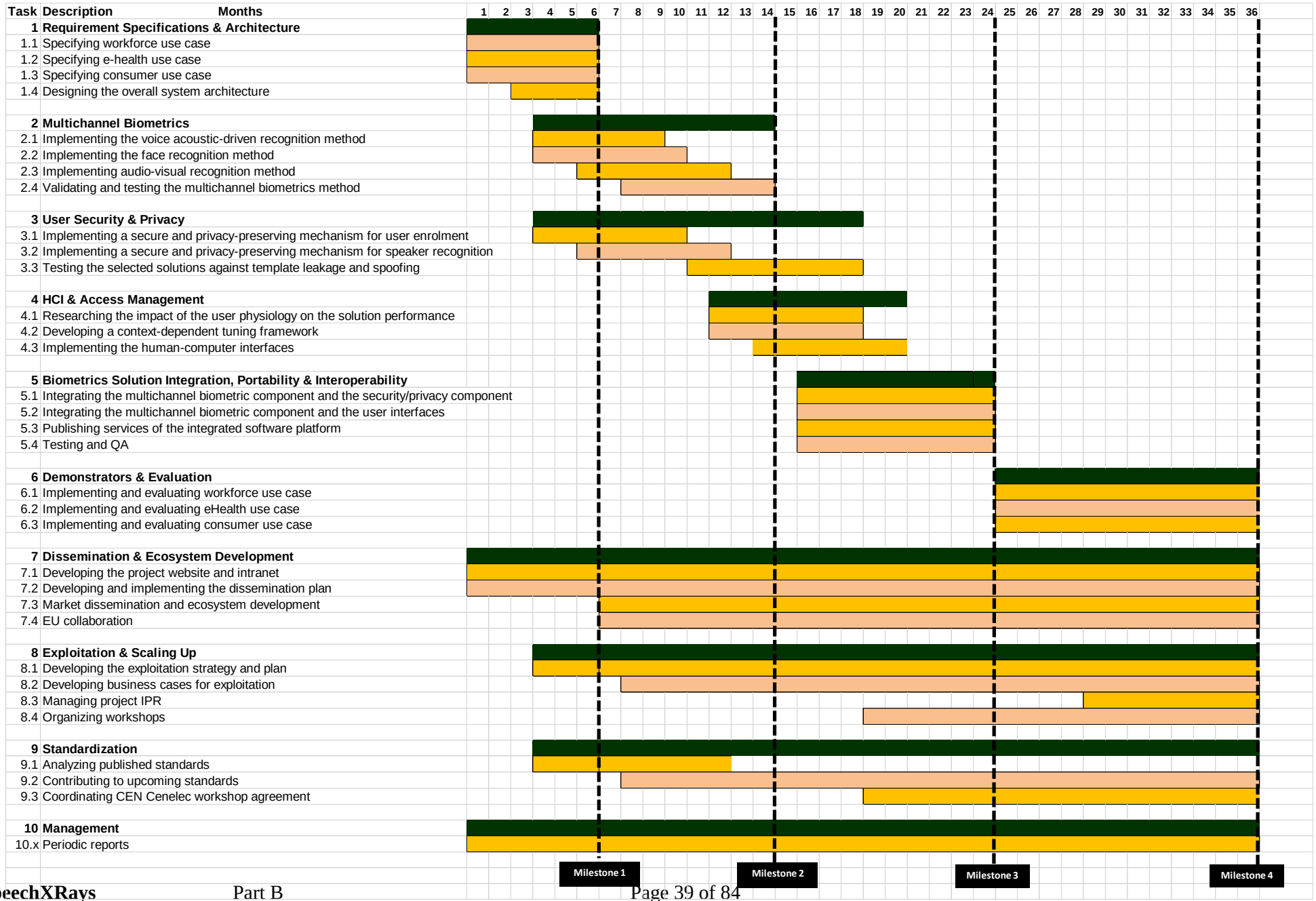
Figure 10: Project Overview PERT Chart

The GANTT chart (Figure 11) includes all tasks described in the WP

- The project duration will be 36 months.
- There are 4 main milestones cutting across all work packages
- Work breakdown into work packages is based on gathering related work, rather than on gathering tasks that occur at around the same time, therefore, some of the work packages run in parallel throughout the project.

3.1.2 Detailed work description

Figure 11: Gantt Chart



3.2 Management structure and procedures

3.2.1 Organizational structure, milestones and decision-making

This project will be carried out by a Consortium of 10 partners from 5 different EU Member States. The project work is divided into 10 work packages. These constitute the work breakdown structure of the project, gathering together the major groups of activities to be carried out. The overall management structure is depicted in Figure 12, with roles and responsibilities identified and summarised below.

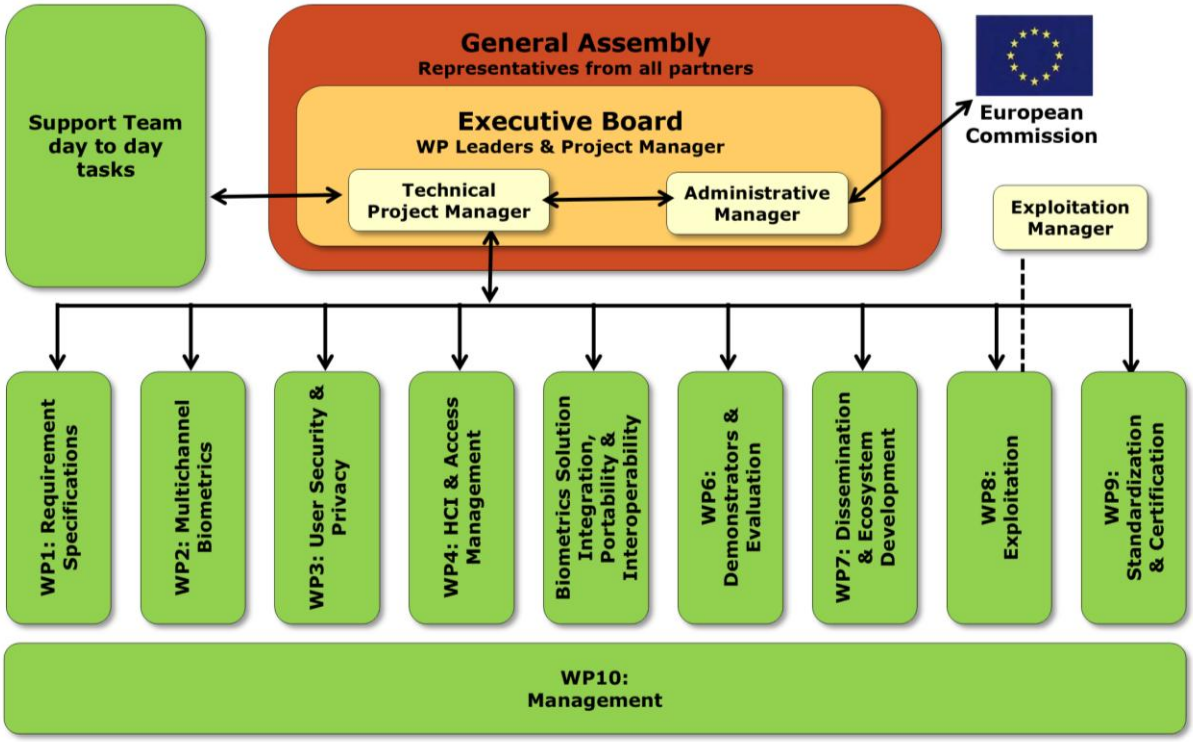


Figure 12: Project organizational structure

Table 19: List of project milestones

Decision-making

This section describes the most important mechanisms for reaching decisions (Table 20), in a Consortium with multiple partners, each with their own goals. The general principle will be to try to achieve decisions by informal means and consensus, using formal procedures such as voting only when essential. Nevertheless: *all* decisions which can have an impact on project progress (whether reached formally or not) will be documented, for visibility within the Consortium. Precise details of the remit of the various management bodies, and of voting procedures etc. are carefully defined in the *Consortium Agreement*.

Level	Decision mechanism	Escalate if:
Project	Verbal consensus only *Meetings*: regular; as needed	No consensus reached
Executive Board	Verbal consensus; vote if necessary Simple majority *Meetings:* Every 12 weeks	One partner insists

General Assembly	Voting mandatory; simple majority. *Meetings:* Every 12 months,	Intervention by the Commission, or legal action, is the only escalation possible; decision on this up to individual partners

Table 20: Decision-making mechanisms

Conflict management

Identification of any conflicts which arise in the project is the responsibility of all project participants. Any signs of disagreement between project participants should be notified to the work package leader or project manager (as appropriate), who should then instigate the conflict resolution procedure, escalating to higher levels only if necessary:

1. The manager should *separately* contact all parties either in person or by *telephone*, to identify the different viewpoints (it is important not to use email: that medium very often leads to a rapid escalation of disagreements). Based on a clarification of viewpoints, the manager should try to propose a solution. If one is achieved, it should be recorded in a short report; if not, no documents should be produced, and the problem escalated.
2. If level 1 fails, the matter should be taken up by the Executive Board (at a special meeting, if need be). At this level, all work should be in writing. If conflicts relate to matters which would normally be assessed as part of the annual reviews by the Commission, the views of the Commission should be sought.
3. If level 2 fails, a special meeting of the General Assembly should be called. Partner representatives will then be required to vote on the issue.

Project re-planning and change management

In an ambitious and dynamic project of this kind, changes to customer requirements are expected and will generate changes to the project plans. Handling changes in project plans will therefore be regarded as a normal part of project management, to be carried out without undue formalities.

Project progress will be continuously monitored, and where discrepancies between plans and progress are observed (or predicted), corrective actions will be initiated. In particular, the Executive Board will carry out *risk assessment* at their regular meetings. This involves identifying project risks and assessing their probability and the nature of the consequences should the risk be incurred. If the risk level is judged to be high, changes in project planning may be necessary. A set of project risks has already been identified (see Section 3.2.3). It will serve as the basis for risk assessment at the first meeting of the Executive Board, and will be continuously updated thereafter.

Decisions on any necessary re-planning of detailed tasks at the *work package level* will be made by the Work Package Leader, in consultation with all partners involved in the work package. Results should be reported to the Project Coordinator. *Project level* changes will be the responsibility of the Executive Board (except in the case of *major* changes). In addition to any reviews arising from regular risk assessment, the detailed project plan will be reviewed at least once per year, and revised if necessary. Certain types of re-planning may require the approval of the Commission, according to the terms of the *Grant Agreement*. It will be the responsibility of the Project Coordinator to contact the Commission regarding the matters.

Project re-planning which results in changes deemed to be *major* must be handled by the General Assembly, using voting procedures. Changes will be deemed to be major if any one partner protests about a proposed change, or automatically if the change involves:

- Modifications to the Consortium Agreement or to the management structures and principles
- Problems with the performance of any partner, or partner request to leave the Consortium
- Re-allocation of budget between work packages and/or partners

Implementation of major changes may necessitate a change in the overall project plan, detailed project plans or the work breakdown structure of the project. As explained above, the management structure of the project essentially follows the work breakdown structure of the project. The management structure can therefore adapt to changes in the work breakdown structure.

Innovation management

Innovation management is a process which requires an understanding of both market and the technical problems of the project, with a goal of successfully implementing appropriate creative ideas. The consortium will establish a task force to be led by WP9 Leader on innovation management with the duties below:

- Monitor and collect market needs and customer requirements on resource-efficient machining solutions
- Observe additional added-value which may be created during the project implementation.
- Identify any mismatch between the project values and market/customer needs.
- Bring necessary attentions to the Executive Board for decisions so as to respond to an external or internal opportunity.
- Implement the decisions into exploitation activities to seize the opportunity.

The innovation management of the project is both combined with the exploitation activities such as the 4 industry specific workshops, and scheduled as a standing agenda item of the regular Executive Board meetings. The consortium consists of both end-users and suppliers who will be actively involved in this task force of innovation management.

Quality assurance

The project will employ the following mechanisms for quality assurance in the project:

- A *Project Quality Handbook*, derived from experience in earlier projects, customized for this project and updated as required.
- Feedback from annual Commission reviews. Project management will foster an attitude where these reviews are treated as part of the project's QA, rather than as an adversarial assessment.

3.2.2 Management bodies and management skills within the project

Level	Management Body	Composition	Principal Responsibilities
WP	WP leader	One person, from partner leading the WP.	• Co-ordinate and report on progress of detailed work in the WP.
Project	Executive Board	Leaders + Project Manager.	• Make strategic decisions concerning project co-ordination, direction, and overall management and planning. • Project Risk Management.
	Project Management Team	Project Manager + Support Team (see details below).	• Implement decisions of the executive board and general assembly. • Assist all other management bodies. • Overall day-to-day project management.
	General Assembly	One representative of each partner.	• Strategic decisions on major changes. • Resolution of any major conflicts.

Table 21: Project governance bodies

OT will have the role of *coordinator* and have overall responsibility for management of the project, and for all liaisons with the Commission. OT has already been involved in a number of R&I projects under the national or EC frameworks, either as coordinator or contributor (Table 22).

Project acronym	Description	RTD programme	Role
IDEA4SWIFT	Automatic Border Control for Frequent Traveler	ITEA3	coordinator
SIMPATIC	Anonymous security function implementation on mobile	ANR (FR)	partner

LYRICS	Anonymous security function design	ANR (FR)	partner
MAS	Nanoelectronics for eHealth	ENIAC	partner

Table 22: Coordinator project experience

The administrative manager of SpeechXRays will be Jean-Loup Dépinay who has been involved in FP6 and FP7 EC-funded projects where he has been leading and managing several research work packages. The technical project manager of SpeechXRays will be David Horowitz from Horowitz Biometrics, who has vast domain experience in the field of biometrics in particular, and security and identity in general. Jean-Loup Dépinay and David Horowitz will be assisted by a support team, so they can concentrate on the real content of the tasks. The duties of the support team will include:

- Follow-up: check that progress reports, deliverables etc. are produced according to plan; alert the relevant managerial bodies to any discrepancies which arise.
- Advise project participants on the details of administrative and other data required in reports.
- Take care of all practical arrangements in connection with arrangements for meetings etc.
- Maintain an electronic infrastructure for ease of communication within the Consortium, and for controlled, shared access to project documents.

3.2.3 Risk management

This project implementation plan, produced at the start of the project, is subject to revision in the course of the project, in accordance with the procedures for project re-planning outlined in this section.

One of the main reasons that project re-planning may be necessary is as a result of regular risk assessment in the project (Figure 13). The initial list of risks here presented in Annex A Critical Implementation risks and mitigation actions is a start to this process; more detailed assessment of risks will be carried out regularly, based on practical experiences in running the project.

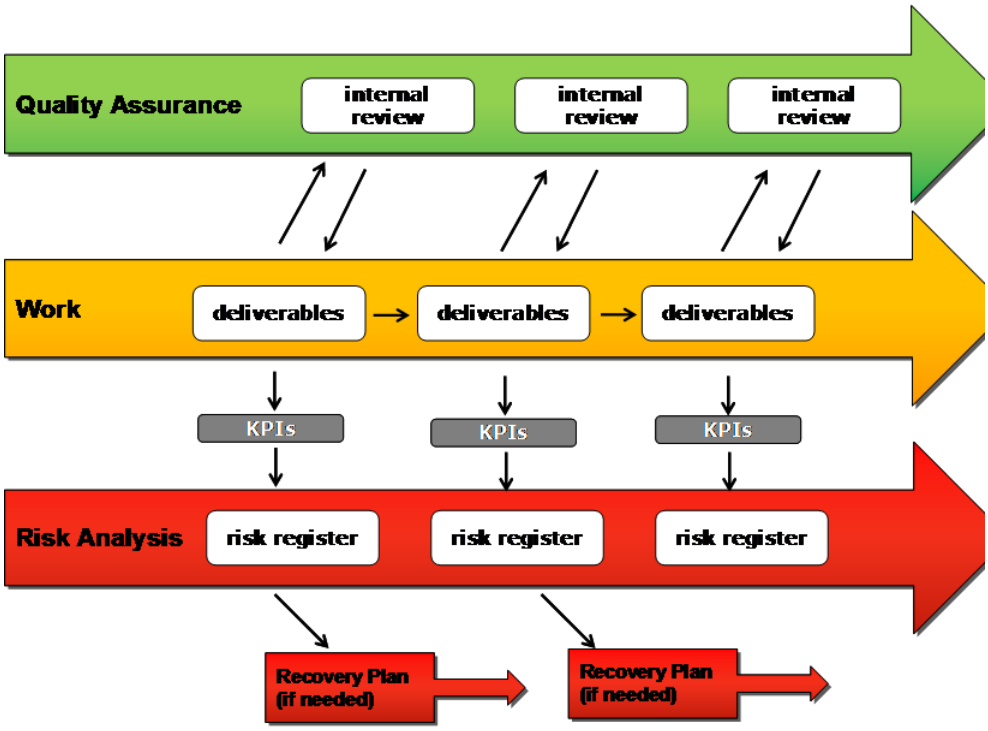


Figure 13: Risk management process

3.3 Consortium as a whole

The consortium was formed to put together a group of 10 organisations that complement each other in terms of background knowledge, technical competence, capability of new knowledge creation, business and market experience, and expertise in end-user domains where the project technologies and innovations can be readily exploited. The consortium consists of academic/research organisations, technology suppliers and end-users (Table 23). The partners have been selected that they can contribute most effectively to different work packages. The most competent partner in the core area of each work package has been chosen as the WP Leader, taking the geographical distribution of the partners into account.

Most partners also possess extensive knowledge and hands-on experience regarding the dissemination and exploitation of the project results:

- FORTH, UCL, TSP have experience using Open Access (e.g. deposit of peer-reviewed articles in the OpenAIRE repository, https://www.openaire.eu/) for wide dissemination of project results.
- OT, HB, SIV are experienced in industry-oriented research and technology development at TRL 6-8 Moreover, they all possess time-tested experience of commercialisation.
- OT has worldwide customers that can reach to the target industries globally for exploitation of the project results.
- OT, via its corporate communication team, has a strong project exploitation capability through face to face contact at presentations, industrial seminars and trade shows.

Category	Partner Name	Profile	Main Roles
Research	FORTH	Leading Greek research institute with expertise in Human Computer Interaction	WP4 Leader
	UCL	British university with expertise in image/video coding and signal processing	WP6 and WP9 Leader
	TSP	French research institute with expertise in biometrics and anti-spoofing	WP7 Leader WP2 and WP3 Support
Industrial Suppliers	OT	World leader in digital security solutions for the mobility space serving 5,000 banks, 300 mobile operators and more than 100 governments	Coordinator (WP10) Exploitation Manager (WP8)
	HB	British SME, early leader in acoustic driven voice feature based biometrics	WP2 Leader Technical Project Leader
	SIV	Romanian system integrator with an extensive EC project track record	WP1 and WP5 Leader
	TEC	British SME consultancy with expertise in IT security and privacy	WP3 Leader
	EYE	Estonian SME specialized in emotion recognition based on face video analysis	WP2 and WP4 Support
Industrial End users	FNET	Leading Greek triple-play ISP with over 1M customers	Consumer Pilot Leader
	IFIN	Romanian nuclear physics research centre	Workforce Pilot Leader
	FORTH	Leading Greek research institute serving as end-user with it Computational Medicine Lab	eHealth Pilot Leader

Table 23: Partner list

Table 24 highlight the complementarity and interdisciplinarity of the consortium

Skill/expertise/technology	OBE	HB	SIV	TEC	EYE	FNET	IFIN	FORTH	UCL	TSP
Acoustics		X							X	
Emotion recognition					X			X		
Signal processing		X							X	
Voice recognition	X	X							X	
Face recognition	X	X			X			X	X	X
Audio-visual analysis		X								X
Anti-spoofing										X
Revocable biometrics				X						X
Cryptobiometrics				X					X	
Privacy-preserving mechanisms	X			X					X	
Secure mobile applications	X									
Workforce applications			X				X			
eHealth applications			X					X		
Consumer applications					X	X				

Table 24: Illustration of the interdisciplinary character of the consortium

3.4 *Resources to be committed*

The allocation of person-month effort amongst the partners is summarised in Annex 2 according to their responsibilities and the resources estimated for achieving their assigned tasks. The staff effort in each WP is estimated based on the complexity of the tasks, complementarity of partner skills, inter-WP relationships and integration schedule between WPs. Project risk **R2** on "a research, industrial or software development partner exits the consortium" (Section 3.2.3) has been taken into account when assigning partners to WPs so that no single WP or task will be left incomplete. The overall effort of the project is **599.5 person months** over the 4 project years. The details of cost allocation per partner are summarised in Table 26: Other cost breakdown by partner.

Effort and Cost Allocation per Partner (Euros)										
	Effort		Costs							
Partner	Total person-months	Partner share of the total effort	**Direct cost of one person-month**	Direct personnel costs	Travel, equipment & other direct costs	Indirect costs	Sub-contracting	**Total costs**	Partner share of the budget	EC contri-bution
OT	104	17%	**8,350**	868,400	44,000	228,100	-	**1,140,500**	21%	798,350
HB	109	18%	**8,000**	868,000	39,000	226,750	-	**1,133,750**	21%	793,625
SIV	97	16%	**5,000**	482,500	52,715	133,804	-	**669,019**	13%	468,313
TEC	59	10%	**6,500**	380,250	50,500	107,688	-	**538,438**	10%	376,905
EYE	37	6%	**6,500**	237,250	39,000	69,063	-	**345,313**	6%	241,718
FNET	33	5%	**5,500**	178,750	36,000	53,688	-	**268,438**	5%	187,906
IFIN	20	3%	**4,500**	87,750	23,000	27,688	-	**138,438**	3%	138,438
FORTH	56	9%	**4,000**	222,000	21,000	60,750	-	**303,750**	6%	303,750
UCL	48	8%	**5,072**	290,920	21,000	77,980	-	**389,900**	7%	377,400

TSP	41	7%	**7,700**	311,850	21,000	83,213	-	**416,063**	8%	416,063
TOTAL	599.5	100%		3,927,670	347,215	1,068,721		**5,343,606**		4,102,467
% by cat				73.68%	6.51%	19.81%			SME	29%

Table 25: Project effort breakdown by cost type and partner

The resources are described in the following main categories:

- *Direct personnel cost.*
- *Other direct cost.* This category includes travel, equipment and other goods and services.
  - Travel budget is reserved for each partner to attend project meetings, workshops, setting up demonstrators, and other dissemination and exploitation events over the 3-year project period. The average expense for one 3-day trip in Europe costs has been estimated between 1500 and 1750 Euros depending on the partner with 4 person-trips per year for a regular partner, 6 person-trips per year for a WP leader and 8 person-trips per year for the coordinator.
  - A equipment budget between 5,000 and 25,000 Euros has been allocated to partners for sourcing hardware and software equipment required (additional details are provided in Table 26 when "other direct cost" exceed 15% of the "personnel cost")
  - A budget of 15,000 Euros has been reserved to FNET to purchase small gifts that will be given to FNET users involved in the pilot (although the unit cost of the gift is small – 15 Euros per user for 1000 users, it will be sufficient to get people motivated to try the new authentication service)
  - A budget of 3000 Euros for the financial audit is are reserved for those partners whose requested fund from EU is over 325,000 Euros.

Finally, Table 26 shows other direct costs and provides specific details when they exceed 15% of the personnel costs (as per H2020 rules).

Partner	Equipment	Travel	Other	Sub contracting	Comments for other costs > 15%
OBE	5,000	36,000	3,000		
HB		36,000	3,000		
SIV	22,715	27,000	3,000		
TEC	16,000	31,500	3,000		
EYE	18,000	21,000			12 trips @1750 EUR, cloud computing capacity for emotion analysis computation @0.5k EUR per month for 36 months
FNET		21,000	15,000		12 trips @1750 EUR, corporate gifts for trial users @15 EUR per unit
IFIN	5,000	18,000			12 trips @1500 EUR, equipment required for physical access control trial (secure door @4500 EUR + embedded tablet/camera @500 EUR
FORTH		21, 000			
UCL		18,000	3,000		
TSP		18,000	3,000		
Total	**66,715**	**247,500**	**33,000**		

Table 26: Other cost breakdown by partner

4. Members of the Consortium

4.1 Participants

Nb	Acronym	Participant legal name	Type	Country
#1	OT	Oberthur Technologies	Industrial	France
#2	HB	Horowitz Biometrics	Industrial/SME	UK
#3	SIV	SIVECO	Industrial	Romania
#4	TEC	Tech Inspire	Industrial/SME	UK
#5	EYE	RealEyes OÜ	Industrial/SME	Estonia
#6	FNET	FORTHNET	Industrial	Greece
#7	IFIN	IFIN-HH	Research	Romania
#8	FORTH	Foundation for Research and Technology - Hellas	Research	Greece
#9	UCL	University College London	Academic	UK
#10	TSP	Institut Mines-Telecom / Telecom SudParis	Academic	France

Partner 1: Oberthur Technologies SA (OT)	

The organization
OT is a world leader in digital security solutions for the mobility space. OT has always been at the heart of mobility, from the first smart cards to the latest contactless payment technologies which equip millions of smartphones. Present in the Payment, Telecommunications and Identity markets, OT offers end-to-end solutions in the Smart Transactions, Mobile Financial Services, Machine-to-Machine, Digital Identity and Transport & Access Control fields. With 6000 collaborators worldwide, OT is a recognized and highly regarded global leader in digital security solutions.
Relevant skills/experience/technologies
OT has technical expertise in the development of embedded secure software, secure devices and identity documents, and associated server based solution operated by clients in-house or in managed services. OT brings a unique industry positioning serving 5,000 banks, 300 mobile operators and more than 100 goverments. OT's new initiative "My Voice is My Password", recently launched at the Mobile World Congress 2014, will be one of the key exploitation tracks for the SpeechXRays project.
Role in the project
OT is the project coordinator and will lead WP8 Exploitation & Scaling Up and WP10 Management

Key personnel
Jean-Loup Dépinay (M) is program manager in charge of the collaborative R&D projects of Oberthur Technologies and he has coordinated or participated to 15 projects funded by French or European programs (FUI, ANR, Eniac...) As Java Card OpenPlatform Architect, he has architected and managed several Java Card platforms which have been deployed worldwide. He was also responsible for developing Java Card security improvements. Mr. Dépinay is currently a member of the Java Card Forum. Mr. Dépinay has been an active participant in the GlobalPlatform Card Committee since the very beginning of GlobalPlatform and was elected to the Board of Directors in 2008
Emmanuelle Dottax (F) has been working in the field of cryptography and secure implementations for more than ten years. She holds a MSc in Cryptography and Discrete Mathematics, and was first involved in the NESSIE European project with Ecole Normale Supérieure, where she took an interest in embedded implementations and physical attacks. She then continued studying security of implementations as a member of the Security Team of Morpho. She has been managing the Crypto Group of Oberthur Technologies for 5 years before becoming a Security Architect. She holds a strong expertise in embedded security, cryptographic protocols and implementation of cryptographic algorithms. She has published several scientific papers in international conferences and is co-inventor of more than 20 patents
Nicolas Bousquet (M) has been working for 7 years for smart card industry in software design and development. In Oberthur Technologies, he is an embedded developer engineer. He has been involved in the development of Java Card 3.0 Connected Edition, and participated to the definition of its specification. He also handles internals projects such as prototyping innovative devices. He is now involved in mobile security dealing with emerging technologies such as Trusted Execution Environment. He participated to some funded collaborative projects closely linked to Java Card: Inspired, Mecanos, and is currently involved VEADISTA funded projects.

Relevant publications/patents/products/services

OT Digital Identity Solutions: with more than 100 customer applications worldwide, backed by extensive experience of smart card production and high-security printing, OT offers a broad range of identity solutions for all types of traditional and electronic document, from passports and national identity cards to driving licences, access badges, health cards, residency permits and visas. OT envisions and designs the products for tomorrow's identity market: simpler and more secure for users, these identity documents are developed in response to the needs and expectations of citizens for mobility and data protection.
Dottax, E., Giraud, C., Rivain, M., & Sierra, Y. (2009). On second-order fault analysis resistance for CRT-RSA implementations. In Information Security Theory and Practice. Smart Devices, Pervasive Systems, and Ubiquitous Networks (pp. 68-83). Springer Berlin Heidelberg.
Rivain, M., **Dottax, E.,** & Prouff, E. (2008, January). Block ciphers implementations provably secure against second order side channel analysis. In Fast Software Encryption (pp. 127-143). Springer Berlin Heidelberg.
Bringer, J., Chabanne, H., & **Dottax, E.** (2006, June). HB^+^+: a Lightweight Authentication Protocol Secure against Some Attacks. In Security, Privacy and Trust in Pervasive and Ubiquitous Computing, 2006. SecPerU 2006. Second International Workshop on (pp. 28-33). IEEE.
Dottax, E. (2002). Fault attacks on NESSIE signature and identification schemes. Public report, NESSIE, 284-285.

Relevant research projects
IDEA4SWIFT is and ITEA3 project focusing on identity management, secure documents, interoperable exchange and citizens authentication for worldwide interconnection of frequent travellers.
SIMPATIC is a national French research project funded by ANR providing the most possible efficient and secure hardware/software implementation of a bilinear pairing in a SIM card.
LYRICS is a national French research project funded by ANR focusing on lightweight privacy-enhancing cryptography for mobile contactless services.
MAS is an ENIAC project developing a secure communication platform and nanoelectronics circuits for health and wellness applications to support the development of flexible, robust, safe and inexpensive mobile AAL systems, to improve the quality of human life and improve the well-being of people.

Existing infrastructure
OT has 50+ sales offices and 35+ service centers, supported by 10 R&D centers.

Does the participant plan to subcontract certain tasks	N
Does the participant envisage that part of its work is performed by linked third parties	N
Does the participant envisage the use of contributions in kind provided by third parties	N

Partner 2: Horowitz Biometrics (HB)	HOROWITZ BIOMETRICS

The organization

Horowitz Biometrics is an early leader in acoustic driven voice feature based biometrics. The voice biometrics technology is based on 20 years of research and development. The unique solutions are a ground-breaking development of voice acoustic analysis for user authentication and identification within a flexible multichannel framework. The unique proposition provides reliable and state of the art biometric solutions enhancing user experience and solving the identity assurance crisis. The company's mission is to harness the power of voice acoustics to transform the voice biometrics technology.

Relevant skills/experience/technologies

The team has with strong technical expertise and research and development experience with background in voice technologies, and specifically speaker identification and automatic speech recognition. The company has also directed several research projects in the field of voice biometrics, such as VoiceID, a project funded by the US Office of Naval Research (ONR), during which the company was able to mature the technologies used in SpeechXRays from TRL3 to TRL6.

Role in the project

Horowitz Biometrics is the technical project leader and will lead WP2 Multichannel Biometrics

Key personnel

Dr David Horowitz (M), Founder and CTO, has led a career as a C-Level Manager, Entrepreneur and Scientist. He is an industry expert in multi-channel biometrics, voice identification (speaker recognition), conversational personal assistants and biometrics solutions architecture. Dr. Horowitz has worked with U.K. start-up companies on the full product development life cycle. He has been instrumental helping companies transform their ideas and concepts into usable technology and working deployed products. As a scientist, Dr. Horowitz is an often cited leader in the field of Artificial Intelligence methods based on Brain Science and Cognition; as well as the human perception of sound, acoustics and signal processing.
He has won the approval of $26M of contracts for auditory cognition and computer science research, including €6.3M from the European Union in 2001. His research in voice biometrics began while he was a graduate student at the Massachusetts Institute of Technology (M.I.T.) where he held several roles over nearly a 9 year period. Dr. Horowitz is the author of 28 first rate peer reviewed publications and either the principal or co-inventor of 9 patents (8 awarded; one pending).

Dr. Hari Krishna Maganti (M), CIO, brings over 15 years of technical expertise and experience in voice technologies. Prior to Horowitz Biometrics, Hari has been responsible for leading the development of S-voice (Samsung personal voice assistant) at Samsung Electronics. He had been a active researcher engaged in four major EC projects working across premier research institutes in the world including the Indian Institute of Science (Bangalore, India), the IDIAP Research Institute (Switzerland), University of Ulm (Germany) and Fondazione Bruno Kessler (Italy) resulting in several international patents, publications including a best paper award. He is an active member of IEEE, IETE, CMI and program committee member and reviewer of several international conferences and journals. Hari has excellent industry experience which includes working across different application domains and significant contributions in the areas of algorithm design, software development and hardware implementation. His strong technical and management skills enable him to drive a strong product development lifecycle, including design, implementation, integration, and testing on various platforms.

Dr Gérard Chollet (M), CSO, studied Linguistics, Electrical Engineering and Computer Science at the University of California, Santa Barbara where he was granted a PhD in Computer Science and Linguistics. He taught at Memphis State University and University of Florida before joining CNRS. In

1981, he was asked to take in charge the speech research group of Alcatel. In 1983, he joined a newly created CNRS research unit at ENST. The group contributed to a number of European projects such as SAM, ARS, FreeTel as well as national projects. In 1992, he was asked to participate to the development of IDIAP, a new research laboratory of the `Fondation Dalle Molle' in Martigny, Switzerland. IDIAP contributed to SpeechDat, M2VTS and other European projects. From 1996 to 2012, he was full time at ENST, managing research projects and supervising doctoral work. Funding was secured from such projects as Eureka-Majordome and MajorCall, NoE-BioSecure, Strep-SecurePhone, IP-Companion@ble, AAL-vAssist, FET-ILHAIRE. CNRS decided in july 2012 to grant him an emeritus status. He has supervised over forty doctoral thesis.

Relevant publications/patents/products/services
"The Quantal Speech Recogniser", Sole Inventor, **Horowitz, D.M.** (May 22, 2011) – pending.
Hueber, T., Benaroya, E. L., **Chollet, G.,** Denby, B., Dreyfus, G., & Stone, M. (2010). Development of a silent speech interface driven by ultrasound and optical images of the tongue and lips. Speech Communication, 52(4), 288-300.
Horowitz, D.M. and Hodges, J.: Short Proceedings and Monograph - Towards a Research Agenda for the Next Decade on Speech and Multimodality. July, 2007. This project involves an international workshop and a survey of the current state of the art in multimodal technology and speech recognition.
Koreman, J., A. C. Morris, D. Wu, S. Jassim, H. Sellahewa, J. Ehlers, **G. Chollet** et al. "Multi-modal biometric authentication on the SecurePhone PDA." (2006).
"Automatic prosody markup for TTS", Co-Inventor **Horowitz, D.M.**, Vox Generation Ltd, July, 2001. Applies traditional speech science (formant bandwidth and open quotient) as well as Natural Language Processing (word chunking, ToBI tone prediction at phrase boundaries).

Relevant research projects
VoiceID: an early stage research project funded by the **US Office of Naval Research** focusing on Human Identity Verification from Voice Identification based upon the Individual Characteristics of the Human Vocal Tract.

Existing infrastructure
IT infrastructure including hardware workstations and software licenses required for software development.

Does the participant plan to subcontract certain tasks	N
Does the participant envisage that part of its work is performed by linked third parties	N
Does the participant envisage the use of contributions in kind provided by third parties	N

Partner 3: SIVECO Romania SA (SIV)	

The organization

SIVECO Romania SA is a private shareholder company, established in 1992, with over 1000 employees, located in Bucharest, Romania. During its twenty years of existence, SIVECO has become one of the most important Romanian providers and software integrators of Enterprise Resource Management License and Maintenance, eLearning, eGovernment, eHealth, eBusiness, eAgriculture, eCustoms solutions and turnkey projects acting both on the internal and international markets. Moreover, SIVECO has gained a solid reputation on international markets by developing successful projects together with several international companies, collaboration that has blossomed into genuine partnership over the years. SIVECO provides all services on the whole life cycle of the information projects: analysis of users' requirements, design, development, testing, implementation, end-users training and technical assistance, system maintenance. SIVECO has developed and currently are running some of the largest and most complex, national-wide information systems in Romania, in different domains: Education, Agriculture, Health Insurance, Customs, Nuclear and Social Security. Throughout the time, the company's activity and the solutions developed have been awarded with over 180 national and international prizes.

Relevant skills/experience/technologies

SIVECO Romania SA offers a new approach in computer based education for both educational and enterprise sectors, by leveraging the power and flexibility of its eLearning solutions. Their successful references include very complex projects, as for example, the introduction of the AeL eLearning platform in the Romanian pre-university education; providing an integrated information system for large national companies, etc. SIVECO is also a member of Health Level Seven, that is one of several American National Standards Institute (ANSI) - accredited Standards Developing Organizations (SDOs) operating in the healthcare arena. SIVECO has developed and implemented solutions for large government customers: The National Health Insurance House (CNAS) in Romania; The Ministry of Health in Bulgaria; Nepenthes Group France; The Ministry of Health in Croatia (HZZO).

Role in the project

SIVECO will lead WP1 Requirement Specifications & Architecture and WP5 Biometrics Solution Integration, Portability & Interoperability

Key personnel

Ms. Monica FLOREA, PhD (F) currently acts as Head of the European Projects Department and has been leading SIVECO participation in FP6 projects (ALIS, LD-CAST, P. Cezanne), FP7 (TERENCE, Eurocancercoms), ITEA2 (GUARANTEE; TWIRL) and LLP (RENOVA, COMAVET). Her duties include the coordination of SIVECO projects co-financed by European Commission and collaboration with national and international bodies in the framework of European Union programs. She has two degrees from University "Al.I Cuza" of Iasi, Computer Science and Finance and Banks, an MSc - University Aix Marseille II and a PMP certification. She is coordinating the NESSI Romania initiative. She is also Project Manager in many European projects, responsible for the management, Quality Assurance and Risk Management Strategy.

Prof. univ. Traian IONESCU (M) is currently a Research and Development Manager and CEO's Adviser in SIVECO Romania. He holds a Ph.D. in Systems Science. His professional experience is covering the fields of eSecurity, eHealth, and eLearning. He demonstrates a high level of expertise in security of information and person, based on biometric characteristics (algorithms for optimising the relation between False Acception Rate (FAR) and False Rejection Rate, depending on the application type) and also in the production and management of passports and drivers licenses (CTO in projects for Ethiopia and The Ivory Coast). He has collaborated with The Ministry of Defence from Israel by developing and implementing a monitoring surveillance systems for flying objects and also for increasing the security in high sensitive areas (i.e. Tel Aviv diamond stock exchange). He has also collaborated with International Aviation Safety Assessment Program – IASA in the field of security boarding pass. He has

high teaching and research qualification, having more than 20 years experience of working as a research manager. He has chaired the Department of Control and Industrial Informatics, Faculty of Control and Computer Science, UPB, for 18 years (from 1990 till 2008). He has also occupied the position of project team member in over 60 research projects, and Project Manager in most of them (around 50). He has been involved in many national and European R&D projects developed by SIVECO, such as Linked2Safety– A Next Generation, Secure Linked Data Medical Information Space For Semantically – Interconnecting Electronic Health Records and Clinical Trials Systems Advancing Patients Safety in Clinical research (FP7), ASPECT (ICT PSP), EduTubePlus (ICT PSP), RENOVA (LLP).

Ionut ARSENE (M) is currently Project Manager for Customized Applications Department. He has a Diploma of Engineer in Biotechnical and Ecological systems from the Faculty of Engineering of Biotechnical Systems – University "Politehnica" Bucharest, a Master Diploma in Machines Structure and Integration from the Faculty of Engineering and Management of Technological Systems – University "Politehnica" Bucharest, and a Long Postgraduate Ph.D. from the Faculty of Engineering of Biotechnical Systems – University "Politehnica" Bucharest. He also attended many training courses like: "Business process modelling, analysis and design", "Business Analysis", "Presentation Skills", "Project Management Basics and Advanced Seminar". His main activities and responsabilities include coordinating of implementation projects for SIVADOC product - Document management system and workflow, programming / developing, consultancy, technical assistance and maintenance services for software applications and web design and programming.

Relevant publications/patents/products/services
Anca Daniela Ionita, Monica Florea, and Lucian Jelea. Correspondence between Multiple Views in a SOA Trans-National Business System, Proceedings of the World Congress on Engineering. Vol. 1, pp. 493-498, 2009.
Anca Daniela Ionita, Alessandra Catapano, Stelian Giuroiu and Monica Florea. Service oriented system for business cooperation, Proceedings of the 2nd International Workshop on Systems Development in SOA Environments, ACM Press, pp13-18, 2008
Lloyd Kamara, Brendan Neville, Jeremy Pitt and Daniel Ramirez-Cano, Rares Chiriacescu, Liliana Dobrica, Monica Florea and Alexandru Szoke. Regulatory Compliance and Alternative Dispute Resolution in e-Societies. IADIS International Conference e-Society, pp321-328, 2008.
Alexandru Szoke, Sorin Portase, Rares Chiriacescu and Monica Florea. Web Service Execution and Monitoring in Integrated Applications in Support of Business Communities (SEMA2B), Proceedings of the 17th International Conference on Information Systems Development, Paphos, Cypru, pp48-50 (ISD 2008).

Relevant research projects
Linked2Safety (FP7-HEALTH) A Next-Generation, Secure Linked Data Medical Information Space For Semantically- Interconnecting Electronic Health Records and Clinical Trials Systems Advancing Patients Safety In Clinical Research.

Existing infrastructure
SC SIVECO Romania SA has a strong ICT Research Infrastructure: a network and optical fiber high speed Internet connection, a data centre (routing servers, storage servers, database servers), network infrastructure and wireless transmission systems, desktop PCs (Intel®CoreTM i3-3240 3.40GHz, 4GB, 1TB, nVidia GeForce GT620 2GB, Free DOS), laptops (HP EliteBook 8540w, Intel Core i7: i7-620M / 2.66 GHz, 8GB RAM DDR3, 500GB HDD / 7200rpm, 1GB Nvidia Quadra FX 1800M).

Does the participant plan to subcontract certain tasks	N
Does the participant envisage that part of its work is performed by linked third parties	N
Does the participant envisage the use of contributions in kind provided by third parties	N

Partner 4: Tech Inspire Ltd (TEC)	

The organization
Tech Inspire offer technical support in both Engineering and Information Technology (IT) disciplines on the basis of short projects (consultancy) and longer term research collaboration. The experience gained by our team; working actively in a wide range of research and commercialisation projects in the last fifteen years and jointly with key industries and research organisations, is the main asset of our business. Currently, Tech Inspire employs six researchers from different computer science backgrounds focusing mainly on the security and privacy aspects of information infrastructure, mobile computing and Cloud computing. The researchers are internationally known in the area of identity management and privacy preserving data classification in the encrypted domain. The company has recently been focusing on developing novel techniques for mobile phone user authentication based on the mobile behavioural attributes. The researchers are also actively using novel data fusion techniques to correlate similar mobile user behavioural features for authentication. The researchers have expertise in privacy preserving data mining techniques which are critical in today's online marketplace. Our support starts from early stage of developments ranging from technical consultation for the proof of concept to the development of new software and hardware systems.
Relevant skills/experience/technologies
Tech Inspire has expertise in the areas of information security, mobile data privacy and data fusion, cloud computing service optimisation based on trust and risk. Tech Inspire has pioneered hormormophic encryption techniques to analyse biometric features in the encrypted domain. Tech Inspire will provide the project with (i) Security Management (ii) Privacy preserving authentication techniques (iii) Multi-modal data fusion
Role in the project
Tech Inspire will lead WP3 User Security & Privacy.

Key personnel
Professor Muttukrishnan Rajarajan (M) founded the Mobile Networks and Security Research Group in 2003 at Tech Inspire UK. He has led several research projects in the area of security and privacy in mobile networks, cloud computing, social media analytics, identity management and healthcare. He is currently leading a UK Government's digital government activity in the area of identity management where he is defining the required personal biometric attributes for different levels of security. In addition to this he is leading a major UK-India research project in the area of mobile healthcare management for depression and obesity management where he is exploiting the possibility of using voice biometrics. He was also part of the OPTIMIS FP7 project on Optimised Cloud Services. He is currently working with Blackberry to protect the app space using blackberry emulators in the Cloud. He regularly advises British Telecom on security and privacy issues in the mobile and cloud environments. He has published more than 200 scientific journal and conference papers and an author of 2 books on mobile security and privacy.
Dr. Suresh Babu Veluru (M), Research Fellow worked previously in the Faculty of Computer Science at the University of New Brunswick (Canada), and in the Artificial Intelligence Group, Department of Computer Science at the University of York (UK). Dr. Veluru has been working heavily on the development of fuzzy node weighted tree based similarity algorithm for e-Health Environment. His main

expertise and publications in the last 10 years are in the areas of Pattern Recognition and Data Mining, Natural Language Processing and text mining and Artificial Intelligence and Privacy Preserving Data Mining.
Dr Rahul Yogachandran (M) is an expert in the area of privacy preserving data analytics. He has recently developed a new privacy model based on the attribute based encryption techniques whereby t he users can upload the data to a central server on a privacy protected manner for disease diagnosis. He has published more than 15 papers in the area of e-health and recently has been working with Blackberry UK to understand the malware apps in the Android and Blackberry market place. He will contribute to the privacy preserving data analytics part of the project. He has also unique expertise in analysing for emotional patterns within encrypted facial images. Identified at Rahulamathavan Y. in publications.

Relevant publications/patents/products/services
Rahulamathavan Y, Veluru S, Phan R, Chambers J and **Rajarajan** M (2014), Privacy-Preserving Clinical Decision Support System using Gaussian Kernel based Classification, IEEE Journal of Biomedical and Health Informatics.
Li, F., **Rahulamathavan**, Y. and **Rajarajan**, M. (Sep 2014). Lightweight Static and Dynamic Attributes Based Access Control Scheme for Secure Data Access in Mobile Environment. 39th IEEE Conference on Local Computer Networks, Sep 2014, Edmonton, Canada
Rahulamathavan, Y., Moonsamy, V., Batten, L., Shunliang, S. and Rajarajan, M. (Jul 2014). An Analysis of Tracking Service Settings in Blackberry 10 and Windows Phone 8 Smartphones. 19th Australasian Conference on Information Security and Privacy (ACISP), Jul 2014, Wollongong, Australia
Fahad, L.G., Tahir, S.F. and **Rajarajan**, M. (Aug 2014). Activity Recognition in Smart Homes using Clustering based Classification. 22nd IEEE International Conference on Pattern Recognition (ICPR), Aug 2014, Stockholm, Sweden.
Shittu, R., Healing, A., Ghanea-Hercock, R., Bloomfiled, R. and **Rajarajan**, M. (Sep 2014). A New Metric for Prioritising Intrusion Alerts Using Correlation and Outlier Analysis. 39th IEEE Conference on Local Computer Networks, Sep 2014, Edmonton, Canada

Relevant research projects
OPTIMIS is an FP7-ICT project aimed at enabling organizations to automatically externalize services and applications to trustworthy and auditable cloud providers in the hybrid model.
TRUMP is a collaborative UK-India project, investigating mobile technology as a trusted platform for deploying innovative, healthcare interventions in rural areas.
UID is national research project funded by the UK Engineering and Physical Sciences Research Council (EPSRC) funded project that links information pertaining to human characteristics in real and virtual worlds in order to better understand and manage the uncertainties inherent in establishing human identity in different geographic locations.
Future of Identity is a Network of Excellence project funded by the UK Engineering and Physical Sciences Research Council (EPSRC)
Identifying and Modelling Victim, Business, Regulatory and Malware Behaviours in a Changing Cyberthreat Landscape is a research project funded by the UK Engineering and Physical Sciences Research Council (EPSRC)

Existing infrastructure
Cloud setup, mobile Security test bed, in-house data mining tools, Android lab

Does the participant plan to subcontract certain tasks	N

Does the participant envisage that part of its work is performed by linked third parties	N
Does the participant envisage the use of contributions in kind provided by third parties	N

Partner 5: Real Eyes OÜ (EYE)	

The organization

Realeyes specialises in the quantitative collection of emotional response data online via conventional webcams. Based on Paul Ekman's theory of the cross-cultural universality of emotions and their corresponding facial expressions, our software can measure and analyse respondent's reactions to a variety of stimuli using cutting-edge facial coding technology, and providing crucial consumer insight. Thanks to the technological advances of cloud computing and the popularity of webcams, we've constructed an online coding system, which can collect and process data and report results from all over the world in seconds, dramatically improving the viability of the emotion tracking techniques and scaling their potential.

Relevant skills/experience/technologies

We are a research driven and client focused European company, with offices in Estonia, Hungary, the UK and the USA and over 5 years of operating experience across 11 different countries. The company currently employs 42 specialists in different areas, such as research, development, sales and operations, most of whom work in the European economic area. Thanks to continuing support by the EU through Eurostars and FP7 grant schemes Realeyes has one of the strongest industrial R&D teams in the field in Europe, which consists of 9 machine learning and computer vision researchers, data scientists and engineers. Technology built by Realeyes is patent protected with 7 pending EU patent applications. As a commercial services provider Realeyes is trusted by some of the world biggest brands, publishers and agencies alike, such as AOL, IPSOS, Danone, Mars, Walt Disney and many more.

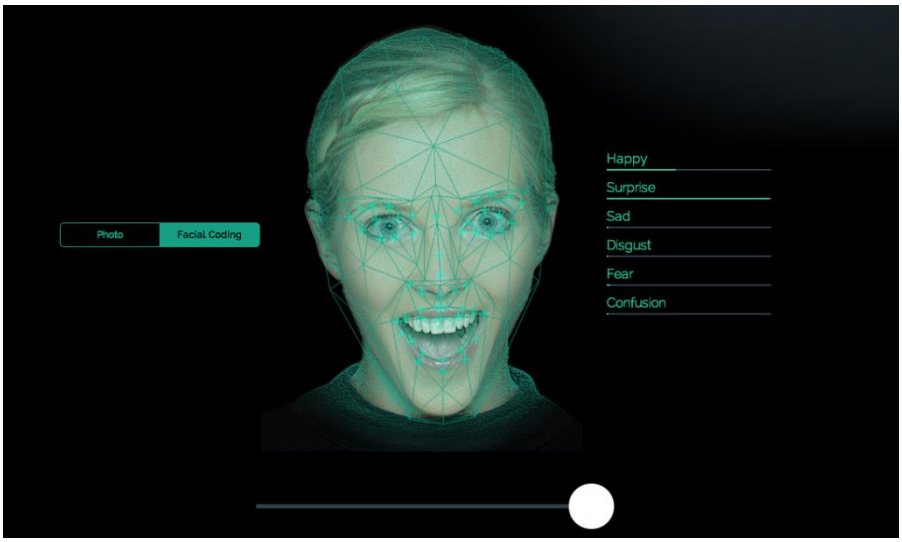
Role in the project

Realeyes will support WP2 Multichannel biometrics and WP4 HCI & Access Management with its emotion recognition technology and expertise.

Key personnel

Dr Gabor Szirtes (M), Head of Research, has previously worked on computational problems of biological learning and memory from machine learning perspective. His interest in functional modelling of the hippocampal formation led him to dynamical (neural Kalman-filter strategies) and structural (random graph simulations, small world architectures) questions. While functional modelling can be defined in many ways, reality imposes different constraints on both structure and dynamics. To get a better understanding of these constraints and thus the encoding/decoding processes, he studied early visual processing and the statistical analysis of single- and multi-unit recordings using maximum likelihood methods (Columbia University, New York) and second and higher order statistical methods (Department of Psychophysiology, Eötvös University, Budapest). Beside single cell level analysis he got involved in research on higher order cognitive behaviour by analysing gaze tracking and fMRI data (PERCEPT project within EU FP6). Central to decoding/encoding processes is the notion of representations, so he studied factors that make neural representations and early sensory processing extremely efficient in terms of computational speed, energy and noise tolerance. The results about linking the theory of Compressive Sampling (a revolutionary idea in signal processing) to the functioning of early visual system have been published in PLoS in 2012. Prior to joining Realeyes, he worked in the neurophysiology lab of Dr Anton Sirota at the University of Tuebingen, Germany, where his main task was to implement novel statistical methods to analyse large-scale data, improve conventional signal processing methods and to model the complex correlations between animal behaviour (recorded by high speed motion capture system) and in vivo neural recordings. In addition, he is an active member of EUCog - European Network for the Advancement of Artificial Cognitive Systems, Interaction and Robotics; and a reviewer of PloS ONE, PloS Computational Biology, Neural Networks, Journal of Computational Neuroscience and Neurocomputing.

Dr Elnar Hajiyev (M), CTO is leading the development of the webcam eye-tracking project and gaze database. He holds BSc (first class) in Information and Media Technology from Brandenburg Univer- sity of Technology, Germany and MSc (distinction) in Computer Science from University of Oxford, UK. His DPhil in Computer Science from the Programming Tools Group, University of Oxford, focused on semantics of aspect oriented programming languages and logic programming in the context of modern relational databases. During his education he received numerous excellency awards, including an Overseas Research Student award, scholarships from Shell and DAAD. Elnar has significant experience working in high-technology companies, including the largest Internet Service Provider of Azerbaijan, Siemens Magnet Technology and his previous technology startup, Semmle, who specialise in on-demand software analytics. He has published more than ten peer-reviewed papers in international journals and conference proceedings.

Relevant publications/patents/products/services
Szirtes, Gábor, et al. "Facing reality: an industrial view on large scale use of facial expression analysis." Proceedings of the 2013 on Emotion recognition in the wild challenge and workshop. ACM, 2013.
Jeni, L. A., Lőrincz, A., Nagy, T., Palotai, Z., Sebők, J., Szabó, Z., & Takács, D. (2012). 3D shape estimation in video sequences provides high precision evaluation of facial expressions. Image and Vision Computing, 30(10), 785-795.
Realeyes Emotion Analytics Platform measuring people's emotional response to media content via standard webcams 

Relevant research projects
CARP, an FP7-ICT project designing high-level programming formalisms geared towards accelerators, writing highly optimizing compilers to compile high-level code into efficient OpenCL, verifying correctness of accelerator kernels, and employing intensive symbolic testing techniques to find bugs.
European Regional Development Fund Grant

Existing infrastructure
Scalable cloud infrastructure on Amazon Cloud for online data collection and analytics, as well as training and testing of next generation emotion tracking algorithms. Existing emotion recognition technology and database of emotion data.

Does the participant plan to subcontract certain tasks	N
Does the participant envisage that part of its work is performed by linked third parties	N
Does the participant envisage the use of contributions in kind provided by third parties	N

Partner 6: Forthnet S.A. – Hellenic Telecommunications and Telematics Applications Company (FNET)	

The organization

Forthnet S.A. is a leading provider of broadband network services in Greece. The company was the first commercial Internet Service Provider in Greece, established in November 1995. Forthnet has entered both the telecommunications and network services business, being a convergent services provider offering from voice telephony to Internet and value-added services over its private broadband network. The company has more than 270.000 enterprise customers using leased lines and broadband access services; more than 320.000 voice telephony lines and 500 data center customers. Forthnet customer base comprises a major part of the Greek Internet community and the market of alternate voice telephony & network providers. The sales volume for 2005, 2006, 2007 and 2008 was 88 MEuro; 93 MEuro; 114 MEuro; 136 MEuro respectively. Forthnet has a full-time staff of 880 persons. The company launched in 2005 an investment plan of 253 million Euro, comprising mainly of fibre infrastructure for over 600 km of MAN, long distance and international connectivity, development investments for broadband network and services infrastructure, EDP infrastructure and market expansion activities. Forthnet operates 75 Points of Presence (PoPs) in respective towns of Greece, interconnected over a high-speed backbone. Forthnet group of companies recently acquired Netmed S.A., the leading satellite TV platform provider with more than 300.000 customers in Greece and Cyprus, and launched a major integration project towards converged broadband access and entertainment media services.

Relevant skills/experience/technologies

Forthnet utilizes and integrates technological solutions on the basis of the latest telecommunications prototypes to develop and provide new services on the Network. It also utilizes various software technologies (Java/J2EE, .Net, Linux, open source, database systems) for the development of information systems for the SMEs and for the realization and provision of eServices. Main interests of R&D department include Broadband communications, Next-Generation networks, Wireless & Ad-Hoc networks, E-Content & Networked Media management & distribution, eTourism, eHealth, eLearning, eGovernment, Advanced Messaging Systems and EWS, User mobility and Mobile Internet. System & network technology and software engineering are within the technological skills and know-how of the R&D team, based upon object-oriented development with C++, Java/J2EE on various operating platforms. Forthnet R&D department has participated in several European research projects in the past, related to synthesis and interoperability of services, mobile application and personalized services within the eHealth domain. Forthnet S.A. has a strong previous participation in EC funded projects in the areas of eHealth, such as HEARTFAID (STREP – IST FP6), which aimed at the development of a knowledge based decision support system for improving the medical-clinical management of heart failure within the elderly population. Forthnet has also participated in FP7 IP REACTION project, where it was mainly involved in the implementation and provision of server and network infrastructure and integrates advanced network and edge communication technologies, as well as contributing to the underlying security modules.

Role in the project

FNET will lead the Consumer Pilot in WP6 Demonstrators & Evaluation.

Key personnel

Manolis Stratakis (M) holds an MSc by research in Computer Networks and Digital Communications and a BSc in Electronic Computer Systems, both from the University of Salford, UK. He is currently the Head of Research Projects in the R&D department of Forthnet S.A., where he is managing several European and National research projects, primarily related to Internet and web applications and the

development of Value Added Services in the areas of Mobile Internet, Advanced Messaging Systems, mobile Learning, Electronic Commerce, Teleworking, eHealth, Telemedicine and 3G Technologies. He has worked from 1992 to 1997 at the Institute of Computer Science, Foundation for Research and Technology - Hellas (FORTH), where he was mainly involved in the design and development of digital computer systems. He has also worked as a visiting professor in the Technological Education Institute of Heraklion, School of Technological Applications, from 1993 to 2000. Since 1994 he has delivered a number of Internet related courses in the Cyprus International Institute of Management and several other academic establishments. His research interests include integrated services computer networks, new technologies and applications over the Internet, mobile Internet, intelligent and personalised messaging services, real life links with advanced technology and regional development.

Stylianos A. Louloudakis (M) holds a BSc in Computer Science of the University of Essex, England, and an MSc in Internet and Database Systems of the Southbank University of London, England. He was employed by the Department. of Applied Mathematics and Computer Science, at the Foundation for Research and Technology - Hellas (FORTH) as a computer programs' analyst, where he was mainly involved in the development of applications based on the Java programming language. He was employed by the R&D Department of Forthnet S.A. on January 2005 and since then he has been involved in the development of a number of European and National projects, in the areas of eHealth, Mobile Internet Communications, Mobile Applications, Advanced Messaging Systems, as well as in Computer and Sensor Networks.

Antonis Miliarakis (M) holds an MPhil degree by the Systems Engineering Department, at BRUNEL University, UK. He graduated with honors from the Electrical Engineering Department of the Technological Educational Institute of Crete, Greece, in 2002. Since October 2000 he has worked at Forthnet S.A. where his main responsibility is the technical management of ICT research projects and the design of mobile service platforms and wireless networks. During his activities at the research and development department he has participated in the implementation of many European and national IT projects. Since September 2004 he has been lecturing Computer Systems Architecture, Medical Informatics and Microprocessors at the Applied Informatics and Multimedia department of Technological Education Institute of Crete. As a web services designer, he has designed and implemented applications for desktop and mobile platforms like Pocket PC and Palm OS, using a variety of tools like C, VB6.0, eVB3.0, eVC++, VB.NET and ASP.

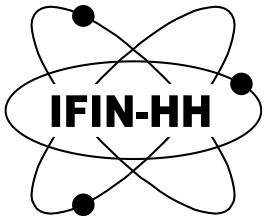
Relevant publications/patents/products/services
Service portfolio: Forthnet provides Internet access services, Internet news services, website hosting services, and telecommunications services such as voice transmission. Forthnet's network covers mainland Greece, Crete, and the major Greek islands.
Asanin, Stefan, Peter Rosengren, Tobias Brodén, Ivo Ramos Maia Martins, Carlos Cavero Barca, Manuel Marcelino Pérez Pérez, Lydia Montandon, Manolis Stratakis, and Stelios Louloudakis. "Adopting Rule-Based Executions in SOA-Oriented Remote Patient Monitoring Platform with an Alarm and Alert Subsystem." In Wireless Mobile Communication and Healthcare, pp. 437-444. Springer Berlin Heidelberg, 2013.
Validation of a Flexible and Innovative Platform for the Home Monitoring of Heart Failure Patients: Preliminary Results – Forthnet S.A.: Manolis Stratakis, Stelios Louloudakis - Computers in Cardiology 2009

Relevant research projects
The HEARTFAID project (ISST-2004-027107) for the development of innovative computerized systems and services that improve medical knowledge, diagnosis, prognosis, treatment and personalization of elderly patients with Heart Failure.
The REACTION project (FP7-ICT-2009-4) for developing an integrated approach to improved long term management of diabetes; continuous blood glucose monitoring, clinical monitoring and intervention strategies, monitoring and predicting related disease indicators, complemented by education on life style factors such as obesity and exercise and, ultimately, automated closed-loop delivery of insulin.

The SEMEOTICONS project (FP7-ICT-2013-10), for designing and constructing an innovative multisensory system integrated into a hardware platform, collecting Bio-data for extracting biometric, colorimetric, morphometric and compositional descriptors measuring an individual's facial signs. The integration of such descriptors will provide a Vitrual's Individual Model, for computing, tracing and analyzing the daily evolution of an individual's "wellness index".
The GUARANTEE project (ITEA2 – Call 6) provides a technical solution for personal safety in the home environment. GUARANTEE introduces local and network-supported decision making for safety applications on the basis of sensor input and with immediate response and feedback to the people concerned.

Existing infrastructure
Forthnet's broadband infrastructure network and existing customer base (1.08M subscribers).

Does the participant plan to subcontract certain tasks	N
Does the participant envisage that part of its work is performed by linked third parties	N
Does the participant envisage the use of contributions in kind provided by third parties	N

Partner 7: Horia Hulubei National Institute for Physics and Nuclear Engineering (IFIN-HH)	

The organization

IFIN-HH is one of the most important R&D organizations in Romania. In the period 2008-2010 the scientists at IFIN-HH published 946 articles in peer-reviewed Thomson-Reuters-indexed journals and 272 articles in journals not indexed by Thomson Reuters. In the same period the scientists at IFIN-HH organized 20 international conferences at 16 national ones. IFIN-HH is a member of Joint Institute for Nuclear Research – JINR (Dubna, Russia, http://www.jinr.ru), Facility for Antiproton and Ion Research – FAIR (Darmstadt, Germany, http://www.fair-center.eu) and CERN (Geneva, Switzerland, http://home.web.cern.ch). IFIN-HH takes part in large international physics experiments such as ATLAS, ALICE, LHC-b, DIRAC, FOPI, LCG, GASP, KASCADE, SPIRAL 2, and large international projects such as the Real-Time On-Line Decision Support – RODOS, European Nuclear Structure Integrated Structure Initiative – EURONS, and European Isotope Separation On-Line Radioactive Ion Beam Facility – EURISOL. IFIN-HH collaborates with more than 50 universities and research institutes in Europe, 11 in the USA and Canada and 3 from Asia.

Relevant skills/experience/technologies

The most important infrastructure of IFIN-HH is the Nuclear Physics Pillar of the Extreme-Light Infrastructure, ELI-NP (http://www.eli-np.ro), which is currently being built within the premises of IFIN-HH. IFIN-HH is in charge of numerous Installations of National Interest (in Romanian: Instalatii de Interes National) of which we mention here the VVR-S Nuclear Reactor for Research and Production of Radioisotopes, The National Deposit of Radioactive Waste – DNDR, the Tandem Van de Graaff linear accelerator, the Cyclotron U120 accelerator, and the Multipurpose Irradiation Installation – IRASM. IFIN-HH also host one of the largest distributed and parallel computing infrastructure in the country which amounts to 6000 computer cores and 2 PB of storage. The mission of IFIN-HH is focused on advanced scientific research in atomic and subatomic physics.

Role in the project

IFIN will lead the Workforce Pilot in WP6 Demonstrators & Evaluation.

Key personnel

Mitica Dragusin (M), Nuclear Safety Director, has been employed at the Horia Hulubei National Institute for Physics and Nuclear Engineering (IFIN-HH) for 31 years. He has worked for 19 years in the radiation processing of the water-soluble polymers with high activity radiation sources Co-60 and 12 years in the decommissioning of the nuclear facilities. He is Nuclear Safety Director in IFIN-HH from 2006, is the project manager of the decommissioning the nuclear research reactor type VVR-S from institute, which started in 2010 and will be finalized in 2020. From 2013 is also project manager of the cross-border project Romania-Bulgaria – Emersys – "Toward an integrated, joint cross-border detection system and harmonized rapid responses procedures to chemical, biological, radiological and nuclear emergencies", scheduled to be finished in July 2015, founded by European Regional Development Fund and co-financed by Romanian and Bulgarian Government

Constantin Ivan (M), Technical-Administrative Director, has been employed at the Horia Hulubei National Institute for Physics and Nuclear Engineering (IFIN-HH) in 1985 and has then worked on radiation detectors and associated electronics, as well as radionuclide metrology, namely the development of new equipment and measurements methods for radioactivity. Starting 2004 Dr. Ivan serves at Technical-Administrative Director of IFIN-HH.

Mihnea Dulea (M), Head of the Department of Computational Physics and Information Technologies is a Senior Researcher working on Grid computing, High-Performance Computing and computational biophysics and is the incumbent Head of the Department of Computational Physics and

Information Technologies of IFIN-HH. He is also the President of the Romanian Association for the Promotion of Advanced Computational Methods in Scientific Research, which now represents Romania in PRACE, and has served as coordinator and work package coordinator for more than a dozen national and international projects on Grid infrastructures and High-Performance Computers. Dr. DULEA coordinates the Romanian Tier 2 Federation RO-LCG which represents Romania in WLCG collaboration.
Alexandru Nicolin (M), Senior Researcher II, Department of Computational Physics and Information Technologies, works on numerical and symbolic computing applications for condensed mater physics. Following his graduate studies at the Niels Bohr Institute of the University of Copenhagen, Dr. Nicolin has joined IFIN-HH in 2009 and his currents effort are focused on expanding the Computing Centre of IFIN-HH.

Relevant publications/patents/products/services
Dulea, M., Constantinescu, S., Ciubancan, M. (2012). Support for multiple virtual organizations in the Romanian LCG Federation, 5th Romanian Tier-2 Federation Grid, Cloud & High-Performance Computing Science (RO-LCG), 59-62.
Dulea, M. (2012). National and regional organization of collaborations in advanced computing, 5th Romanian Tier-2 Federation Grid, Cloud & High-Performance Computing Science (RO-LCG), 63-66.
Dima, M., **Dulea M.** (2010). Classical and quantum communications in Grid computing, Optoelectronics and advanced materials – Rapid Communications, 4, 1840-1843.
Dima, M., **Dulea,** M., et al. (2009). The QUANTGRID project (RO) – Quantum security in Grid computing applications, AIP Conference Proceedings, 1203, 461-465.

Relevant research projects
CONDEGRID (PN2-Capacities-M3 CERN): National contribution to the development of the LCG computing grid for elementary particle physics (08EU/2012) – Director: M. Dulea, Period: 2012-2014
IDEI-25(PN-II-ID-PCE-2011-3-0323): High-performance computing for nuclear and particle physics– Director: M.O. Dima, Period: 2011 – 2015
HP-SEE (FP7-RI-261499): High-Performance Computing Infrastructure for South East Europe's Research Communities – Leader Romanian JRU: M. Dulea, Period: 2010-2013
GRICEFCO (SOPIEC-A2-O2.2.3-2008-3 EU structural funds 209): Grid system for physics research and related areas – Director: M. Dulea, Period: 2009 – 2011

Existing infrastructure
The existing infrastructure of IFIN-HH has a two-fold relevance for the project: on one hand, IFIN-HH has a broad set of infrastructures which can be used to test the security system which will be developed in the project, while on the other hand it has an state-of-the art ITC infrastructure which insures excellent real-time communications with the other partners in the project which can constantly monitor the security system.

Does the participant plan to subcontract certain tasks	N
Does the participant envisage that part of its work is performed by linked third parties	N
Does the participant envisage the use of contributions in kind provided by third parties	N

Partner 8: Computational Medicine Laboratory (CML) & Human Computer Interaction Laboratory, Institute of Computer Science (ICS) Foundation for Research and Technology-Hellas (FORTH)	

The organization

The Foundation for Research and Technology – Hellas (FORTH) is one of the largest research centres of Greece with well-organized facilities and highly qualified staff. It functions under the supervision of the General Secretariat for Research and Technology of the Hellenic Ministry of Development. The Foundation, with its high quality research results as well as its valuable socioeconomic contribution, makes it one of the top research centres internationally. The Institute of Computer Science (FORTH-ICS), one of the six institutes of FORTH, has a relatively long history and recognized tradition, since its establishment in 1983, in conducting basic and applied research, developing applications and products, providing services, and playing a leading role in Greece and internationally, in the fields of Information and Communication Technologies. Our activities cover important research and development areas, taking into consideration new perspectives, emerging fields of research and technological challenges worldwide.

Relevant skills/experience/technologies

The Human Computer Interaction Laboratory (HCI) of ICS-FORTH, established in 1989, is an internationally recognized centre of excellence in the design and development of adaptable and accessible interactive applications and services for various platforms, such as personal computers, mobile phones, smart appliances and furniture, and other computational devices distributed in the environment. The Laboratory has participated in more than 50 R&D projects in the field of HCI.
The Computational Medicine Laboratory (CML) at FORTH-ICS has established a tradition of internationally acknowledged excellence in conducting high-level R&D work and in developing innovative systems and services. Its research activities focus on the development of innovative computer methods and tools in the area of medical and biomedical informatics, computational medicine, ehealth, m-Health, medical imaging and bioinformatics. The mission of the Computational Medicine Laboratory (CML) is to develop novel ICT technologies in the wider context of personalized, predictive and preventive medicine.

Role in the project

FORTH-HCI will lead WP4 HCI & Access Management.
FORTH-CML will lead the eHealth Pilot in WP6 Demonstrators & Evaluation.

Key personnel

Dr. Kostas Marias (M) holds a Principal Researcher position in the Institute of Computer Science (ICS-FORTH), and since 2010 he is the Head and Founder of the Computational Medicine Laboratory at FORTH-ICS. During 2001-2003, he worked as a Researcher at the University of Oxford and from 2003-2006 as Associated Researcher at FORTH-ICS. He was the coordinator two EC projects on cancer modelling (www.contracancrum.eu and www.tumor-project.eu), and during 2006-2013 worked in several EC funded projects developing ICT technology for personalized medicine. He coordinated the development of a wide range of image analysis and modelling tools (biomodeling.ics.forth.gr) designed for the clinical setting within the wider Virtual Physiological Human (VPH) EC initiative. He has published more than 100 papers in international journals, books and conference proceedings focusing on medical image analysis, biomedical informatics and modelling for personalized medicine.

Dr. Margherita Antona (F) is a Principal Researcher at ICS-FORTH. She is member of the Human Computer Interaction Laboratory of ICS-FORTH, Coordinator of the Centre for Universal Access & Assistive Technologies, and Coordinator of the AmI Classroom activity of the ICS-FORTH AmI Programme. Her research interests include adaptive and intelligent interfaces, computer-supported user interface design, design for all and assistive technologies, eLearning and Ambient Intelligence. She has participated in more than 20 European and national R&D projects. She is Deputy Coordinator of the

KRIPIS National Project "Quality of life", and the scientific responsible for the participation of ICS-FORTH in the projects AAL-REMOTE and FP7-ICT-VERITAS. She has coauthored more than 90 scientific publications. She is Co-Chair of the International Conference on Universal Access in Human-Computer Interaction (UAHCI) and member of the Editorial Board of the Universal Access in the Information Society International Journal. She is member of Program Committee and Paper Review Committee in various international conferences and workshops.

Dr. Vangelis Sakkalis (M) holds a Principal Researcher position in the Institute of Computer Science – Foundation for Research and Technology (ICS - FORTH). He received his PhD in Electronic and Computer Engineering after completing his Master's degree at Imperial College of Science, Technology and Medicine, UK. His background falls in Biomedical Engineering, Atomic-Molecular Physics, Optoelectronics and Laser. His research interests include biosignal and image analysis, visualization, classification algorithms and biostatistics applied in computational medicine, cognitive neuroscience and biomedical informatics. He is currently coordinating 2 projects (EU and national) related to cancer research. He has published more than 100 papers in scientific archival journals, proceedings of international conferences & workshops and scientific newsletters, related to his fields of expertise. He has given numerous invited lectures worldwide and his research has been funded by numerous funding agencies and companies.

Dr. Emmanouil G. Spanakis (M) is a Collaborating Researcher at the CML of FORTH-ICS. He is also a visiting lecturer at the Computer Science Department, University of Crete. He holds a Ph.D., a M.Sc. and a B.Sc. in Computer Science from the University of Crete, Heraklion, Greece. His expertise, specialization and research lie in the wider scientific domain of computational medicine and wireless communication networks, and in particular on biomedical informatics; wireless medical sensors; ambient intelligence services and smart surroundings; eHealth and mHealth related services; as well as in cross-layer design in wireless ad-hoc networks; wireless interference channel under Signal to Interference Plus Noise Ratio (SINR) constraints; performance and analysis of mobile ad-hoc routing protocols; and wireless network measurements analysis.

George Margetis (M) holds a degree in Computer Science and M.Sc. in "Computer Networks and Digital Communications" and "Information Systems". He is a member of the Human-Computer Interaction Laboratory of FORTH-ICS since 2005. His past work includes network traffic measurement and analysis in high-speed networks, resource control and service differentiation in wired networks. His current work focuses on interaction design, Ambient Intelligence and Smart Spaces, Universal Access and Design for All. He has participated as a technical coordinator or implementation member in a number of European and National research projects. His recent work includes the analysis and investigation of tools and interaction techniques for multimodal interaction in Ambient Intelligence environments, mainly in the fields of education, independent living, tourism and culture.

Relevant publications/patents/products/services

Spanakis, E.G.; Sakkalis, V.; Marias, K.; Traganitis, A. Cross Layer Interference Management in Wireless Biomedical Networks. Entropy 2014, 16, 2085-2104.

Leonidis, A., **Antona, M**., & Stephanidis, C. (2012). Rapid Prototyping of Adaptable User Interfaces. International Journal of Human-Computer Interaction, 28 (4), 213-235.

Margetis, G., Zabulis, X., Koutlemanis, P., **Antona, M.,** and Stephanidis, C. (2013). Augmented interaction with physical books in an Ambient Intelligence learning environment. Multimedia Tools and Applications, 67 (2), 473-495.

Tsiknakis, M.N., Sfakianakis, S.G., **Marias, K**., & Graf, N. (2012). A technical infrastructure to support personalized medicine. IEEE 12th International Conference on Bioinformatics & Bioengineering (BIBE), 2012.

Sakkalis, V., Sfakianakis, S.G., & **Marias, K**. (2012). Bridging social media technologies and scientific research: an exemplary platform for VPH modellings. 3rd International ICST Conference on Wireless Mobile Communication and Healthcare (MobiHealth 2012), Workshop on Advances in Personalized Healthcare Services, Wearable Mobile Monitoring, and Social Media Pervasive Technologies (APHS 2012), Paris, France, November 21-23, 2012.

Relevant research projects
MyHealthAvatar is a proof of concept for the digital representation of patient health status. It is designed as a lifetime companion for individual citizens that will facilitate the collection of, and access to, long-term health-status information. This will be extremely valuable for clinical decisions and offer a promising approach to acquire population data to support clinical research, leading to strengthened multidisciplinary research excellence in supporting innovative medical care. MyHealthAvatar will be built on the latest ICT technology with an aim of engaging public interest to achieve its targeted outcomes. In addition to data access, it is also an interface to access integrative models and analysis tools, utilizing resources already created by the VPH community.
HOBBIT sets out to study a future robot that will make older persons feel safe at home. It will pick up objects from the floor, can learn objects and bring objects, and it is equipped with easy-to-use entertainment functions. HOBBIT will offer tools to stay socially connected, keep active with playing games and exercise, and enjoy your time checking out now films, music and books. HOBBIT will detect emergency situations and trigger an appropriate alarm. The focus of HOBBIT is on the development of the mutual care concept: building a relationship between the human and the robot in which both take care for each other. Like when a person learns what an animal understands and can do; similar to building a bond with a pet. The main task of the robot is fall prevention and detection. To achieve this, the robot will clean the floor from all objects and thus reduce the risk of falling. It will detect emergency situations such that help can be called in time. The purpose of the Mutual Care approach is to increase the acceptance of the home robot.
SEMEOTICONS will design and construct an innovative multisensory system integrated into a hardware platform having the exterior aspect of a mirror: the so-called "Wize Mirror". This will easily fit into users' home or other sites of their daily life (e.g. fitness and nutritional centres, pharmacies, schools and so on). The Wize Mirror will collect data mainly in the form of videos, images and gas concentration signals. These will be processed by advanced dedicated methods to extract biometric, morphometric, colorimetric, and compositional descriptors measuring individual's facial signs. The integration of such descriptors will provide a Virtual Individual's Model, which will be used to compute and trace the daily evolution of an individual's "wellness index".
VERITAS (Virtual and augmented environments and realistic user interactions to achieve embedded accessibility design) aims to develop, validate and assess tools for built-in accessibility support at all stages of ICT and non-ICT product development, including specification, design, and development and testing. The goal is to introduce simulation-based and virtual reality testing at all stages of assistive technologies product design and development into the automotive, smart living spaces, (buildings & construction, domotics), workplace and infotainment applications areas.
REMOTE is a pan-European research project concerned with the needs of elderly and individuals with chronic conditions. The focus is to support independent living with the aid of AmI technologies and tele-healthcare with various kinds of monitoring and automation services for tracing activity, fall detection and health condition, as well as detecting risks or critical situations of citizens.

Existing infrastructure
IT infrastructure – hardware, software, development and design tools needed for the project

Does the participant plan to subcontract certain tasks	N
Does the participant envisage that part of its work is performed by linked third parties	N
Does the participant envisage the use of contributions in kind provided by third parties	N

Partner 9: University College London (UCL)	

The organization

UCL's main campus is located in the Bloomsbury area of central London, with a number of institutes and teaching hospitals located elsewhere in central London, and satellite campuses in Adelaide, Australia and Doha, Qatar. UCL is organised into 10 constituent faculties, within which there are over 100 departments, institutes and research centres. UCL has around 26,700 students and 11,025 staff and had a total income of £937 million in 2012/13, of which £335 million was from research grants and contracts. UCL has around 4,000 academic and research staff and 650 full professors, the highest number of any British university.

Relevant skills/experience/technologies

The UCL team has expertise in image and video coding, approximate signal processing, incremental refinement of computation for signal transforms and multimedia processing algorithms, intelligent signal processing, including the application of array signal processing techniques to a variety of problems , information processing and information fusion.

Role in the project

UCL will lead WP6 Demonstrators & Evaluation and WP9 Standardization.

Key personnel

Dr Hugh Griffiths (M) was educated at Hardye's School, Dorchester, and Keble College, Oxford University, where he received the MA degree in Physics. He also received the PhD (1986) and DSc(Eng) (2000) degrees from the University of London. In 2006 he was appointed Principal of the Defence College of Management and Technology, Shrivenham (part of Cranfield University). From 1982 to 2006 he was with University College London, serving as Head of the Department of Electronic and Electrical Engineering from 2001 to 2006. His research interests include radar sensor systems and signal processing (particularly synthetic aperture radar and bistatic and multistatic radar and sonar) as well as antennas and antenna measurement techniques. He has published over 300 papers and technical articles on these subjects. He received the IERE Lord Brabazon Premium in 1984, the IEE Mountbatten and Maxwell Premiums in 1996, and the IEEE Nathanson Award in 1996. He serves on the IEEE AESS Board of Governors and as Chairman of the IEEE AESS Radar Systems Panel, and as Editor-in-Chief of IEE Proceedings on Radar, Sonar and Navigation. Also, he was Chairman of the IEE International Radar Conference RADAR 2002 in Edinburgh, UK. He is also a member of the Defence Scientific Advisory Council for the UK Ministry of Defence, and of the Supervisory Board for the UK Ministry of Defence's Defence Technology Centre in ElectroMagnetic Remote Sensing. He is a Fellow of the IEE, Fellow of the IEEE, and in 1997 he was elected to Fellowship of the Royal Academy of Engineering.

Dr Clayton Stewart (M) is currently Visiting Professor, Department of Electronic and Electrical Engineering, University College London and consultant on international S&T engagement with clients including DARPA. He has served as Technical Director Office of Naval Research Global, providing technical direction to a staff of engineers/scientists involved in monitoring, assessing, and sponsoring world-wide S&T; Corporate Vice President/Manager SAIC Reconnaissance/Surveillance Operation; Associate Professor of ECE and Associate Director, Center of Excellence in Command, Control, Communications, and Intelligence at George Mason University, Fairfax, V; Sperry Corporation and ARCO Power Technologies, Inc.. He has been a director in Air Force Studies & Analyses at the Pentagon,

an Air Force Academy Associate Professor of EE and an Electronic Warfare Officer/Engineer who flew various tactical aircrafts. He graduated from University of Redlands, BS in Engineering Science and received his MSEE and PhDEE from the Air Force Institute of Technology.
Prof Karl Woodbridge (M) obtained a BSc in Physics in 1976 and a D.Phil in Materials Science in 1979. He joined University College London in 1990 after 11 years working for Philips Electronics in the area of Molecular Beam Epitaxial (MBE) growth of III-V compounds for device applications. He worked initially at UCL in the semiconductor device area before moving to the RF sensors field. He was seconded part time to DERA/QinetiQ Malvern during 2003-2004 working on radar and air traffic management system. He is currently a member of the academic staff in the Sensors Systems and Circuits group and current research has centered on radar systems for a number of applications. He is currently leading a major activity on the development of a pervasive wireless detection system. He has also recently become involved in the setting up of a new departmental III-V MBE facility.

Relevant publications/patents/products/services
Robert D. Henderson ; Robert Short and Clayton V. Stewart. "Tactical multisensor fusion (TMSF)", Proc. SPIE 3720, Signal Processing, Sensor Fusion, and Target Recognition VIII, 460 (July 27, 1999); doi:10.1117/12.357186;
Stewart, Clayton, Yi-Chuan Lu, and Victor Larson. "A Neural Clustering Approach for Waveform Classification." Pattern Recognition, Vol. 27, No. 4, April 1994, pp. 503-513.
Liu, Jun and Clayton Stewart. "Detection of Linear Features in Images Using Radon and Hough Transforms," OE/Aerospace Sensing '94 The Society of Photo Optical Instrumentation Engineers, Orlando, FL, April, 1994. 1 citation.
Kuo-Chu Chang and Clayton V. Stewart, "Application of Bayes nets in sensor fusion", Proc. SPIE 2093, 644 (1994)
Chang, K.C. and Clayton Stewart. "Bayes Nets for Sensor Fusion." SPIE EUROPTO, Innsbruck, Austria, October 4-8, 1993.

Relevant research projects
Sensing and Fusion Testbed, George Mason University, 1992-94, Dr Clayton Stewart
Classification of Aircraft from their Acoustic Signatures, George Mason University, 1992-94, Dr Clayton Stewart

Existing infrastructure
UCL laboratories and IT infrastructure.

Does the participant plan to subcontract certain tasks	N
Does the participant envisage that part of its work is performed by linked third parties	N
Does the participant envisage the use of contributions in kind provided by third parties	N

Partner 10: Institut Mines Telecom / Telecom Sud Paris, Electronics and Physics Departement, Intermedia Lab (TSP)	

The organization

Institut Mines-Télécom (IMT) is an umbrella entity integrating six major Grandes Ecoles (French higher education establishments) in the field of information and communication technology (ICT), including the Mines-Télécom SudParis (TSP) school. IMT is under the authority of the French Ministry of Industry. Its mission is to provide education programs for engineers and managers, to conduct research in ICT and to contribute to the industrial development of ICT in close collaboration with industry. IMT is one of the major French players in the R&D Framework Programs supported by the European Commission (more than 40 FP6/IST and 16 FP7 ICT projects). Telecom SudParis developed a vast experience in all major biometric areas such as speech-, face-, handwritten signature- and iris-based authentication, and also in the new field of combining cryptography and biometrics. The Télécom SudParis biometric group with the INTERMEDIA Research Group was the coordinator of the BioSecure FP6 NoE and is also a member of the BEST network.

Relevant skills/experience/technologies

Telecom SudParis developed a vast experience in all major biometric areas such as speech-, face-, handwritten signature- and iris-based recognition, and also in the new field of combining cryptography and biometrics. The research activities of the Intermedia Group are oriented towards pattern recognition, signal processing, and data-driven machine learning methods, that are exploited for different applications such as speech, speaker and language recognition, very low-bit speech coding, biometrics (2D and 3D face, and voice), and crypto-biometrics (including privacy preserving biometrics). D. Petrovska initiated the recordings of the POLYCOST database, the first European telephonic database for Speaker Recognition, available through ELRA. The originality of the speaker recognition research conducted in the Intermedia group is the introduction of high-level features extracted with Automated Language Independent Speech Processing (ALISP) methods, as complementary sources for speaker verification. In such a way idiolectal characteristics of the speakers can be acquired. The advantage of ALSIP-based methods is that they are easily deployable for new languages.

Role in the project

Telecom SudParis will support WP2 Multichannel Biometrics and WP3 User Security & Privacy. Telecom SudParis will lead WP7 Dissemination & Ecosystem Development.

Key personnel

Dijana Petrovska-Delacrétaz (F) (PhD EPFL 1990) She obtained her degree in Physics and PhD from the Swiss Federal Institute of Technology (EPFL) in Lausanne. She was working as a Consultant at AT&T Speech Research Laboratories and was as a Senior Scientist for four years at the Informatics Department of Fribourg University, Switzerland. Since 2004 she is an associate professor within Mines-Télécom SudParis Intermedia group. She participated actively to the coordination of the FP6 NoE BioSecure (related to Multimodal Biometrics), and co-organized in 2005 the 1st BioSecure Residential Workshop of a one month duration with more than 100 participants.

Bernadette Dorizzi (F) is a Professor at Télécom SudParis since September 1989, and has been head of the Electronics and Physics department until December 2009. She is in charge of the Intermedia (Interaction for Multimedia) research team. B. Dorizzi has been coordinating the BioSecure European Network of Excellence and is president of the Association BioSecure (see section on research projects).

Jérôme Boudy (M) (PhD 1988, HDR 2013) is professor in Signal processing for the Electronic & Physics Department: he has led the RNTS-TelePat project on remote Healthcare vigilance (2003-06) and participated actively on ANR-Tandem and IST-FP7 CompanionAble projects. His research area, as member of INTERMEDIA, is on medical, actimetric signal processing and data fusion process for health distress detection, and speech processing. He has co-directed five PhDs on Biomedical and Health distress detection processing and is codirecting presently two theses on speech processing. He is also currently co-animator of the Digital Health network at IMT**.**

Relevant publications/patents/products/services
Bimbot, F., Bonastre, J. F., Fredouille, C., Gravier, G., Magrin-Chagnolleau, I., Meignier, S., Ortega-García J. , **Petrovska-Delacrétaz, D**., Reynolds, D. A. (2004). A tutorial on text-independent speaker verification. EURASIP journal on applied signal processing, 2004, 430-451.
Petrovska-Delacrétaz, D., Chollet, G., & **Dorizzi, B**. (2009). Guide to biometric reference systems and performance evaluation. Springer.
Tistarelli, M., Bicego, M., Alba-Castro, J. L., Gonzàlez-Jiménez, D., Mellakh, M. A., Salah, A. A., **Petrovska-Delacrétaz, D., Dorizzi, B.** (2009). 2D Face Recognition. In Guide to Biometric Reference Systems and Performance Evaluation (pp. 213-262). Springer London.
Khoury, E., Vesnicer, B., Franco-Pedroso, J., Violato, R., Boulkcnafet, Z., Mazaira Fernandez, L. M., ... Chollet G., **Petrovska-Delacretaz, D.** Marcel, S. (2013, June). The 2013 speaker recognition evaluation in mobile environment. In Biometrics (ICB), 2013 International Conference on (pp. 1-8). IEEE
Simonnet, T., Chollet, G., Caon, D., & **Boudy, J.** (2012, March). Automated Audio-visual Dialogs over Internet to Assist Dependant People. In ICNS 2012, The Eighth International Conference on Networking and Services (pp. 105-110).
Kanade, S. G., **Petrovska-Delacrétaz, D., & Dorizzi, B.** (2012). Enhancing Information Security and Privacy by Combining Biometrics with Cryptography. Synthesis Lectures on Information Security, Privacy, and Trust, 3(1), 1-140.

Relevant research projects
SecurePhone was a European co-funded project (FP6-IST-2002-506883) with the aims to realising a new mobile communication system (the "SecurePhone") enabling biometrically authenticated users to deal m-contracts during a mobile phone call in an easy yet highly dependable and secure way. The SecurePhone, based on an prototypal 3G/B3G-enabled handheld computer platform (a smartphone), will provide users with a number of innovative functionalities, such as the possibility to securely authenticate themselves by means of a "biometric recogniser", mutually recognise each other in initiating a phone call, exchange and modify in real time audio and/or text files and eventually e-sign and securely transmit significant parts of their phone conversation. The solution proposed by this project was to realise an innovative prototypal 3G/B3G enabled PDA (the "SecurePhone") enhanced with a "biometric recogniser" in order to permit to users to mutually recognise each other and securely authenticate.
BioSecure (2004-2007) was an FP6 Network of Excellence (NoE) aiming, through integrating multidisciplinary research efforts and facilitating objective evaluations, to address a range of challenging issues in the field of biometrics, with 30 core partners, representing a critical mass of expertise. The mainly academic organizations involved in BioSecure covered a wide range of research activities in the area of multimodal biometrics with extensive experience in database acquisition and performance evaluation campaigns. The project addressed scientific, technical and interoperability challenges as well as standardization and regulatory questions which are critical issues for the future of biometrics and its use in every day's life.
3COST (2012-2016) De-Identification for Privacy Protection in Multimedia Content: De-identification in multimedia content can be defined as the process of concealing the identities of individuals captured in a

given set of data (images, video, audio, text), for the purpose of protecting their privacy. This will provide an effective means for supporting the EU's Data Protection Directive (95/46/EC), which is concerned with the introduction of appropriate measures for the protection of personal data. The fact that a person can be identified by such features as face, voice, silhouette and gait, indicates the de-identification process as an interdisciplinary challenge, involving such scientific areas as image processing, speech analysis, video tracking and biometrics. This Action aims to facilitate coordinated interdisciplinary efforts (related to scientific, legal, ethical and societal aspects) in the introduction of person de-identification and reversible de-identification in multimedia content by networking relevant European experts and organisations.
BioSecure Foundation: The major role of "Association BioSecure" is to maintain and distribute the major outcomes of the BioSecure FP6 Network of Excellence that lasted from June 2004 to September 2007. It provides to the biometric R&D community, resources such as: • Evaluation platforms including databases, reference systems (baseline algorithms), assessment protocols for a variety of well-established modalities (speech, face, on-line signature, fingerprints, hand shape, iris). • Educational material (repository of texts and presentations related to different assets of biometrics) • Handbook on Standards providing updated information on standardisation activities

Existing infrastructure
TSP will update the already available biometric reference systems (including algorithms, and all the relevant material to reproduce baseline results for eight biometric modalities) with developments relevant to the SpeechXRays project. TSP will provide the materials available from the BioSecure Foundation (databases, evaluations protocols, reference-baseline algorithms). TSP will provide the possibility to use its computing resources (including a computer cluster for evaluations of algorithms that will need to be run on large databases).

Does the participant plan to subcontract certain tasks	N
Does the participant envisage that part of its work is performed by linked third parties	N
Does the participant envisage the use of contributions in kind provided by third parties	N

5. Ethics and Security

5.1 Ethics

5.1.1 Principal Rules

In accordance with the European Data Protection Directive, The SPEECHXRAYS Consortium has defined and will maintain ethics rules regarding any personal data handled in the scope of the projects. It concerned especially the collected biometrics data we have envisaged in the purpose of validate and experiment our solutions of biometrics authentications

The proposed SpeechXRays project is aimed at developing biometrics based on voice acoustics analysis and audio-visual identity verification. For the optimal use of new enabling technology, the system will be tested with both normal and hospital users. The project does not raise any sensitive ethical issues as ample care will be taken not to violate any personal and private related issues. All the users will be clearly informed about the project and safety issues prior to any data collection.

Also, informed consent will be obtained from all users prior to the data collection. The users will have access to their biometric recordings and can withdraw any of their biometric data if they decide at a later date. Apart from name, age, place, gender, native language and recordings, no other private or user specific information will be stored about each participant. All the collected data will be stored securely on highly protected servers, along with appropriate level of encryption and firewall protection.

Thus, ethical principles are respected by obtaining informed consent, maintain confidentiality, and data protection.

The project management committee will monitor the usage and distribution of recordings, applies the above mentioned measures rigorously, and will ensure that country specific EU data protection laws are adhered to at all times during the lifetime of the project. .

For our evaluation work and experiments, we will follow the national laws and recommendations that are applicable in that country. The rules we have defined in the documents are either the direct implementation of the guidelines and are inspired by the principal guidelines from Article 29 of the Working Party:

http://ec.europa.eu/justice/data-protection/article-29/index_en.htm

Country	Article 29 Working Part Member	Role
Estonia	Estonian Data Protection Inspectorate (Andmekaitse Inspektsioon)	The Inspectorate is the national authority for privacy protection and freedom of information.
France	CNIL http://www.cnil.fr/documentation/fiches-pratiques/fiche/article/biometrie-des-dispositifs-sensibles-soumis-a-autorisation-de-la-cnil/	The CNIL has been entrusted with the general duty to inform people of the rights that the data protection legislation allows them.
Greece	Hellenic Data Protection Authority	The mission of the Hellenic Data Protection

	http://www.dpa.gr/portal/page?_pageid=33,40911&_dad=portal&_schema=PORTAL	Authority is the protection of the personal data and the privacy of individuals in Greece
Romania	National Supervisory Authority for Personal Data Processing http://www.dataprotection.ro	The Authority has the goal of protecting the fundamental rights and freedoms of the natural persons, family and private life, in connection with the processing of personal data and the free circulation of these data.
United Kingdom	Information Commissioner https://ico.org.uk/for-organisations/guide-to-data-protection/ Version 2.1, 6 February 2015	The UK's independent authority set up to uphold information rights in the public interest, promoting openness by public bodies and data privacy for individuals.

5.1.2 Ethics Report (27th February 2015)

This proposed project involves both an ethically sensitive topic (the development of voice/visual biometric technology and the detection of emotions, for access to high security areas - including application by law enforcement and security related bodies) as well as involvement of a large number of participants (2,000) both in research centers dealing with sensitive nuclear research as well and in hospitals.

It is the aim of the proposed work to develop and test in real-life environments a user recognition platform based on voice acoustics analysis and audio-visual identity verification. The applicants consider the voice the most convenient and cost-effective biometric modality, which can be easily captured on a mobile device using the embedded microphone.

The planned solution will be validated by industrial partners in large-scale use cases where real- life authentication services will be deployed. The use cases are: consumer use case (ICT/networks), eHealth use case (health), workforce use case (energy research). The demonstration and evaluation work package (WP6) is ambitious as a total of 2000 users (600 users in the workforce pilot; 400 users in the eHealth pilot; 1000 users in the consumer pilot) will be involved. ***The details regarding the recruitment procedures are not clear.*** *The research and piloting raises two main concerns: the inclusion of human participants in pilots and trials, including hospital patients, and data protection issues arising from the collection and use of biometric data.*

The applicants have addressed the concerns raised in the ethics screening (Document SpeechXRays, v3) and clarified some of the open questions in a satisfactory manner. For example, the involvement of children or vulnerable persons has been explicitly excluded; the applicants state that involvement of patients will be made contingent on hospital advice; and the initially identified issue of physical intervention has been explained since only non-invasive sensors (microphones and cameras) will be used. A data protection policy has been elaborated and as part of this policy, a Chief Information Security Office (CISO) will be nominated.

The data protection mechanisms described are adequate if a Data Protection Officer is appointed. However, the following ethical issues remain:

The ethics documentation states that "re-use of data for secondary use can be envisaged without explicit consent of the participant". This should not be taken for granted. Except for anonymous data, secondary use requires the consent of the original participants or ethics committee approval.

Details of recruitment procedures are not clear and informed consent procedures are not provided in sufficient detail. While the applicant notes that this information will be sent to the local ethics committee, it also needs to be sent to REA.

It is stated that "scientists working on sensitive nuclear research projects will be able to access the secure information repository of the institute via remote biometrics-based identification through their mobile device. In addition, physical access to the research facility will be tested using the same biometrics-based identification." In the pilot phase, this could lead to security leaks.

Following the report we have introdudes the following deliveribalble in WP1:

D1.8	Workforce use case recruitment specifications	WP1	IFIN		PU	6
D1.9	eHealth use case recruitment specifications	WP1	FORTH		PU	6
D1.10	Consumer use case recruitment specifications	WP1	FNET		PU	6

Those deliverables will be approved by 3 authorities: the national data protection authorities in the country that hosts the test, the REA and the CISO of the project.

In addition we have corrected the second-use (see 5.1.4Ethics Report Recommendation sub chapter re-use of data, secondary use of data and of large biometrics data sets**) by specifying that it is not allowed without consent**.

For IFIN-HH we propose a specific clause about security:

Our recruiting criteria and the specification of the test usage will specifically avoid any security leaks. Those criteria, in that objective should be approved by the internal security officers of the IFIN-HH,

5.1.3 Ethics Issues

Section 1: HUMAN EMBRYOS/FOETUSES		**YES/NO**	**Page**
Does this research involve Human Embryonic Stem Cells (hESCs)?		NO	
If YES:	-Will they be directly derived from embryos within this project?		
	-Are they previously established cells lines?		
Does this research involve the use of human embryos?			
Does this research involve the use of human foetal tissues / cells?			
Section 2: HUMANS		YES/NO	Page
Does this research involve human participants?		YES	
If YES:	-Are they volunteers for social or human sciences research?	YES	10,11
	-Are they persons unable to give informed consent?	NO	
	-Are they vulnerable individuals or groups?	NO	
	-Are they children/minors?	NO	
	-Are they patients?	YES	WP6
	-Are they healthy volunteers for medical studies?	NO	

Does this research involve physical interventions on the study participants?		NO	
If YES:	-Does it involve invasive techniques?		
	-Does it involve collection of biological samples?		
Section 3: HUMAN CELLS / TISSUES		YES/NO	Page
Does this research involve human cells or tissues? (other than from Human Embryos/Foetuses, see section 1)		NO	
If Yes	-Are they available commercially?		
	-Are they obtained within this project?		
	-Are they obtained within another project?		
	-Are they originating from biobank or another laboratory or institution?		
Section 4: PERSONAL DATA		**YES/NO**	**Page**
Does this research involve personal data collection and/or processing?		YES	WP6
If Yes	-Does it involve the collection and/or processing of sensitive personal data (e.g. health, sexual lifestyle, ethnicity, political opinion, religious or philosophical conviction)?	YES	
	-Does it involve processing of genetic information?	NO	
	-Does it involve tracking or observation of participants?	YES	
Does this research involve further processing of previously collected personal data (secondary use)?		YES	
Section 5: ANIMALS		**YES/NO**	**Page**
Does this research involve animals?		NO	
If Yes	-Are they vertebrates?		
	-Are they non-human primates (NHPs)?		
	-Are they genetically modified?		
	-Are they cloned farm animals?		
	-Are they endangered species?		
Please indicate the species involved			
Section 6: THIRD COUNTRIES		**YES/NO**	**Page**
Does this research involve non-EU countries? **Specify the countries involved:**		NO	
Is it planned to use local resources (e.g. animal and/or human tissue samples, genetic material, live animals, human remains, materials of historical value, endangered fauna or flora samples, etc.)?			
Is it planned to import any material – including personal data – from non-EU countries into the EU?			
If Yes:	Specify material and countries involved		
Is it planned to export any material – including personal data –from the EU to non-EU countries?			
If Yes:	Specify material and countries involved		
Does this research involve low and/or lower-middle income countries, are any benefit-sharing actions planned?			
Could the situation in the country put the individuals taking part in the research			

at risk?		
Section 7: ENVIRONMENT & HEALTH AND SAFETY	YES/NO	Page
Does this research involve the use of elements that may cause harm to the environment, to animals or plants?	NO	
Does this research deal with endangered fauna and/or flora/protected areas?	NO	
Does this research involve the use of elements that may cause harm to humans, including research staff?	NO	
Section 8: DUAL USE	**YES/NO**	**Page**
Does this research have the potential for military applications?	NO	
Section 9: MISUSE	**YES/NO**	**Page**
Does this research have the potential for malevolent/criminal/terrorist abuse?	YES	6,7,40
Section 10: OTHER ETHICS ISSUES	**YES/NO**	**Page**
Are there any other ethics issues that should be taken into consideration?	NO	

Humans

Does this research involve human participants	**Yes**	
Are they volunteers for social or human sciences research	Yes	
Are they children/minors	Yes	No , we will exclude children/minors from our research
Are they patients	Yes	For patients, we will seek advice from the hospital to know if they can provide written consent prior to the experiments based on their understanding about the nature of this project
Does this research involve physical interventions on the study participants	Yes	We will only use non invasive sensors such as microphones and cameras
Does it involve invasive techniques	Yes	No

Protection of personal data

Does this research involve personal data collection and/or processing	**Yes**	
Does it involve the collection and/or processing of sensitive personal data (e.g. health, sexual lifestyle, ethnicity, political opinion, religious or	Yes	The research does not aim in any case to collect data that can result in the incidental finding of the individuals identity, in such cases any publicly available datasets will reviewed and withdrawn

philosophical conviction)		from the biometric repository
Does it involve tracking or observation of participants	Yes	
Does this research involve further processing of previously collected personal data (secondary use)	Yes	

Misuse

Does this research have the potential for malevolent/criminal/terrorist abuse	**Yes**	

Other ethics issues

Are there any other ethics issues that should be taken into consideration	**Yes**	

5.1.4 Ethics Report Recommendation

informed consent procedures that will be implemented

As soon as the protocols of the pilots are finalized, these protocols together with the templates for informed consent including data protection issues will be submitted to the local ethical committees should that deemed to be necessary. For FORTH this will involve the FORTH's ethics committee (http://www.ite.gr/index_main.php?c=46&l=e) and possibly the ethics committee of the University Hospital of Heraklion.

A specific campaign of information before the campaign of collecting that will present:

- the objectives of the experiment, the final usage of Biometric and the expected benefits in outputs of projects,
- the Protection of collected data during experiment,
- Usage of collected data after experiment.

For volunteers we will propose a specific consent form. Following the advices of ethical committees and national authorities specifically concerned by the authorities this form will include elements such as:

- A complete reminder of all information provided during the previous campaign of information
- A mean to get information (website, newsletter…) on the going experiment
- Ask mean to contact the individuals in case of incident with the database
- A kit of information (documentation, website, chart of Ethics..) will be given to the invidual

The participants will have also to make an explicit choice between two options during the data collection

1. data can be used only for research purpose
2. data can be used for research and later (at end of the project) made it available to the public for future research

recruitment procedures (inclusion/exclusion criteria, involvement of vulnerable individuals or minors)

Only adults who are able to consent will be selected in pilots through thorough inclusion criteria, and at the same time they will be empowered by appropriate consent forms to control the destiny of their data with regard to sharing. To this end, sample informed consent forms will be provided before the initiation of the pilots for approval.

We will refuse any children/minors consent form and for vulnerable people the objective also is to refuse consent that cannot be done with a full understanding of the experiment. We will rely on Hospital Ethics committee for instance in the eHealth case to propose the campaign only to non vulnerable people.

collection of novel biometrics information

Referring to Section 1.4.2 and 1.4.3 of the proposal, the innovation in Voice and Face Biometrics Data may be noted.

- voice biometrics is based on the acoustic correlates of the speakers vocal physiology

- the acoustic correlates of voice quality (and vocal physiology) have been shown to be robust and are ripe for exploitation and novel

- the project involves the coordination of dynamic facial information with speech, and will pay particular attention to lip shape and its relation to the audio signal which is novel

- dynamic face recognition in combination with voice biometrics provides a paradigm from which much novel invention can be derived.

data access permission and protection

The consortium will define a Data Access policy in accordance with Data Protection Directive. For instance we envisage the nomination of an **Ethics Advisor and a Chief Information Security Officer (CISO)**.

The General Assembly will nominate a Ethics advisor in charge of regular report to the European Commission about the ethics enforcement procedures set by the consortium (every six months).

The Exececutive board will nominate a CISOat least 3 weeks before the beginning of WP6.

CISO will develop a policy to define multiple levels of permissions e.g. Principal investigators could be able to access raw biometric data and the corresponding personnel information while third-parties could be able to access only the features extracted from raw data and anonymous identities. If data required to be transferred from one location to another then it will be done by using secure storage vaults such as trusted platform or encryption. This process will protect the raw biometric data from sharing, copying and modifying.

Any access to biometric data should be asked and justified to the Project Executive Committee that will allow the CISO to provide the adequate credential. The Access Control should bone using Strong Authentication means that can be provided by the partners (e.g. Oberthur Technologies).

You can see also in chapter 1.3 some views about the security of biometric template Storage

data management policy

We will follow the EU Directive 95/46/EC (Data Protection Directive) and exploit well established standards to satisfy the following seven principals

1. *Notice*— only the facial and voice biometrics of individuals will be collected
2. *Purpose*—the data will only be used for algorithm evaluation, experiment and demonstration.
3. *Consent*—users will be provided with options whether they want their data to be used only for research or research and later for public usage (potentially for further research)
4. *Security*—well established security protocols such as strong authentication; firewall and intrusion detection techniques will be used to protect the server with biometric data.
5. *Disclosure*—users will be provided with who is collecting the data
6. *Access*—OAuth 2.0 will be used for access control
7. *Accountability*—data subjects should have a method available to them to hold data collectors accountable for not following the above principles.

We envisage that biometric storage will be done at the collect location on dedicated means like a dedicated server. A copy of the database could be on request if justified to the Project Executive committee and the assurance that at least the national rule of the Collection location is enforced. After usage the copy should be sent back.

We will define an end date. If the individual does not consent explicitly for a re-use of their data after this data his/her data will be erased. At any time, on demand, an individual's data can be erased.

re-use of data, secondary use of data and of large biometrics data sets

As described above re-use of data for secondary use cannot be envisaged without explicit consent of the participant. Furthermore, during project lifetime as the database will remain at their location it shall be available only if the role of CISO is still ensured.

This procedure is similar to the ones of BioSecure association that is continuing to distribute de biometric database that were acquired during BioSecure project.

http://biosecure.it-sudparis.eu/AB/

social engineering and mock identity development mitigation policies

The algorithm we develop/implement will be collision resistant i.e., adversary cannot create a genuine biometric feature from someone who cannot be authorized.

We will use pseudonyms generated from biometric features for authentication which will mitigate adversary to use the pseudonym to gain access to different systems.

- hacking risks mitigation policy (hacking contest)

The server holding the raw biometric data and features will be protected via well-established security protocols i.e., access control, strong passwords, firewalls, and intrusion detection techniques.

Individuals biometric data will not be stored in the system's entry points i.e., user's mobile device. During the authentication, entry points will extract the features of the user's data and securely transmit them to the authentication server using AES encryption. This procedure mitigates the risks during data collection and transmission.

5.1.5 REQUIREMENTS:

	Before/after	Sensitivity	Schedule	SpeechXRays implementation

	grant agreement			
Data protection To cover the pilots involving personal data, copies of ethical approvals by the competent legal local/national Ethics Boards/Bodies/administrations must be submitted to the REA prior to the commencement of the research.	After	Normal	3 months prior to the pilots	**Recruitment specifications document introcuded in WP1. Those specifications includes the end user consent form and will be submitted for approval to the listed authorities**
Data protection officer A Chief Information Security Officer (CISO) must be appointed.	After	Normal	3 months from start of project	**The role is now introduced in previous chapter Ethics Report Recommendation**.
Secondary data use Applicants must confirm whether they will use secondary personal data. If so, applicants have to show that the original consent procedure included approval for secondary use or that an ethics committee released the data for such use.	After	Normal	3 months prior to start of the pilots	**It will be introduced in end-user cosent form as mentioned in previous chapter**
Pilots involving humans Details of how the 2,000 users will be recruited must be given (e.g. inclusion/exclusion criteria, direct/indirect incentives for participation, information on the risks and benefits for the participants etc.).	After	Normal	3 months prior to the pilots	**The details will be all included in Recrutment document (D8, D9 , D10) of WP1**
Copies of examples of Informed Consent Forms and Information Sheets must be sent to REA.	After	Normal	3 months prior to the pilots	**This procedure will be incuded in Recruitment documents**
Misuse The applicants must describe	After	High	3 months prior to the	**This concern is fully understand by IFIN-HH and will**

how the pilot involving the use of biometric security measures in a nuclear plant will minimize any risks for illegitimate access, either to data or to the plant.			pilots	**be specifically introduced in D1.8 Workforce Recruitment procedure**.
General An external independent Ethics advisor must be appointed to oversee the ethical concerns involved in this research. A report by the Ethics advisor should be submitted to the European Commission with the Periodic Reports.	After	Normal	3 months from start of project	**The role is now introduced in previous chapter Ethics Report Recommendation. Two deliverables D 10.5 First Ethics periodic report and D 10.6 Second Ethic periodic report have been added.**

5.1.6 Specific Issue: Biometric Template Storage

When people use biometric services for authentication, they must allow the service to have access to their biometrics credentials. This exposes the user to abuse, with security, privacy and economic implications. For instance, the service could extract information such as gender, ethnicity, and even the emotional state of the user from the recording – factors not intended to be exposed by the user – and use them for undesired purposes. Moreover, due to the recent trends toward Cloud computing, it is imaginable that the biometric authentication systems will also be outsourced to potentially untrusted servers in the Internet. These servers could be malicious itself or vulnerable to passive and active attacks by intruders. Hence it is crucial to preserve the privacy of the user's biometric data without compromising or altering the system performance. Any private information that can be gleaned by inspecting a user's interaction with a system must be protected from prying eyes.

The system will allow voice and dynamic face recognition processing tasks subject to no party, including the users, the system, or a snooper, can derive undesired or unintended information from the transaction. This implies, for instance, that a user may enrol for authentication without fear that an intruder or even the system itself could capture and abuse his voice or statistical models derived from it. This will be achieved by incorporating biometric cryptosystem and cancellable biometrics technologies.

We will develop and implement a one-way cryptographic function tailored for voice accoustic and dynamic face recognition to transform the user biometric data into a template with the following features:

- the template used for the authentication, generated from the biometric data, cannot be reverse engineered to reveal the true biometric data
- the user will be able to generate different ''templates'' for different applications with the same biometric data, whilst ensuring that these different identities cannot be linked to each other

This will preserve the privacy of the user's biometric data from template leakage. In case of leakage, the system will simply revoke the enrolled template with freshly generated template. In general the following four different types of cryptographic techniques are used to protect the template: 1. salting (e.g. biohashing) 2. noninvertible transform (e.g. robust hashing) 3. key binding (e.g. fuzzy vault, fuzzy commitment) 4. key generation (e.g. secure sketch, fuzzy extractor). Each technique has its own advantages and disadvantages and have been exploited in several biometric authentication systems in the past. However, a single technique cannot be used to satisfy all the security and privacy requirements. Moreover, these techniques have only been implemented and tested on traditional biometrics such as fingerprints, Iris and face based authentication systems. This project will implement and investigate the cryptographic techniques for combined voice acoustic and lip based face

authentication system individually and jointly. Each scheme will be evaluated in terms of false acceptance rate and false rejection rate.

The project will develop an end-to-end privacy-preserving biometric authentication system to protect users vocal tract physiology derived from the feature analysis of the speech spectrogram and dynamic face features such as lip movement during the authentication from the authentication server as well as passive eavesdroppers. The end-to-end anonymous protocol is crucial when the biomtric system is outsourced to third party such as cloud computing paradigm. In literature, there have been several privacy preserving biometric recognition systems such as the face recognition that are developed based on the cryptographic primitives such as homomorphic encryption, secure multiparty computation and oblivious transfer. However, developing a private tool to analyse the speech spectrogram and dynamic face recognition in encrypted domain in order to derive the precise vocal tract physiology and lip movement have not been done to-date. Moreover, the model of the acoustic cues of the voice physiology combined with lip movement of face for an individual is unique like his fingerprint. Hence it is crucial to keep it secure during transmission and storage. We will achieve this by implementing secure two-party protocol using Paillier cryptography to perform authentication in the encrypted domain. The Paillier cryptosystem is an additively homomorphic public-key encryption scheme, whose provable semantic security is based on the decisional composite residuosity problem. Additive homomorphic property supports addition and scaling operations in the encrypted domain. Hence the user's biometric inputs will be encrypted using the Paillier cryptography and the authentication will be performed by the server in the encrypted domain.

5.1.7 Overall Approach to Ethics

The project coordinator, OT, applies high standards when it comes to ethics, in all projects in which we are involved. We take the view that ethics in research is not only about answering *yes*, or *no* to questions in a questionnaire, but about taking responsibility for the research one conducts; it is important for the SpeechXRays consortium to show that ethics is given the attention it deserves in the research we propose.

Nothing in this proposal/project shall be deemed to require a party to breach any mandatory statutory law under which the party is operating, including any national or European regulations, rules and norms regarding ethics in conducting research. The SpeechXRays project, as an applicant and potential participant in H2020, confirms that the proposed research and consortium participants fully comply with the principles of the European Charter for Researchers and the European Code of Conduct for Research Integrity of ALLEA (All European Academics) and ESF (European Science Foundation).

The coordinator of the SpeechXRays project, OT, follows ethical guidelines in its work. The ethical guidelines are based on the vision of using science and technology to create a better society and are reviewed every year to ensure they stay up to date with developments in society and the challenges of today. They generally fall into these categories: research ethics, business ethics, and ethics in interpersonal relationships.

All OT's employees (including employees participating in projects led by OT) are expected to act in accordance with the ethical guidelines and principles. As coordinator of the SpeechXRays project, OT will ensure that any ethical issues that may arise during the project (even if not originally anticipated) will be handled appropriately and in a transparent and fair manner.

5.2 Security:Security Scrunity

No classification and recommendations for the Grant Agreement Preparation

5.2.1 Recommendations or Justification

1) Provide 2 versions of report (D1.1), one for partners, one for dissemination.

    a. UPDATE: the deliverable regarding use case specified have doubled. We have defined use case description documents which are the public version of the original ones

2) D6.1 activities should be achieved within a non-classified environment.

a. UPDATE: the Task 6.1 in Work Package 6 has been updated to underlined that impletation, evaluation and testing should compromised the activities of the users (e.g. Romanian Gendarmerie) and they will take place in non classified environment.

ESTIMATED BUDGET FOR THE ACTION (page 1 of 2)

	Estimated eligible[1] costs (per budget category)									EU contribution			Additional information		
	A. Direct personnel costs				B. Direct costs of subcontracting	[C. Direct costs of fin. support]	D. Other direct costs	E. Indirect costs[2]	Total costs	Reimbursement rate %	Maximum EU contribution[3]	Maximum grant amount[4]	Information for indirect costs	Information for auditors	Other information:
	A.1 Employees (or equivalent) A.2 Natural persons under direct contract A.3 Seconded persons [A.6 Personnel for providing access to research infrastructure]		A.4 SME owners without salary A.5 Beneficiaries that are natural persons without salary				D.1 Travel D.2 Equipment D.3 Other goods and services D.4 Costs of large research infrastructure						Estimated costs of in-kind contributions not used on premises	Declaration of costs under Point D.4	Estimated costs of beneficiaries/ linked third parties not receiving EU funding
Form of costs[6]	Actual	Unit[7]	Unit[8]		Actual	Actual	Actual	Flat-rate[9] 25%							
	(a)	Total (b)	No hours	Total (c)	(d)	(e)	(f)	(g)=0,25x ((a)+(b)+ (c)+(f) +[(h1)+(h2)]- (m))	(i)= (a)+(b)+(c)+ (d)+(e)+(f)+ (g)+(h1)+(h2)+(h3)	(j)	(k)	(l)	(m)	Yes/No	
1. OT	868400.00	0.00			0.00	0.00	44000.00	228100.00	1140500.00	70.00	798350.00	798350.00	0.00	No	
2. HB	868000.00	0.00	0.00	0.00	0.00	0.00	39000.00	226750.00	1133750.00	70.00	793625.00	793625.00	0.00	No	
3. SIV	482500.00	0.00			0.00	0.00	52715.00	133803.75	669018.75	70.00	468313.13	468313.00	0.00	No	
4. INSP	380250.00	0.00	0.00	0.00	0.00	0.00	50500.00	107687.50	538437.50	70.00	376906.25	376905.00	0.00	No	
5. EYE	237250.00	0.00	0.00	0.00	0.00	0.00	39000.00	69062.50	345312.50	70.00	241718.75	241718.00	0.00	No	
6. FNET	178750.00	0.00			0.00	0.00	36000.00	53687.50	268437.50	70.00	187906.25	187906.00	0.00	No	
7. IFIN	87750.00	0.00			0.00	0.00	23000.00	27687.50	138437.50	100.00	138437.50	138437.50	0.00	No	
8. FORTH	222000.00	0.00			0.00	0.00	21000.00	60750.00	303750.00	100.00	303750.00	303750.00	0.00	No	
9. UCL	290920.00	0.00			0.00	0.00	21000.00	77980.00	389900.00	100.00	389900.00	377400.00	0.00	No	
10. TSP	311850.00	0.00			0.00	0.00	21000.00	83212.50	416062.50	100.00	416062.50	416062.50	0.00	No	
Total consortium	3927670.00	0.00		0.00	0.00	0.00	347215.00	1068721.25	5343606.25		4114969.38	4102467.00	0.00		0.00

ESTIMATED BUDGET FOR THE ACTION (page 2 of 2)

(1) See Article 6 for the eligibility conditions
(2) The indirect costs covered by the operating grant (received under any EU or Euratom funding programme; see Article 6.5.(b)) are ineligible under the GA. Therefore, a beneficiary that receives an operating grant during the action's duration cannot declare indirect costs for the year(s)/reporting period(s) covered by the operating grant (see Article 6.2.E).
(3) This is the theoretical amount of EU contribution that the system calculates automatically (by multiplying all the budgeted costs by the reimbursement rate). This theoretical amount is capped by the 'maximum grant amount' (that the Commission/Agency decided to grant for the action) (see Article 5.1).
(4) The 'maximum grant amount' is the maximum grant amount decided by the Commission/Agency. It normally corresponds to the requested grant, but may be lower.
(5) Depending on its type, this specific cost category will or will not cover indirect costs. Specific unit costs that include indirect costs are: costs for energy efficiency measures in buildings, access costs for providing trans-national access to research infrastructure and costs for clinical studies.
(6) See Article 5 for the forms of costs
(7) Unit : hours worked on the action; costs per unit (hourly rate) : calculated according to beneficiary's usual accounting practice
(8) See Annex 2a 'Additional information on the estimated budget' for the details (costs per hour (hourly rate)).
(9) Flat rate : 25% of eligible direct costs, from which are excluded: direct costs of subcontracting, costs of in-kind contributions not used on premises, direct costs of financial support, and unit costs declared under budget category F if they include indirect costs
(10) See Annex 2a 'Additional information on the estimated budget' for the details (units, costs per unit).
(11) See Annex 2a 'Additional information on the estimated budget' for the details (units, costs per unit, estimated number of units, etc)
(12) Only specific unit costs that do not include indirect costs
(13) See Article 9 for beneficiaries not receiving EU funding
(14) Only for linked third parties that receive EU funding

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

HOROWITZ BIOMETRICS LIMITED (HB) LTD, 08820146, established in 364A HIGH ROAD, LONDON NW10 2EA, United Kingdom, GB206829208, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘2’)

in Grant Agreement No 653586 (‘the Agreement’)

between OBERTHUR TECHNOLOGIES SA **and** *the Research Executive Agency (REA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘Multi-channel biometrics combining acoustic and machine vision analysis of speech, lip movement and face (SpeechXRays)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

SIVECO ROMANIA SA (SIV) SA, J40146581992, established in SOSEAUA BUCURESTI-PLOIESTI COMPLEX VICTORIA PARK CORP CLADIRE C4 SECTOR 1 73-81, BUCURESTI 013685, Romania, RO476331 , ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘3’)

in Grant Agreement No 653586 (‘the Agreement’)

between OBERTHUR TECHNOLOGIES SA **and** *the Research Executive Agency (REA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘Multi-channel biometrics combining acoustic and machine vision analysis of speech, lip movement and face (SpeechXRays)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

TECH INSPIRE LTD (INSP) LTD, 8699805, established in Pragnell Road 15, London SE12 0LF, United Kingdom, GB176580184, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘4’)

in Grant Agreement No 653586 (‘the Agreement’)

between OBERTHUR TECHNOLOGIES SA **and** *the Research Executive Agency (REA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘Multi-channel biometrics combining acoustic and machine vision analysis of speech, lip movement and face (SpeechXRays)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

REALEYES OU (EYE) OU, 11730664 , established in VAHE 15, TALLINN 11615, Estonia, EE101347468 , ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘5’)

in Grant Agreement No 653586 (‘the Agreement’)

between OBERTHUR TECHNOLOGIES SA **and** *the Research Executive Agency (REA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘Multi-channel biometrics combining acoustic and machine vision analysis of speech, lip movement and face (SpeechXRays)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

Hellenic Telecommunications & Telematics Applications Company (FNET), 34461/06/B/95/94, established in Science & Technology Park of Crete, Vassilikia Vouton, Innovation Dept. , Heraklion 71003, Greece, EL094444827, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘6’)

in Grant Agreement No 653586 (‘the Agreement’)

between OBERTHUR TECHNOLOGIES SA **and** *the Research Executive Agency (REA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘Multi-channel biometrics combining acoustic and machine vision analysis of speech, lip movement and face (SpeechXRays)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

INSTITUTUL NATIONAL DE CERCETARE -DEZVOLTARE PENTRU FIZICA SI INGINERIE NUCLEARA "HORIA HULUBEI" (IFIN-HH) (IFIN), R3321234, established in Atomistilor Street 407, MAGURELE RO 077125, Romania, RO3321234, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘7’)

in Grant Agreement No 653586 (‘the Agreement’)

between OBERTHUR TECHNOLOGIES SA **and** *the Research Executive Agency (REA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘Multi-channel biometrics combining acoustic and machine vision analysis of speech, lip movement and face (SpeechXRays)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS (FORTH) GR2, PD432/87, established in N PLASTIRA STR 100, HERAKLION 70013, Greece, EL090101655, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘8’)

in Grant Agreement No 653586 (‘the Agreement’)

between OBERTHUR TECHNOLOGIES SA **and** *the Research Executive Agency (REA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘Multi-channel biometrics combining acoustic and machine vision analysis of speech, lip movement and face (SpeechXRays)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

UNIVERSITY COLLEGE LONDON (UCL), RC000631, established in GOWER STREET, LONDON WC1E 6BT, United Kingdom, GB524371168, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘9’)

in Grant Agreement No 653586 (‘the Agreement’)

between OBERTHUR TECHNOLOGIES SA **and** *the Research Executive Agency (REA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘Multi-channel biometrics combining acoustic and machine vision analysis of speech, lip movement and face (SpeechXRays)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

Institut Mines-Telecom (TSP), 180092025, established in RUE BARRAULT 46, PARIS 13 75634, France, FR55180092025, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘10’)

in Grant Agreement No 653586 (‘the Agreement’)

between OBERTHUR TECHNOLOGIES SA **and** *the Research Executive Agency (REA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘Multi-channel biometrics combining acoustic and machine vision analysis of speech, lip movement and face (SpeechXRays)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ⓘ print format A4 landscape

MODEL ANNEX 4 FOR H2020 GENERAL MGA — MULTI

FINANCIAL STATEMENT FOR *[BENEFICIARY [name]/ LINKED THIRD PARTY [name]]* FOR REPORTING PERIOD [reporting period]

	Eligible[1] costs (per budget category)												Receipts	EU contribution			Additional information
	A. Direct personnel costs				B. Direct costs of subcontracting	*[C. Direct costs of fin. support]*	D. Other direct costs		E. Indirect costs[2]	*[F. Costs of …]*		Total costs	Receipts	Reimbursement rate %	Maximum EU contribution[3]	Requested EU contribution	Information for indirect costs :
	A.1 Employees (or equivalent) A.2 Natural persons under direct contract A.3 Seconded persons *[A.6 Personnel for providing access to research infrastructure]*		A.4 SME owners without salary A.5 Beneficiaries that are natural persons without salary				D.1 Travel D.2 Equipment D.3 Other goods and services	*[D.4 Costs of large research infrastructure]*		*[F.1 Costs of …]*			Receipts of the action, to be reported in the last reporting period, according to Article 5.3.3				Costs of in-kind contributions not used on premises
Form of costs[4]	Actual	Unit	Unit		Actual	Actual	Actual	Actual	Flat-rate[5] 25%	Unit	Unit						
	a	Total b	No hours	Total c	d	*[e]*	f	*[g]*	h=0,25 x (a+b+ c+f+*[g]* + *[i1]*[6] +*[i2]*[6] - o)	No units	Total *[i1]*	Total *[i2]*	j = a+b+c+d+*[e]* +f +*[g]* +h+*[i1]* +*[i2]*	k	l	m	n	o
[short name beneficiary/linked third party]																	

The beneficiary/linked third party hereby confirms that:
The information provided is complete, reliable and true.
The costs declared are eligible (see Article 6).
The costs can be substantiated by adequate records and supporting documentation that will be produced upon request or in the context of checks, reviews, audits and investigations (see Articles 17, 18 and 22).
For the last reporting period: that all the receipts have been declared (see Article 5.3.3).

ⓘ Please declare all eligible costs, even if they exceed the amounts indicated in the estimated budget (see Annex 2). Only amounts that were declared in your individual financial statements can be taken into account lateron, in order to replace other costs that are found to be ineligible.

[1] See Article 6 for the eligibility conditions

[2] The indirect costs claimed must be free of any amounts covered by an operating grant (received under any EU or Euratom funding programme; see Article 6.2.E). If you have received an operating grant during this reporting period, you cannot claim any indirect costs.

[3] This is the *theoretical* amount of EU contribution that the system calculates automatically (by multiplying the reimbursement rate by the total costs declared). The amount you request (in the column 'requested EU contribution') may have to be less (e.g. if you and the other beneficiaries are above budget, if the 90% limit (see Article 21) is reached, etc).

[4] See Article 5 for the form of costs

[5] Flat rate : 25% of eligible direct costs, from which are excluded: direct costs of subcontracting, costs of in-kind contributions not used on premises, direct costs of financial support, and unit costs declared under budget category F if they include indirect costs (see Article 6.2.E)

[6] Only specific unit costs that do not include indirect costs

ANNEX 5

MODEL FOR THE CERTIFICATE ON THE FINANCIAL STATEMENTS

- **For options [*in italics in square brackets*]: choose the applicable option. Options not chosen should be deleted.**
- **For fields in [grey in square brackets]: enter the appropriate data**

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Terms of Reference for an Independent Report of Factual Findings on costs declared under a Grant Agreement financed under the Horizon 2020 Research and Innovation Framework Programme

This document sets out the '**Terms of Reference (ToR)**' under which

[OPTION 1: [insert name of the beneficiary] ('the Beneficiary')] [OPTION 2: [insert name of the linked third party] ('the Linked Third Party'), third party linked to the Beneficiary [insert name of the beneficiary] ('the Beneficiary')]

agrees to engage

[**insert legal name of the auditor**] ('the Auditor')

to produce an independent report of factual findings ('the Report') concerning the Financial Statement(s)[1] drawn up by the *[Beneficiary] [Linked Third Party]* for the Horizon 2020 grant agreement [insert number of the grant agreement, title of the action, acronym and duration from/to] ('the Agreement'), and

to issue a Certificate on the Financial Statements' ('CFS') referred to in Article 20.4 of the Agreement based on the compulsory reporting template stipulated by the Commission.

The Agreement has been concluded under the Horizon 2020 Research and Innovation Framework Programme (H2020) between the Beneficiary and *[OPTION 1: the European Union, represented by the European Commission ('the Commission')][OPTION 2: the European Atomic Energy Community (Euratom,) represented by the European Commission ('the Commission')][OPTION 3: the [Research Executive Agency (REA)] [European Research Council Executive Agency (ERCEA)] [Innovation and Networks Executive Agency (INEA)] [Executive Agency for Small and Medium-sized Enterprises (EASME)] ('the Agency'), under the powers delegated by the European Commission ('the Commission').]*

[1] By which costs under the Agreement are declared (see template 'Model Financial Statements' in Annex 4 to the Grant Agreement).

The *[Commission] [Agency]* is mentioned as a signatory of the Agreement with the Beneficiary only. The *[European Union][Euratom][Agency]* is not a party to this engagement.

1.1 Subject of the engagement

The coordinator must submit to the *[Commission][Agency]* the final report within 60 days following the end of the last reporting period which should include, amongst other documents, a CFS for each beneficiary and for each linked third party that requests a total contribution of EUR 325 000 or more, as reimbursement of actual costs and unit costs calculated on the basis of its usual cost accounting practices (see Article 20.4 of the Agreement). The CFS must cover all reporting periods of the beneficiary or linked third party indicated above.

The Beneficiary must submit to the coordinator the CFS for itself and for its linked third party(ies), if the CFS must be included in the final report according to Article 20.4 of the Agreement..

The CFS is composed of two separate documents:

- The Terms of Reference ('the ToR') to be signed by the *[Beneficiary] [Linked Third Party]* and the Auditor;
- The Auditor's Independent Report of Factual Findings ('the Report') to be issued on the Auditor's letterhead, dated, stamped and signed by the Auditor (or the competent public officer) which includes the agreed-upon procedures ('the Procedures') to be performed by the Auditor, and the standard factual findings ('the Findings') to be confirmed by the Auditor.

If the CFS must be included in the final report according to Article 20.4 of the Agreement, the request for payment of the balance relating to the Agreement cannot be made without the CFS. However, the payment for reimbursement of costs covered by the CFS does not preclude the *[Commission,][Agency,]* the European Anti-Fraud Office and the European Court of Auditors from carrying out checks, reviews, audits and investigations in accordance with Article 22 of the Agreement.

1.2 Responsibilities

The *[Beneficiary] [Linked Third Party]:*

- must draw up the Financial Statement(s) for the action financed by the Agreement in compliance with the obligations under the Agreement. The Financial Statement(s) must be drawn up according to the *[Beneficiary's] [Linked Third Party's]* accounting and book-keeping system and the underlying accounts and records;
- must send the Financial Statement(s) to the Auditor;
- is responsible and liable for the accuracy of the Financial Statement(s);
- is responsible for the completeness and accuracy of the information provided to enable the Auditor to carry out the Procedures. It must provide the Auditor with a written representation letter supporting these statements. The written representation letter must state the period covered by the statements and must be dated;
- accepts that the Auditor cannot carry out the Procedures unless it is given full access to the *[Beneficiary's] [Linked Third Party's]* staff and accounting as well as any other relevant records and documentation.

The Auditor:

- *[Option 1 by default:* is qualified to carry out statutory audits of accounting documents in accordance with Directive 2006/43/EC of the European Parliament and of the Council of 17 May 2006 on statutory audits of annual accounts and consolidated accounts, amending Council Directives 78/660/EEC and 83/349/EEC and repealing Council Directive 84/253/EEC or similar national regulations*]*.
- *[Option 2 if the Beneficiary or Linked Third Party has an independent Public Officer:* is a competent and independent Public Officer for which the relevant national authorities have established the legal capacity to audit the Beneficiary*].*
- *[Option 3 if the Beneficiary or Linked Third Party is an international organisation:* is an [internal] [external] auditor in accordance with the internal financial regulations and procedures of the international organisation*].*

The Auditor:

- must be independent from the Beneficiary *[and the Linked Third Party]*, in particular, it must not have been involved in preparing the *[Beneficiary's] [Linked Third Party's]* Financial Statement(s);
- must plan work so that the Procedures may be carried out and the Findings may be assessed;
- must adhere to the Procedures laid down and the compulsory report format;
- must carry out the engagement in accordance with this ToR;
- must document matters which are important to support the Report;
- must base its Report on the evidence gathered;
- must submit the Report to the *[Beneficiary] [Linked Third Party]*.

The Commission sets out the Procedures to be carried out by the Auditor. The Auditor is not responsible for their suitability or pertinence. As this engagement is not an assurance engagement, the Auditor does not provide an audit opinion or a statement of assurance.

1.3 Applicable Standards

The Auditor must comply with these Terms of Reference and with[2]:

- the International Standard on Related Services ('ISRS') 4400 *Engagements to perform Agreed-upon Procedures regarding Financial Information* as issued by the International Auditing and Assurance Standards Board (IAASB);
- the *Code of Ethics for Professional Accountants* issued by the International Ethics Standards Board for Accountants (IESBA). Although ISRS 4400 states that independence is not a requirement for engagements to carry out agreed-upon procedures, the *[Commission][Agency]* requires that the Auditor also complies with the Code's independence requirements.

The Auditor's Report must state that there is no conflict of interests in establishing this Report between the Auditor and the Beneficiary *[and the Linked Third Party]*, and must specify - if the service is invoiced - the total fee paid to the Auditor for providing the Report.

1.4 Reporting

The Report must be written in the language of the Agreement (see Article 20.7).

Under Article 22 of the Agreement, the [*Commission*] [*Agency*], the European Anti-Fraud Office and the Court of Auditors have the right to audit any work that is carried out under the action and for which costs are declared from [*the European Union*] [*Euratom*] budget. This includes work related to this engagement. The Auditor must provide access to all working papers (e.g. recalculation of hourly rates, verification of the time declared for the action) related to this assignment if the *[Commission] [Agency]*, the European Anti-Fraud Office or the European Court of Auditors requests them.

1.5 Timing

The Report must be provided by *[*dd Month yyyy*]*.

[2] Supreme Audit Institutions applying INTOSAI-standards may carry out the Procedures according to the corresponding International Standards of Supreme Audit Institutions and code of ethics issued by INTOSAI instead of the International Standard on Related Services ('ISRS') 4400 and the Code of Ethics for Professional Accountants issued by the IAASB and the IESBA.

1.6 Other terms

[*The [Beneficiary] [Linked Third Party] and the Auditor can use this section to agree other specific terms, such as the Auditor's fees, liability, applicable law, etc. Those specific terms must not contradict the terms specified above.*]

[legal name of the Auditor]	[legal name of the *[Beneficiary][Linked Third Party]*]
[name & function of authorised representative]	[name & function of authorised representative]
[dd Month yyyy]	[dd Month yyyy]
Signature of the Auditor	Signature of the *[Beneficiary][Linked Third Party]*

Independent Report of Factual Findings on costs declared under Horizon 2020 Research and Innovation Framework Programme

(To be printed on the Auditor's letterhead)

To

[name of contact person(s)], [Position]

[[*Beneficiary's*] [*Linked Third Party's*] name]

[Address]

[dd Month yyyy]

Dear [Name of contact person(s)],

As agreed under the terms of reference dated [dd Month yyyy]

with *[OPTION 1: [insert name of the beneficiary] ('the Beneficiary')] [OPTION 2: [insert name of the linked third party] ('the Linked Third Party'), third party linked to the Beneficiary [insert name of the beneficiary] ('the Beneficiary')],*

we

[name of the auditor] ('the Auditor'),

established at

[full address/city/state/province/country],

represented by

[name and function of an authorised representative],

have carried out the procedures agreed with you regarding the costs declared in the Financial Statement(s)[3] of the *[Beneficiary] [Linked Third Party]* concerning the grant agreement

[insert grant agreement reference: number, title of the action and acronym] ('the Agreement'),

with a total cost declared of

[total amount] EUR,

and a total of actual costs and 'direct personnel costs declared as unit costs calculated in accordance with the [*Beneficiary's*] [*Linked Third Party's*] usual cost accounting practices' declared of

[sum of total actual costs and total direct personnel costs declared as unit costs calculated in accordance with the *[Beneficiary's] [Linked Third Party's]* usual cost accounting practices] EUR

and **hereby provide our Independent Report of Factual Findings ('the Report')** using the compulsory report format agreed with you.

The Report

Our engagement was carried out in accordance with the terms of reference ('the ToR') appended to this Report. The Report includes the agreed-upon procedures ('the Procedures') carried out and the standard factual findings ('the Findings') examined.

The Procedures were carried out solely to assist the [*Commission*] [*Agency*] in evaluating whether the [*Beneficiary's*] [*Linked Third Party's*] costs in the accompanying Financial Statement(s) were declared in accordance with the Agreement. The *[Commission] [Agency]* draws its own conclusions from the Report and any additional information it may require.

[3] By which the Beneficiary declares costs under the Agreement (see template 'Model Financial Statement' in Annex 4 to the Agreement).

The scope of the Procedures was defined by the Commission. Therefore, the Auditor is not responsible for their suitability or pertinence. Since the Procedures carried out constitute neither an audit nor a review made in accordance with International Standards on Auditing or International Standards on Review Engagements, the Auditor does not give a statement of assurance on the Financial Statements.

Had the Auditor carried out additional procedures or an audit of the *[Beneficiary's] [Linked Third Party's]* Financial Statements in accordance with International Standards on Auditing or International Standards on Review Engagements, other matters might have come to its attention and would have been included in the Report.

Not applicable Findings

We examined the Financial Statement(s) stated above and considered the following Findings not applicable:

Explanation (to be removed from the Report):

*If a Finding was not applicable, it must be marked as '**N.A**.' ('Not applicable') in the corresponding row on the right-hand column of the table and means that the Finding did not have to be corroborated by the Auditor and the related Procedure(s) did not have to be carried out.*

The reasons of the non-application of a certain Finding must be obvious i.e.

i) if no cost was declared under a certain category then the related Finding(s) and Procedure(s) are not applicable;

ii) if the condition set to apply certain Procedure(s) are not met the related Finding(s) and those Procedure(s) are not applicable. For instance, for 'beneficiaries with accounts established in a currency other than euro' the Procedure and Finding related to 'beneficiaries with accounts established in euro' are not applicable. Similarly, if no additional remuneration is paid, the related Finding(s) and Procedure(s) for additional remuneration are not applicable.

List here all Findings considered not applicable for the present engagement and explain the reasons of the non-applicability.

….

Exceptions

Apart from the exceptions listed below, the *[Beneficiary] [Linked Third Party]* provided the Auditor all the documentation and accounting information needed by the Auditor to carry out the requested Procedures and evaluate the Findings.

Explanation (to be removed from the Report):

- *If the Auditor was not able to successfully complete a procedure requested, it must be marked as '**E**' ('Exception') in the corresponding row on the right-hand column of the table. The reason such as the inability to reconcile key information or the unavailability of data that prevents the Auditor from carrying out the Procedure must be indicated below.*
- *If the Auditor cannot corroborate a standard finding after having carried out the corresponding procedure, it must also be marked as '**E**' ('Exception') and, where possible, the reasons why the Finding was not fulfilled and its possible impact must be explained here below.*

List here any exceptions and add any information on the cause and possible consequences of each exception, if known. If the exception is quantifiable, include the corresponding amount.

….

Example (to be removed from the Report):

1. *The Beneficiary was unable to substantiate the Finding number 1 on … because ….*
2. *Finding number 30 was not fulfilled because the methodology used by the Beneficiary to calculate unit costs was different from the one approved by the Commission. The differences were as follows: …*
3. *After carrying out the agreed procedures to confirm the Finding number 31, the Auditor found a difference of _____ EUR. The difference can be explained by …*

Further Remarks

In addition to reporting on the results of the specific procedures carried out, the Auditor would like to make the following general remarks:

Example (to be removed from the Report):

1. *Regarding Finding number 8 the conditions for additional remuneration were considered as fulfilled because …*
2. *In order to be able to confirm the Finding number 15 we carried out the following additional procedures: ….*

Use of this Report

This Report may be used only for the purpose described in the above objective. It was prepared solely for the confidential use of the *[Beneficiary] [Linked Third Party]* and the [*Commission*] [*Agency*], and only to be submitted to the [*Commission*] [*Agency*] in connection with the requirements set out in Article 20.4 of the Agreement. The Report may not be used by the *[Beneficiary] [Linked Third Party]* or by the [*Commission*] [*Agency*] for any other purpose, nor may it

be distributed to any other parties. The [*Commission*] [*Agency*] may only disclose the Report to authorised parties, in particular to the European Anti-Fraud Office (OLAF) and the European Court of Auditors.

This Report relates only to the Financial Statement(s) submitted to the *[Commission] [Agency]* by the *[Beneficiary] [Linked Third Party]* for the Agreement. Therefore, it does not extend to any other of the [*Beneficiary's*] [*Linked Third Party's*] Financial Statement(s).

There was no conflict of interest[4] between the Auditor and the Beneficiary *[and Linked Third Party]* in establishing this Report. The total fee paid to the Auditor for providing the Report was EUR _____ (including EUR_____ of deductible VAT).

We look forward to discussing our Report with you and would be pleased to provide any further information or assistance.

[legal name of the Auditor]

[name and function of an authorised representative]

[dd Month yyyy]

Signature of the Auditor

[4] A conflict of interest arises when the Auditor's objectivity to establish the certificate is compromised in fact or in appearance when the Auditor for instance:
- was involved in the preparation of the Financial Statements;
- stands to benefit directly should the certificate be accepted;
- has a close relationship with any person representing the beneficiary;
- is a director, trustee or partner of the beneficiary; or
- is in any other situation that compromises his or her independence or ability to establish the certificate impartially.

Agreed-upon procedures to be performed and standard factual findings to be confirmed by the Auditor

The European Commission reserves the right to i) provide the auditor with additional guidance regarding the procedures to be followed or the facts to be ascertained and the way in which to present them (this may include sample coverage and findings) or to ii) change the procedures, by notifying the Beneficiary in writing. The procedures carried out by the auditor to confirm the standard factual finding are listed in the table below.

If this certificate relates to a Linked Third Party, any reference here below to 'the Beneficiary' is to be considered as a reference to 'the Linked Third Party'.

The 'result' column has three different options: 'C', 'E' and 'N.A.':

- 'C' stands for 'confirmed' and means that the auditor can confirm the 'standard factual finding' and, therefore, there is no exception to be reported.
- 'E' stands for 'exception' and means that the Auditor carried out the procedures but cannot confirm the 'standard factual finding', or that the Auditor was not able to carry out a specific procedure (e.g. because it was impossible to reconcile key information or data were unavailable),
- 'N.A.' stands for 'not applicable' and means that the Finding did not have to be examined by the Auditor and the related Procedure(s) did not have to be carried out. The reasons of the non-application of a certain Finding must be obvious i.e. i) if no cost was declared under a certain category then the related Finding(s) and Procedure(s) are not applicable; ii) if the condition set to apply certain Procedure(s) are not met then the related Finding(s) and Procedure(s) are not applicable. For instance, for 'beneficiaries with accounts established in a currency other than the euro' the Procedure related to 'beneficiaries with accounts established in euro' is not applicable. Similarly, if no additional remuneration is paid, the related Finding(s) and Procedure(s) for additional remuneration are not applicable.

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
A	**ACTUAL PERSONNEL COSTS AND UNIT COSTS CALCULATED BY THE BENEFICIARY IN ACCORDANCE WITH ITS USUAL COST ACCOUNTING PRACTICE**		

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	The Auditor draws a sample of persons whose costs were declared in the Financial Statement(s) to carry out the procedures indicated in the consecutive points of this section A. (*The sample should be selected randomly so that it is representative. Full coverage is required if there are fewer than 10 people (including employees, natural persons working under a direct contract and personnel seconded by a third party), otherwise the sample should have a minimum of 10 people, or 10% of the total, whichever number is the highest)* The Auditor sampled _____ people out of the total of _____ people.		
A.1	**PERSONNEL COSTS** <u>For the persons included in the sample and working under an employment contract or equivalent act (general procedures for individual actual personnel costs and personnel costs declared as unit costs)</u> To confirm standard factual findings 1-5 listed in the next column, the Auditor reviewed following information/documents provided by the Beneficiary: ○ a list of the persons included in the sample indicating the period(s) during which they worked for the action, their position (classification or category) and type of contract; ○ the payslips of the employees included in the sample; ○ reconciliation of the personnel costs declared in the Financial Statement(s) with the accounting system (project accounting and general ledger) and payroll system; ○ information concerning the employment status and employment conditions of personnel included in the sample, in particular their employment contracts or equivalent;	1) The employees were i) directly hired by the Beneficiary in accordance with its national legislation, ii) under the Beneficiary's sole technical supervision and responsibility and iii) remunerated in accordance with the Beneficiary's usual practices.	
		2) Personnel costs were recorded in the Beneficiary's accounts/payroll system.	
		3) Costs were adequately supported and reconciled with the accounts and payroll	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	○ the Beneficiary's usual policy regarding payroll matters (e.g. salary policy, overtime policy, variable pay); ○ applicable national law on taxes, labour and social security and ○ any other document that supports the personnel costs declared. The Auditor also verified the eligibility of all components of the retribution (see Article 6 GA) and recalculated the personnel costs for employees included in the sample.	records.	
		4) Personnel costs did not contain any ineligible elements.	
		5) There were no discrepancies between the personnel costs charged to the action and the costs recalculated by the Auditor.	
	Further procedures if 'additional remuneration' is paid To confirm standard factual findings 6-9 listed in the next column, the Auditor: ○ reviewed relevant documents provided by the Beneficiary (legal form, legal/statutory obligations, the Beneficiary's usual policy on additional remuneration, criteria used for its calculation…); ○ recalculated the amount of additional remuneration eligible for the action based on the supporting documents received (full-time or part-time work, exclusive or non-exclusive dedication to the action, etc.) to arrive at the applicable FTE/year and pro-rata rate (see data collected in the course of carrying out the procedures under A.2 'Productive hours' and A.4 'Time recording system').	6) The Beneficiary paying "additional remuneration" was a non-profit legal entity.	
		7) The amount of additional remuneration paid corresponded to the Beneficiary's usual remuneration practices and was consistently paid whenever the same kind of work or expertise was required.	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	IF ANY PART OF THE REMUNERATION PAID TO THE EMPLOYEE IS NOT MANDATORY ACCORDING TO THE NATIONAL LAW OR THE EMPLOYMENT CONTRACT ("ADDITIONAL REMUNERATION") AND IS ELIGIBLE UNDER THE PROVISIONS OF ARTICLE 6.2.A.1, THIS CAN BE CHARGED AS ELIGIBLE COST TO THE ACTION UP TO THE FOLLOWING AMOUNT: *(A) IF THE PERSON WORKS FULL TIME AND EXCLUSIVELY ON THE ACTION DURING THE FULL YEAR: UP TO EUR 8 000/YEAR;* *(B) IF THE PERSON WORKS EXCLUSIVELY ON THE ACTION BUT NOT FULL-TIME OR NOT FOR THE FULL YEAR: UP TO THE CORRESPONDING PRO-RATA AMOUNT OF EUR 8 000, OR* *(C) IF THE PERSON DOES NOT WORK EXCLUSIVELY ON THE ACTION: UP TO A PRO-RATA AMOUNT CALCULATED IN ACCORDANCE TO ARTICLE 6.2.A.1.*	8) The criteria used to calculate the additional remuneration were objective and generally applied by the Beneficiary regardless of the source of funding used.	
		9) The amount of additional remuneration included in the personnel costs charged to the action was capped at EUR 8,000 per FTE/year (up to the equivalent pro-rata amount if the person did not work on the action full-time during the year or did not work exclusively on the action).	
	Additional procedures in case "unit costs calculated by the Beneficiary in accordance with its usual cost accounting practices" is applied: Apart from carrying out the procedures indicated above to confirm standard factual findings 1-5 and, if applicable, also 6-9, the Auditor carried out following procedures to confirm standard factual findings 10-13 listed in the next column:	10) The personnel costs included in the Financial Statement were calculated in accordance with the Beneficiary's usual cost accounting practice. This methodology was consistently used in all H2020 actions.	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	○ obtained a description of the Beneficiary's usual cost accounting practice to calculate unit costs;. ○ reviewed whether the Beneficiary's usual cost accounting practice was applied for the Financial Statements subject of the present CFS; ○ verified the employees included in the sample were charged under the correct category (in accordance with the criteria used by the Beneficiary to establish personnel categories) by reviewing the contract/HR-record or analytical accounting records; ○ verified that there is no difference between the total amount of personnel costs used in calculating the cost per unit and the total amount of personnel costs recorded in the statutory accounts; ○ verified whether actual personnel costs were adjusted on the basis of budgeted or estimated elements and, if so, verified whether those elements used are actually relevant for the calculation, objective and supported by documents.	11) The employees were charged under the correct category.	
		12) Total personnel costs used in calculating the unit costs were consistent with the expenses recorded in the statutory accounts.	
		13) Any estimated or budgeted element used by the Beneficiary in its unit-cost calculation were relevant for calculating personnel costs and corresponded to objective and verifiable information.	
	<u>For natural persons included in the sample and working with the Beneficiary under a direct contract other than an employment contract, such as consultants (no subcontractors).</u> To confirm standard factual findings 14-18 listed in the next column the Auditor reviewed following information/documents provided by the Beneficiary: ○ the contracts, especially the cost, contract duration, work description, place of work, ownership of the results and reporting obligations to the Beneficiary;	14) The natural persons reported to the Beneficiary (worked under the Beneficiary's instructions).	
		15) They worked on the Beneficiary's premises (unless otherwise agreed with the Beneficiary).	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	○ the employment conditions of staff in the same category to compare costs and; ○ any other document that supports the costs declared and its registration (e.g. invoices, accounting records, etc.).	16) The results of work carried out belong to the Beneficiary.	
		17) Their costs were not significantly different from those for staff who performed similar tasks under an employment contract with the Beneficiary.	
		18) The costs were supported by audit evidence and registered in the accounts.	
	<u>For personnel seconded by a third party and included in the sample (not subcontractors)</u> To confirm standard factual findings 19-22 listed in the next column, the Auditor reviewed following information/documents provided by the Beneficiary: ○ their secondment contract(s) notably regarding costs, duration, work description, place of work and ownership of the results; ○ if there is reimbursement by the Beneficiary to the third party for the resource made available (in-kind contribution against payment): any documentation that supports the costs declared (e.g. contract, invoice, bank payment, and proof of registration in its accounting/payroll, etc.) and reconciliation of the Financial Statement(s) with the accounting system (project accounting and general ledger) as well as any proof that the amount invoiced by the third party did not include any profit;	19) Seconded personnel reported to the Beneficiary and worked on the Beneficiary's premises (unless otherwise agreed with the Beneficiary).	
		20) The results of work carried out belong to the Beneficiary.	
		If personnel is seconded against payment: 21) The costs declared were supported with documentation and recorded in the	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	○ if there is no reimbursement by the Beneficiary to the third party for the resource made available (in-kind contribution free of charge): a proof of the actual cost borne by the Third Party for the resource made available free of charge to the Beneficiary such as a statement of costs incurred by the Third Party and proof of the registration in the Third Party's accounting/payroll; ○ any other document that supports the costs declared (e.g. invoices, etc.).	Beneficiary's accounts. The third party did not include any profit.	
		If personnel is seconded free of charge: 22) The costs declared did not exceed the third party's cost as recorded in the accounts of the third party and were supported with documentation.	
A.2	**PRODUCTIVE HOURS** To confirm standard factual findings 23-28 listed in the next column, the Auditor reviewed relevant documents, especially national legislation, labour agreements and contracts and time records of the persons included in the sample, to verify that: ○ the annual productive hours applied were calculated in accordance with one of the methods described below, ○ the full-time equivalent (FTEs) ratios for employees not working full-time were correctly calculated.	23) The Beneficiary applied method [*choose one option and delete the others*] [**A**: 1720 hours] [**B**: the 'total number of hours worked'] [**C**: 'annual productive hours' used correspond to usual accounting practices]	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	If the Beneficiary applied method B, the auditor verified that the correctness in which the total number of hours worked was calculated and that the contracts specified the annual workable hours. If the Beneficiary applied method C, the auditor verified that the 'annual productive hours' applied when calculating the hourly rate were equivalent to at least 90 % of the 'standard annual workable hours'. The Auditor can only do this if the calculation of the standard annual workable hours can be supported by records, such as national legislation, labour agreements, and contracts. *BENEFICIARY'S PRODUCTIVE HOURS' FOR PERSONS WORKING FULL TIME SHALL BE ONE OF THE FOLLOWING METHODS:* ***A.*** *1720 ANNUAL PRODUCTIVE HOURS (PRO-RATA FOR PERSONS NOT WORKING FULL-TIME)* ***B.*** *THE TOTAL NUMBER OF HOURS WORKED BY THE PERSON FOR THE BENEFICIARY IN THE YEAR (THIS METHOD IS ALSO REFERRED TO AS 'TOTAL NUMBER OF HOURS WORKED' IN THE NEXT COLUMN). THE CALCULATION OF THE TOTAL NUMBER OF HOURS WORKED WAS DONE AS FOLLOWS: ANNUAL WORKABLE HOURS OF THE PERSON ACCORDING TO THE EMPLOYMENT CONTRACT, APPLICABLE LABOUR AGREEMENT OR NATIONAL LAW PLUS OVERTIME WORKED MINUS ABSENCES (SUCH AS SICK LEAVE OR SPECIAL LEAVE).*	24) Productive hours were calculated annually.	
		25) For employees not working full-time the full-time equivalent (FTE) ratio was correctly applied.	
		If the Beneficiary applied method B. 26) The calculation of the number of 'annual workable hours', overtime and absences was verifiable based on the documents provided by the Beneficiary.	
		If the Beneficiary applied method C. 27) The calculation of the number of 'standard annual workable hours' was verifiable based on the documents provided by the Beneficiary.	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	C. THE STANDARD NUMBER OF ANNUAL HOURS GENERALLY APPLIED BY THE BENEFICIARY FOR ITS PERSONNEL IN ACCORDANCE WITH ITS USUAL COST ACCOUNTING PRACTICES (THIS METHOD IS ALSO REFERRED TO AS 'TOTAL ANNUAL PRODUCTIVE HOURS' IN THE NEXT COLUMN). THIS NUMBER MUST BE AT LEAST 90% OF THE STANDARD ANNUAL WORKABLE HOURS. *'ANNUAL WORKABLE HOURS' MEANS THE PERIOD DURING WHICH THE PERSONNEL MUST BE WORKING, AT THE EMPLOYER'S DISPOSAL AND CARRYING OUT HIS/HER ACTIVITY OR DUTIES UNDER THE EMPLOYMENT CONTRACT, APPLICABLE COLLECTIVE LABOUR AGREEMENT OR NATIONAL WORKING TIME LEGISLATION.*	28) The 'annual productive hours' used for calculating the hourly rate were consistent with the usual cost accounting practices of the Beneficiary and were equivalent to at least 90 % of the 'annual workable hours'.	
A.3	**HOURLY PERSONNEL RATES** <u>I) For unit costs calculated in accordance to the Beneficiary's usual cost accounting practice (unit costs):</u> If the Beneficiary has a "Certificate on Methodology to calculate unit costs " (CoMUC) approved by the Commission, the Beneficiary provides the Auditor with a description of the approved methodology and the Commission's letter of acceptance. The Auditor verified that the Beneficiary has indeed used the methodology approved. If so, no further verification is necessary. If the Beneficiary does not have a "Certificate on Methodology" (CoMUC) approved by the	29) The Beneficiary applied [*choose one option and delete the other*]: [Option I: "Unit costs (hourly rates) were calculated in accordance with the Beneficiary's usual cost accounting practices"] [Option II: Individual hourly rates were applied]	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	Commission, or if the methodology approved was not applied, then the Auditor: ○ reviewed the documentation provided by the Beneficiary, including manuals and internal guidelines that explain how to calculate hourly rates; ○ recalculated the unit costs (hourly rates) of staff included in the sample following the results of the procedures carried out in A.1 and A.2. II) For individual hourly rates: The Auditor: ○ reviewed the documentation provided by the Beneficiary, including manuals and internal guidelines that explain how to calculate hourly rates; ○ recalculated the hourly rates of staff included in the sample following the results of the procedures carried out in A.1 and A.2. *"UNIT COSTS CALCULATED BY THE BENEFICIARY IN ACCORDANCE WITH ITS USUAL COST ACCOUNTING PRACTICES":* *IT IS CALCULATED BY DIVIDING THE TOTAL AMOUNT OF PERSONNEL COSTS OF THE CATEGORY TO WHICH THE EMPLOYEE BELONGS VERIFIED IN LINE WITH PROCEDURE A.1 BY THE NUMBER OF FTE AND THE ANNUAL TOTAL PRODUCTIVE HOURS OF THE SAME CATEGORY CALCULATED BY THE BENEFICIARY IN ACCORDANCE WITH PROCEDURE A.2.* *HOURLY RATE FOR INDIVIDUAL ACTUAL PERSONAL COSTS:* *IT IS CALCULATED BY DIVIDING THE TOTAL AMOUNT OF PERSONNEL COSTS OF AN EMPLOYEE VERIFIED IN LINE WITH*	*For option I concerning unit costs and if the Beneficiary applies the methodology approved by the Commission (CoMUC):* 30) The Beneficiary used the Commission-approved methodology to calculate hourly rates. It corresponded to the organisation's usual cost accounting practices and was applied consistently for all activities irrespective of the source of funding.	
		For option I concerning unit costs and if the Beneficiary applies a methodology not approved by the Commission: 31) The unit costs re-calculated by the Auditor were the same as the rates applied by the Beneficiary.	
		For option II concerning individual hourly rates:	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	PROCEDURE A.1 BY THE NUMBER OF ANNUAL PRODUCTIVE HOURS VERIFIED IN LINE WITH PROCEDURE A.2.	32) The individual rates re-calculated by the Auditor were the same as the rates applied by the Beneficiary.	
A.4	**TIME RECORDING SYSTEM** To verify that the time recording system ensures the fulfilment of all minimum requirements and that the hours declared for the action were correct, accurate and properly authorised and supported by documentation, the Auditor made the following checks for the persons included in the sample that declare time as worked for the action on the basis of time records: o description of the time recording system provided by the Beneficiary (registration, authorisation, processing in the HR-system); o its actual implementation; o time records were signed at least monthly by the employees (on paper or electronically) and authorised by the project manager or another manager; o the hours declared were worked within the project period; o there were no hours declared as worked for the action if HR-records showed absence due to holidays or sickness (further cross-checks with travels are carried out in B.1 below) ;	33) All persons recorded their time dedicated to the action on a **daily/ weekly/ monthly** basis using a **paper/computer-based** system. (*delete the answers that are not applicable)*	
		34) Their time-records were authorised at least monthly by the project manager or other superior.	
		35) Hours declared were worked within the project period and were consistent with the presences/absences recorded in HR-records.	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	○ the hours charged to the action matched those in the time recording system. *ONLY THE HOURS WORKED ON THE ACTION CAN BE CHARGED. ALL WORKING TIME TO BE CHARGED SHOULD BE RECORDED THROUGHOUT THE DURATION OF THE PROJECT, ADEQUATELY SUPPORTED BY EVIDENCE OF THEIR REALITY AND RELIABILITY (SEE SPECIFIC PROVISIONS BELOW FOR PERSONS WORKING EXCLUSIVELY FOR THE ACTION WITHOUT TIME RECORDS).*	36) There were no discrepancies between the number of hours charged to the action and the number of hours recorded.	
	<u>If the persons are working exclusively for the action and without time records</u> For the persons selected that worked exclusively for the action without time records, the Auditor verified evidence available demonstrating that they were in reality exclusively dedicated to the action and that the Beneficiary signed a declaration confirming that they have worked exclusively for the action.	37) The exclusive dedication is supported by a declaration signed by the Beneficiary's and by any other evidence gathered.	
B	**COSTS OF SUBCONTRACTING**		
B.1	**The Auditor obtained the detail/breakdown of subcontracting costs and sampled _____ cost items selected randomly** (*full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is highest*). To confirm standard factual findings 38-42 listed in the next column, the Auditor reviewed the	38) The use of claimed subcontracting costs was foreseen in Annex 1 and costs were declared in the Financial Statements under the subcontracting category.	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	following for the items included in the sample: o the use of subcontractors was foreseen in Annex 1; o subcontracting costs were declared in the subcontracting category of the Financial Statement; o supporting documents on the selection and award procedure were followed; o the Beneficiary ensured best value for money (key elements to appreciate the respect of this principle are the award of the subcontract to the bid offering best price-quality ratio, under conditions of transparency and equal treatment. In case an existing framework contract was used the Beneficiary ensured it was established on the basis of the principle of best value for money under conditions of transparency and equal treatment). In particular, i. if the Beneficiary acted as a contracting authority within the meaning of Directive 2004/18/EC or of Directive 2004/17/EC, the Auditor verified that the applicable national law on public procurement was followed and that the subcontracting complied with the Terms and Conditions of the Agreement. ii. if the Beneficiary did not fall under the above-mentioned category the Auditor verified that the Beneficiary followed their usual procurement rules and respected the Terms and Conditions of the Agreement.. For the items included in the sample the Auditor also verified that: o the subcontracts were not awarded to other Beneficiaries in the consortium;	39) There were documents of requests to different providers, different offers and assessment of the offers before selection of the provider in line with internal procedures and procurement rules. Subcontracts were awarded in accordance with the principle of best value for money. *(When different offers were not collected the Auditor explains the reasons provided by the Beneficiary under the caption "Exceptions" of the Report. The Commission will analyse this information to evaluate whether these costs might be accepted as eligible)*	
		40) The subcontracts were not awarded to other Beneficiaries of the consortium.	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	○ there were signed agreements between the Beneficiary and the subcontractor; ○ there was evidence that the services were provided by subcontractor;	41) All subcontracts were supported by signed agreements between the Beneficiary and the subcontractor.	
		42) There was evidence that the services were provided by the subcontractors.	
C	**COSTS OF PROVIDING FINANCIAL SUPPORT TO THIRD PARTIES**		
C.1	**The Auditor obtained the detail/breakdown of the costs of providing financial support to third parties and sampled _____ cost items selected randomly** (*full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is highest*). The Auditor verified that the following minimum conditions were met: a) the maximum amount of financial support for each third party did not exceed EUR 60 000, unless explicitly mentioned in Annex 1; b) the financial support to third parties was agreed in Annex 1 of the Agreement and the other provisions on financial support to third parties included in Annex 1 were	43) All minimum conditions were met	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	respected.		

D	OTHER ACTUAL DIRECT COSTS		
D.1	**COSTS OF TRAVEL AND RELATED SUBSISTENCE ALLOWANCES** **The Auditor sampled _____ cost items selected randomly** (*full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is the highest*). The Auditor inspected the sample and verified that: ○ travel and subsistence costs were consistent with the Beneficiary's usual policy for travel. In this context, the Beneficiary provided evidence of its normal policy for travel costs (e.g. use of first class tickets, reimbursement by the Beneficiary on the basis of actual costs, a lump sum or per diem) to enable the Auditor to compare the travel costs charged with this policy; ○ travel costs are correctly identified and allocated to the action (e.g. trips are directly linked to the action) by reviewing relevant supporting documents such as minutes of meetings, workshops or conferences, their registration in the correct project account, their consistency with time records or with the dates/duration of the workshop/conference; ○ no ineligible costs or excessive or reckless expenditure was declared.	44) Costs were incurred, approved and reimbursed in line with the Beneficiary's usual policy for travels.	
		45) There was a link between the trip and the action.	
		46) The supporting documents were consistent with each other regarding subject of the trip, dates, duration and reconciled with time records and accounting.	
		47) No ineligible costs or excessive or reckless expenditure was declared.	
D.2	**DEPRECIATION COSTS FOR EQUIPMENT, INFRASTRUCTURE OR OTHER ASSETS** **The Auditor sampled _____ cost items selected randomly** (*full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is the highest*). For “equipment, infrastructure or other assets” [from now on called “asset(s)”] selected in the	48) Procurement rules, principles and guides were followed.	
		49) There was a link between the grant agreement and the asset charged to the action.	

	sample the Auditor verified that: ○ the assets were acquired in conformity with the Beneficiary's internal guidelines and procedures; ○ they were correctly allocated to the action (with supporting documents such as delivery note invoice or any other proof demonstrating the link to the action) ○ they were entered in the accounting system; ○ the extent to which the assets were used for the action (as a percentage) was supported by reliable documentation (e.g. usage overview table); The Auditor recalculated the depreciation costs and verified that they were in line with the applicable rules in the Beneficiary's country and with the Beneficiary's usual accounting policy (e.g. depreciation calculated on the acquisition value). The Auditor verified that no ineligible costs such as deductible VAT, exchange rate losses, excessive or reckless expenditure were declared (see Article 6.5 GA).	50) The asset charged to the action was traceable to the accounting records and the underlying documents. 51) The depreciation method used to charge the asset to the action was in line with the applicable rules of the Beneficiary's country and the Beneficiary's usual accounting policy. 52) The amount charged corresponded to the actual usage for the action. 53) No ineligible costs or excessive or reckless expenditure were declared.	
D.3	**COSTS OF OTHER GOODS AND SERVICES** **The Auditor sampled _____ cost items selected randomly** (*full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is highest*). For the purchase of goods, works or services included in the sample the Auditor verified that: ○ the contracts did not cover tasks described in Annex 1;	54) Contracts for works or services did not cover tasks described in Annex 1. 55) Costs were allocated to the correct action and the goods were not placed in the inventory of durable equipment.	

	○ they were correctly identified, allocated to the proper action, entered in the accounting system (traceable to underlying documents such as purchase orders, invoices and accounting); ○ the goods were not placed in the inventory of durable equipment; ○ the costs charged to the action were accounted in line with the Beneficiary's usual accounting practices; ○ no ineligible costs or excessive or reckless expenditure were declared (see Article 6 GA). In addition, the Auditor verified that these goods and services were acquired in conformity with the Beneficiary's internal guidelines and procedures, in particular: ○ if Beneficiary acted as a contracting authority within the meaning of Directive 2004/18/EC or of Directive 2004/17/EC, the Auditor verified that the applicable national law on public procurement was followed and that the procurement contract complied with the Terms and Conditions of the Agreement. ○ if the Beneficiary did not fall into the category above, the Auditor verified that the Beneficiary followed their usual procurement rules and respected the Terms and Conditions of the Agreement. For the items included in the sample the Auditor also verified that: ○ the Beneficiary ensured best value for money (key elements to appreciate the respect of this principle are the award of the contract to the bid offering best price-quality ratio, under conditions of transparency and equal treatment. In case an existing framework contract was used the Auditor also verified that the Beneficiary ensured it was established on the basis of the principle of best value for money under conditions of transparency and equal treatment); *SUCH GOODS AND SERVICES INCLUDE, FOR INSTANCE, CONSUMABLES AND SUPPLIES, DISSEMINATION (INCLUDING OPEN ACCESS), PROTECTION OF RESULTS, SPECIFIC EVALUATION OF THE ACTION IF IT IS REQUIRED BY THE*	56) The costs were charged in line with the Beneficiary's accounting policy and were adequately supported. 57) No ineligible costs or excessive or reckless expenditure were declared. For internal invoices/charges only the cost element was charged, without any mark-ups. 58) Procurement rules, principles and guides were followed. There were documents of requests to different providers, different offers and assessment of the offers before selection of the provider in line with internal procedures and procurement rules. The purchases were made in accordance with the principle of best value for money. *(When different offers were not collected the Auditor explains the reasons provided by the Beneficiary under the*	

	AGREEMENT, CERTIFICATES ON THE FINANCIAL STATEMENTS IF THEY ARE REQUIRED BY THE AGREEMENT AND CERTIFICATES ON THE METHODOLOGY, TRANSLATIONS, REPRODUCTION.	*caption "Exceptions" of the Report. The Commission will analyse this information to evaluate whether these costs might be accepted as eligible)*	
D.4	**AGGREGATED CAPITALISED AND OPERATING COSTS OF RESEARCH INFRASTRUCTURE** The Auditor ensured the existence of a positive ex-ante assessment (issued by the EC Services) of the cost accounting methodology of the Beneficiary allowing it to apply the guidelines on direct costing for large research infrastructures in Horizon 2020. ***In the cases that a positive ex-ante assessment has been issued*** *(see the standard factual findings 59-60 on the next column)****,*** The Auditor ensured that the beneficiary has applied consistently the methodology that is explained and approved in the positive ex ante assessment;	59) The costs declared as direct costs for Large Research Infrastructures (in the appropriate line of the Financial Statement) comply with the methodology described in the positive ex-ante assessment report.	
		60) Any difference between the methodology applied and the one positively assessed was extensively described and adjusted accordingly.	
	In the cases that a positive ex-ante assessment has NOT been issued *(see the standard factual findings 61 on the next column),* The Auditor verified that no costs of Large Research Infrastructure have been charged as direct costs in any costs category;	61) The direct costs declared were free from any indirect costs items related to the Large Research Infrastructure.	

	In the cases that a draft ex-ante assessment report has been issued with recommendation for further changes *(see the standard factual findings 61 on the next column),* • The Auditor followed the same procedure as above (when a positive ex-ante assessment has NOT yet been issued) and paid particular attention (testing reinforced) to the cost items for which the draft ex-ante assessment either rejected the inclusion as direct costs for Large Research Infrastructures or issued recommendations.		
E	**USE OF EXCHANGE RATES**		
E.1	a) For Beneficiaries with accounts established in a currency other than euros **The Auditor sampled _____ cost items selected randomly and verified that the exchange rates used for converting other currencies into euros were in accordance with the following rules established in the Agreement** (*full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is highest)*: *COSTS INCURRED IN ANOTHER CURRENCY SHALL BE CONVERTED INTO EURO AT THE AVERAGE OF THE DAILY EXCHANGE RATES PUBLISHED IN THE C SERIES OF OFFICIAL JOURNAL OF THE EUROPEAN UNION (https://www.ecb.int/stats/exchange/eurofxref/html/index.en.html), DETERMINED OVER THE CORRESPONDING REPORTING PERIOD.* *IF NO DAILY EURO EXCHANGE RATE IS PUBLISHED IN THE OFFICIAL JOURNAL OF THE EUROPEAN UNION FOR THE CURRENCY IN QUESTION, CONVERSION SHALL BE MADE AT THE AVERAGE OF THE MONTHLY ACCOUNTING RATES ESTABLISHED BY THE COMMISSION AND PUBLISHED ON ITS WEBSITE (http://ec.europa.eu/budget/contracts_grants/info_contracts/inforeuro/inforeuro_en.cfm),*	62) The exchange rates used to convert other currencies into Euros were in accordance with the rules established of the Grant Agreement and there was no difference in the final figures.	

	DETERMINED OVER THE CORRESPONDING REPORTING PERIOD.		
	b) For Beneficiaries with accounts established in euros **The Auditor sampled _____ cost items selected randomly and verified that the exchange rates used for converting other currencies into euros were in accordance with the following rules established in the Agreement** (*full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is highest)*: *COSTS INCURRED IN ANOTHER CURRENCY SHALL BE CONVERTED INTO EURO BY APPLYING THE BENEFICIARY'S USUAL ACCOUNTING PRACTICES.*	63) The Beneficiary applied its usual accounting practices.	

[legal name of the audit firm]

[name and function of an authorised representative]

[dd Month yyyy]

<Signature of the Auditor>

ANNEX 6

MODEL FOR THE CERTIFICATE ON THE METHODOLOGY

- **For options [*in italics in square brackets*]: choose the applicable option. Options not chosen should be deleted.**
- **For fields in [grey in square brackets]: enter the appropriate data.**

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Terms of reference for an audit engagement for a methodology certificate in connection with one or more grant agreements financed under the Horizon 2020 Research and Innovation Framework Programme

This document sets out the '**Terms of Reference (ToR)**' under which

[OPTION 1: [insert name of the beneficiary] ('the Beneficiary')] [OPTION 2: [insert name of the linked third party] ('the Linked Third Party'), third party linked to the Beneficiary [insert name of the beneficiary] ('the Beneficiary')]

agrees to engage

[**insert legal name of the auditor**] ('the Auditor')

to produce an independent report of factual findings ('the Report') concerning the *[Beneficiary's] [Linked Third Party's]* usual accounting practices for calculating and claiming direct personnel costs declared as unit costs ('the Methodology') in connection with grant agreements financed under the Horizon 2020 Research and Innovation Framework Programme.

The procedures to be carried out for the assessment of the methodology will be based on the grant agreement(s) detailed below:

[title and number of the grant agreement(s)] ('the Agreement(s)')

The Agreement(s) has(have) been concluded between the Beneficiary and *[OPTION 1: the European Union, represented by the European Commission ('the Commission')][OPTION 2: the European Atomic Energy Community (Euratom,) represented by the European Commission ('the Commission')][OPTION 3: the [Research Executive Agency (REA)] [European Research Council Executive Agency (ERCEA)] [Innovation and Networks Executive Agency (INEA)] [Executive Agency for Small and Medium-sized Enterprises (EASME)] ('the Agency'), under the powers delegated by the European Commission ('the Commission').]*.

The *[Commission] [Agency]* is mentioned as a signatory of the Agreement with the Beneficiary only. The *[European Union] [Euratom] [Agency]* is not a party to this engagement.

1.1 Subject of the engagement

According to Article 18.1.2 of the Agreement, beneficiaries *[and linked third parties]* that declare direct personnel costs as unit costs calculated in accordance with their usual cost accounting practices may submit to the *[Commission] [Agency]*, for approval, a certificate on the methodology ('CoMUC') stating that there are adequate records and documentation to prove that their cost accounting practices used comply with the conditions set out in Point A of Article 6.2.

The subject of this engagement is the CoMUC which is composed of two separate documents:

- the Terms of Reference ('the ToR') to be signed by the *[Beneficiary] [Linked Third Party]* and the Auditor;

- the Auditor's Independent Report of Factual Findings ('the Report') issued on the Auditor's letterhead, dated, stamped and signed by the Auditor which includes; the standard statements ('the Statements') evaluated and signed by the *[Beneficiary] [Linked Third Party]*, the agreed-upon procedures ('the Procedures') performed by the Auditor and the standard factual findings ('the Findings') assessed by the Auditor. The Statements, Procedures and Findings are summarised in the table that forms part of the Report.

The information provided through the Statements, the Procedures and the Findings will enable the Commission to draw conclusions regarding the existence of the *[Beneficiary's] [Linked Third Party's]* usual cost accounting practice and its suitability to ensure that direct personnel costs claimed on that basis comply with the provisions of the Agreement. The Commission draws its own conclusions from the Report and any additional information it may require.

1.2 Responsibilities

The parties to this agreement are the *[Beneficiary] [Linked Third Party]* and the Auditor.

The *[Beneficiary] [Linked Third Party]:*

- is responsible for preparing financial statements for the Agreement(s) ('the Financial Statements') in compliance with those Agreements;
- is responsible for providing the Financial Statement(s) to the Auditor and enabling the Auditor to reconcile them with the *[Beneficiary's] [Linked Third Party's]* accounting and bookkeeping system and the underlying accounts and records. The Financial Statement(s) will be used as a basis for the procedures which the Auditor will carry out under this ToR;
- is responsible for its Methodology and liable for the accuracy of the Financial Statement(s);
- is responsible for endorsing or refuting the Statements indicated under the heading 'Statements to be made by the Beneficiary/ Linked Third Party' in the first column of the table that forms part of the Report;
- must provide the Auditor with a signed and dated representation letter;
- accepts that the ability of the Auditor to carry out the Procedures effectively depends upon the *[Beneficiary] [Linked Third Party]* providing full and free access to the *[Beneficiary's] [Linked Third Party's]* staff and to its accounting and other relevant records.

The Auditor:

- *[Option 1 by default: is qualified to carry out statutory audits of accounting documents in accordance with Directive 2006/43/EC of the European Parliament and of the Council of 17 May 2006 on statutory audits of annual accounts and consolidated accounts, amending Council Directives 78/660/EEC and 83/349/EEC and repealing Council Directive 84/253/EEC or similar national regulations]*.
- *[Option 2 if the Beneficiary or Linked Third Party has an independent Public Officer: is a competent and independent Public Officer for which the relevant national authorities have established the legal capacity to audit the Beneficiary]*.
- *[Option 3 if the Beneficiary or Linked Third Party is an international organisation: is an [internal] [external] auditor in accordance with the internal financial regulations and procedures of the international organisation]*.

The Auditor:

- must be independent from the Beneficiary *[and the Linked Third Party]*, in particular, it must not have been involved in preparing the Beneficiary's *[and Linked Third Party's]* Financial Statement(s);
- must plan work so that the Procedures may be carried out and the Findings may be assessed;
- must adhere to the Procedures laid down and the compulsory report format;
- must carry out the engagement in accordance with these ToR;
- must document matters which are important to support the Report;
- must base its Report on the evidence gathered;
- must submit the Report to the *[Beneficiary] [Linked Third Party]*.

The Commission sets out the Procedures to be carried out and the Findings to be endorsed by the Auditor. The Auditor is not responsible for their suitability or pertinence. As this engagement is not an assurance engagement the Auditor does not provide an audit opinion or a statement of assurance.

1.3 Applicable Standards

The Auditor must comply with these Terms of Reference and with[1]:

- the International Standard on Related Services ('ISRS') 4400 *Engagements to perform Agreed-upon Procedures regarding Financial Information* as issued by the International Auditing and Assurance Standards Board (IAASB);
- the *Code of Ethics for Professional Accountants* issued by the International Ethics Standards Board for Accountants (IESBA). Although ISRS 4400 states that independence is not a requirement for engagements to carry out agreed-upon procedures, the Commission requires that the Auditor also complies with the Code's independence requirements.

The Auditor's Report must state that there was no conflict of interests in establishing this Report between the Auditor and the Beneficiary *[and the Linked Third Party]* that could have a bearing on the Report, and must specify – if the service is invoiced - the total fee paid to the Auditor for providing the Report.

1.4 Reporting

The Report must be written in the language of the Agreement (see Article 20.7 of the Agreement).

Under Article 22 of the Agreement, the Commission, *[the Agency]*, the European Anti-Fraud Office and the Court of Auditors have the right to audit any work that is carried out under the action and for which costs are claimed from [*the European Union*] [*Euratom*] budget. This includes work related to this engagement. The Auditor must provide access to all working papers related to this assignment if the Commission*, [the Agency]*, the European Anti-Fraud Office or the European Court of Auditors requests them.

1.5 Timing

The Report must be provided by [dd Month yyyy].

[1] Supreme Audit Institutions applying INTOSAI-standards may carry out the Procedures according to the corresponding International Standards of Supreme Audit Institutions and code of ethics issued by INTOSAI instead of the International Standard on Related Services ('ISRS') 4400 and the Code of Ethics for Professional Accountants issued by the IAASB and the IESBA.

1.6 Other Terms

[The [Beneficiary] [Linked Third Party] and the Auditor can use this section to agree other specific terms, such as the Auditor's fees, liability, applicable law, etc. Those specific terms must not contradict the terms specified above.]

[legal name of the Auditor]	[legal name of the [Beneficiary] [Linked Third Party]]
[name & title of authorised representative]	[name & title of authorised representative]
[dd Month yyyy]	[dd Month yyyy]
Signature of the Auditor Signature	Signature of the *[Beneficiary] [Linked Third Party]*

Independent report of factual findings on the methodology concerning grant agreements financed under the Horizon 2020 Research and Innovation Framework Programme

(To be printed on letterhead paper of the auditor)

To

[name of contact person(s)], [Position]

[[Beneficiary's] [Linked Third Party's] name]

[Address]

[dd Month yyyy]

Dear [Name of contact person(s)],

As agreed under the terms of reference dated [dd Month yyyy]

with *[OPTION 1: [insert name of the beneficiary] ('the Beneficiary')] [OPTION 2: [insert name of the linked third party] ('the Linked Third Party'), third party linked to the Beneficiary [insert name of the beneficiary] ('the Beneficiary')]*,

we

[name of the auditor] ('the Auditor'),

established at

[full address/city/state/province/country],

represented by

[name and function of an authorised representative],

have carried out the agreed-upon procedures ('the Procedures') and provide hereby our Independent Report of Factual Findings ('the Report'), concerning the *[Beneficiary's] [Linked Third Party's]* usual accounting practices for calculating and declaring direct personnel costs declared as unit costs ('the Methodology').

You requested certain procedures to be carried out in connection with the grant(s)

[title and number of the grant agreement(s)] ('the Agreement(s)').

The Report

Our engagement was carried out in accordance with the terms of reference ('the ToR') appended to this Report. The Report includes: the standard statements ('the Statements') made by the *[Beneficiary] [Linked Third Party]*, the agreed-upon procedures ('the Procedures') carried out and the standard factual findings ('the Findings') confirmed by us.

The engagement involved carrying out the Procedures and assessing the Findings and the documentation requested appended to this Report, the results of which the Commission uses to draw conclusions regarding the acceptability of the Methodology applied by the *[Beneficiary] [Linked Third Party]*.

The Report covers the methodology used from [dd Month yyyy]. In the event that the *[Beneficiary] [Linked Third Party]* changes this methodology, the Report will not be applicable to any Financial Statement[2] submitted thereafter.

The scope of the Procedures and the definition of the standard statements and findings were determined solely by the Commission. Therefore, the Auditor is not responsible for their suitability or pertinence.

Since the Procedures carried out constitute neither an audit nor a review made in accordance with International Standards on Auditing or International Standards on Review Engagements, we do not

[2] Financial Statement in this context refers solely to Annex 4 of the Agreement by which the Beneficiary declares costs under the Agreement.

give a statement of assurance on the costs declared on the basis of the *[Beneficiary's] [Linked Third Party's]* Methodology. Had we carried out additional procedures or had we performed an audit or review in accordance with these standards, other matters might have come to its attention and would have been included in the Report.

Exceptions

Apart from the exceptions listed below, the *[Beneficiary] [Linked Third Party]* agreed with the standard Statements and provided the Auditor all the documentation and accounting information needed by the Auditor to carry out the requested Procedures and corroborate the standard Findings.

List here any exception and add any information on the cause and possible consequences of each exception, if known. If the exception is quantifiable, also indicate the corresponding amount.

…..

Explanation of possible exceptions in the form of examples (to be removed from the Report):

i. the [Beneficiary] [Linked Third Party] did not agree with the standard Statement number … because…;

ii. the Auditor could not carry out the procedure … established because …. (e.g. due to the inability to reconcile key information or the unavailability or inconsistency of data);

iii. the Auditor could not confirm or corroborate the standard Finding number … because ….

Remarks

We would like to add the following remarks relevant for the proper understanding of the Methodology applied by the [Beneficiary] [Linked Third Party] or the results reported:

Example (to be removed from the Report):

Regarding the methodology applied to calculate hourly rates …

Regarding standard Finding 15 it has to be noted that …

The [Beneficiary] [Linked Third Party] explained the deviation from the benchmark statement XXIV concerning time recording for personnel with no exclusive dedication to the action in the following manner: …

Annexes

Please provide the following documents to the auditor and annex them to the report when submitting this CoMUC to the Commission:

1. Brief description of the methodology for calculating personnel costs, productive hours and hourly rates;
2. Brief description of the time recording system in place;
3. An example of the time records used by the [*Beneficiary] [Linked Third Party*];
4. Description of any budgeted or estimated elements applied, together with an explanation as to why they are relevant for calculating the personnel costs and how they are based on objective and verifiable information;
5. A summary sheet with the hourly rate for direct personnel declared by the [*Beneficiary*] [*Linked Third Party*] and recalculated by the Auditor for each staff member included in the sample (the names do not need to be reported);
6. A comparative table summarising for each person selected in the sample a) the time claimed by the [*Beneficiary*] [*Linked Third Party*] in the Financial Statement(s) and b) the time according to the time record verified by the Auditor;
7. A copy of the letter of representation provided to the Auditor.

Use of this Report

This Report has been drawn up solely for the purpose given under Point 1.1 Reasons for the engagement.

The Report:

- is confidential and is intended to be submitted to the Commission by the [*Beneficiary*] [*Linked Third Party*] in connection with Article 18.1.2 of the Agreement;
- may not be used by the [*Beneficiary*] [*Linked Third Party*] or by the Commission for any other purpose, nor distributed to any other parties;
- may be disclosed by the Commission only to authorised parties, in particular the European Anti-Fraud Office (OLAF) and the European Court of Auditors.
- relates only to the usual cost accounting practices specified above and does not constitute a report on the Financial Statements of the [*Beneficiary*] [*Linked Third Party*].

No conflict of interest[3] exists between the Auditor and the Beneficiary *[and the Linked Third Party*] that could have a bearing on the Report. The total fee paid to the Auditor for producing the Report was EUR _____ (including EUR _____ of deductible VAT).

[3] A conflict of interest arises when the Auditor's objectivity to establish the certificate is compromised in fact or in appearance when the Auditor for instance:

- was involved in the preparation of the Financial Statements;

We look forward to discussing our Report with you and would be pleased to provide any further information or assistance which may be required.

Yours sincerely

[legal name of the Auditor]

[name and title of the authorised representative]

[dd Month yyyy]

Signature of the Auditor

- stands to benefit directly should the certificate be accepted;

- has a close relationship with any person representing the beneficiary;

- is a director, trustee or partner of the beneficiary; or

- is in any other situation that compromises his or her independence or ability to establish the certificate impartially.

Statements to be made by the Beneficiary/Linked Third Party ('the Statements') and Procedures to be carried out by the Auditor ('the Procedures') and standard factual findings ('the Findings') to be confirmed by the Auditor

The Commission reserves the right to provide the auditor with guidance regarding the Statements to be made, the Procedures to be carried out or the Findings to be ascertained and the way in which to present them. The Commission reserves the right to vary the Statements, Procedures or Findings by written notification to the Beneficiary/Linked Third Party to adapt the procedures to changes in the grant agreement(s) or to any other circumstances.

If this methodology certificate relates to the Linked Third Party's usual accounting practices for calculating and claiming direct personnel costs declared as unit costs any reference here below to 'the Beneficiary' is to be considered as a reference to 'the Linked Third Party'.

Please explain any discrepancies in the body of the Report.	
Statements to be made by Beneficiary	**Procedures to be carried out and Findings to be confirmed by the Auditor**
A. Use of the Methodology I. The cost accounting practice described below has been in use since *[*dd Month yyyy*]*. II. The next planned alteration to the methodology used by the Beneficiary will be from [dd Month yyyy*]*.	**Procedure:** ✓ The Auditor checked these dates against the documentation the Beneficiary has provided. **Factual finding:** 1. The dates provided by the Beneficiary were consistent with the documentation.
B. Description of the Methodology III. The methodology to calculate unit costs is being used in a consistent manner and is reflected in the relevant procedures. *[Please describe the methodology your entity uses to calculate personnel costs, productive hours and hourly rates, present your description to the Auditor and annex it to this certificate]* *[If the statement of section "B. Description of the methodology" cannot be endorsed by the Beneficiary or there is no written methodology to calculate unit costs it should be listed here below and reported as exception by the Auditor in the main Report of*	**Procedure:** ✓ The Auditor reviewed the description, the relevant manuals and/or internal guidance documents describing the methodology. **Factual finding:** 2. The brief description was consistent with the relevant manuals, internal guidance and/or other documentary evidence the Auditor has reviewed. 3. The methodology was generally applied by the Beneficiary as part of its usual costs accounting practices.

Please explain any discrepancies in the body of the Report.	
Statements to be made by Beneficiary	**Procedures to be carried out and Findings to be confirmed by the Auditor**
Factual Findings: - *…]*	
C. **Personnel costs** <u>General</u> IV. The unit costs (hourly rates) are limited to salaries including during parental leave, social security contributions, taxes and other costs included in the remuneration required under national law and the employment contract or equivalent appointing act; V. Employees are hired directly by the Beneficiary in accordance with national law, and work under its sole supervision and responsibility; VI. The Beneficiary remunerates its employees in accordance with its usual practices. This means that personnel costs are charged in line with the Beneficiary's usual payroll policy (e.g. salary policy, overtime policy, variable pay) and no special conditions exist for employees assigned to tasks relating to the European Union or Euratom, unless explicitly provided for in the grant agreement(s); VII. The Beneficiary allocates its employees to the relevant group/category/cost centre for the purpose of the unit cost calculation in line with the usual cost accounting practice; VIII. Personnel costs are based on the payroll system and accounting system. IX. Any exceptional adjustments of actual personnel costs resulted from relevant budgeted or estimated elements and were based on objective and verifiable information. *[Please describe the 'budgeted or estimated elements' and their relevance to personnel costs, and explain how they were reasonable and based on objective and verifiable information, present your explanation to the Auditor and annex it to this certificate].* X. Personnel costs claimed do not contain any of the following ineligible costs: costs related to return on capital; debt and debt service charges; provisions for future losses	**Procedure:** *The Auditor draws a sample of employees to carry out the procedures indicated in this section C and the following sections D to F.* *[The Auditor has drawn a random sample of 10 full-time equivalents made up of employees assigned to the action(s). If fewer than 10 full-time equivalents are assigned to the action(s), the Auditor has selected a sample of 10 full-time equivalents consisting of all employees assigned to the action(s), complemented by other employees irrespective of their assignments.].* For this sample: ✓ the Auditor reviewed all documents relating to personnel costs such as employment contracts, payslips, payroll policy (e.g. salary policy, overtime policy, variable pay policy), accounting and payroll records, applicable national tax , labour and social security law and any other documents corroborating the personnel costs claimed; ✓ in particular, the Auditor reviewed the employment contracts of the employees in the sample to verify that: i. they were employed directly by the Beneficiary in accordance with applicable national legislation; ii. they were working under the sole technical supervision and responsibility of the latter; iii. they were remunerated in accordance with the Beneficiary's usual practices; iv. they were allocated to the correct group/category/cost centre for the purposes of calculating the unit cost in line with the Beneficiary's usual cost accounting practices; ✓ the Auditor verified that any ineligible items or any costs claimed under other costs categories or costs covered by other types of grant or by other grants financed from the European Union budget have not been taken

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Statements to be made by Beneficiary	**Procedures to be carried out and Findings to be confirmed by the Auditor**
or debts; interest owed; doubtful debts; currency exchange losses; bank costs charged by the Beneficiary's bank for transfers from the Commission/Agency; excessive or reckless expenditure; deductible VAT or costs incurred during suspension of the implementation of the action. XI. Personnel costs were not declared under another EU or Euratom grant (including grants awarded by a Member State and financed by the EU budget and grants awarded by bodies other than the Commission/Agency for the purpose of implementing the EU budget). <u>If additional remuneration as referred to in the grant agreement(s) is paid</u> XII. The Beneficiary is a non-profit legal entity; XIII. The additional remuneration is part of the beneficiary's usual remuneration practices and paid consistently whenever the relevant work or expertise is required; XIV. The criteria used to calculate the additional remuneration are objective and generally applied regardless of the source of funding; XV. The additional remuneration included in the personnel costs used to calculate the hourly rates for the grant agreement(s) is capped at EUR 8 000 per full-time equivalent (reduced proportionately if the employee is not assigned exclusively to the action). *[If certain statement(s) of section "C. Personnel costs" cannot be endorsed by the Beneficiary they should be listed here below and reported as exception by the Auditor in the main Report of*	into account when calculating the personnel costs; ✓ the Auditor numerically reconciled the total amount of personnel costs used to calculate the unit cost with the total amount of personnel costs recorded in the statutory accounts and the payroll system. ✓ to the extent that actual personnel costs were adjusted on the basis of budgeted or estimated elements, the Auditor carefully examined those elements and checked the information source to confirm that they correspond to objective and verifiable information; ✓ if additional remuneration has been claimed, the Auditor verified that the Beneficiary was a non-profit legal entity, that the amount was capped at EUR 8 000 per full-time equivalent and that it was reduced proportionately for employees not assigned exclusively to the action(s). ✓ the Auditor recalculated the personnel costs for the employees in the sample. **Factual finding:** 4. All the components of the remuneration that have been claimed as personnel costs are supported by underlying documentation. 5. The employees in the sample were employed directly by the Beneficiary in accordance with applicable national law and were working under its sole supervision and responsibility. 6. Their employment contracts were in line with the Beneficiary's usual policy; 7. Personnel costs were duly documented and consisted solely of salaries, social security contributions (pension contributions, health insurance, unemployment fund contributions, etc.), taxes and other statutory costs included in the remuneration (holiday pay, thirteenth month's pay, etc.); 8. The totals used to calculate the personnel unit costs are consistent with those registered in the payroll and accounting records; 9. To the extent that actual personnel costs were adjusted on the basis of budgeted or estimated elements, those elements were

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Statements to be made by Beneficiary	**Procedures to be carried out and Findings to be confirmed by the Auditor**
Factual Findings: - *…]*	relevant for calculating the personnel costs and correspond to objective and verifiable information. The budgeted or estimated elements used are: — (indicate the elements and their values). 10. Personnel costs contained no ineligible elements; 11. Specific conditions for eligibility were fulfilled when additional remuneration was paid: a) the Beneficiary is registered in the grant agreements as a non-profit legal entity; b) it was paid according to objective criteria generally applied regardless of the source of funding used and c) remuneration was capped at EUR 8000 per full-time equivalent (or up to up to the equivalent pro-rata amount if the person did not work on the action full-time during the year or did not work exclusively on the action).
D. Productive hours XVI. The number of productive hours per full-time employee applied is *[delete as appropriate]*: A. 1720 productive hours per year for a person working full-time (corresponding pro-rata for persons not working full time). B. the total number of hours worked in the year by a person for the Beneficiary C. the standard number of annual hours generally applied by the beneficiary for its personnel in accordance with its usual cost accounting practices. This number must be at least 90% of the standard annual workable hours. <u>If method B is applied</u> XVII. The calculation of the total number of hours worked was done as follows: annual workable hours of the person according to the employment contract, applicable labour agreement or national law plus overtime worked minus absences (such as sick leave and special leave). XVIII. 'Annual workable hours' are hours	**Procedure (same sample basis as for Section C: Personnel costs):** ✓ The Auditor verified that the number of productive hours applied is in accordance with method A, B or C. ✓ The Auditor checked that the number of productive hours per full-time employee is correct and that it is reduced proportionately for employees not exclusively assigned to the action(s). ✓ If method B is applied the Auditor verified i) the manner in which the total number of hours worked was done and ii) that the contract specified the annual workable hours by inspecting all the relevant documents, national legislation, labour agreements and contracts. ✓ If method C is applied the Auditor reviewed the manner in which the standard number of working hours per year has been calculated by inspecting all the relevant documents, national legislation, labour agreements and contracts and verified that the number of productive hours per year used for these calculations was at least 90% of the standard number of working hours per year.

Please explain any discrepancies in the body of the Report.	
Statements to be made by Beneficiary	**Procedures to be carried out and Findings to be confirmed by the Auditor**
during which the personnel must be working, at the employer's disposal and carrying out his/her activity or duties under the employment contract, applicable collective labour agreement or national working time legislation. XIX. The contract (applicable collective labour agreement or national working time legislation) do specify the working time enabling to calculate the annual workable hours. <u>If method C is applied</u> XX. The standard number of productive hours per year is that of a full-time equivalent; for employees not assigned exclusively to the action(s) this number is reduced proportionately. XXI. The number of productive hours per year on which the hourly rate is based i) corresponds to the Beneficiary's usual accounting practices; ii) is at least 90% of the standard number of workable (working) hours per year. XXII. Standard workable (working) hours are hours during which personnel are at the Beneficiary's disposal preforming the duties described in the relevant employment contract, collective labour agreement or national labour legislation. The number of standard annual workable (working) hours that the Beneficiary claims is supported by labour contracts, national legislation and other documentary evidence. *[If certain statement(s) of section "D. Productive hours" cannot be endorsed by the Beneficiary they should be listed here below and reported as exception by the Auditor:* - *…]*	**Factual finding:** <u>General</u> 12. The Beneficiary applied a number of productive hours consistent with method A, B or C detailed in the left-hand column. 13. The number of productive hours per year per full-time employee was accurate and was proportionately reduced for employees not working full-time or exclusively for the action. <u>If method B is applied</u> 14. The number of 'annual workable hours', overtime and absences was verifiable based on the documents provided by the Beneficiary and the calculation of the total number of hours worked was accurate. 15. The contract specified the working time enabling to calculate the annual workable hours. <u>If method C is applied</u> 16. The calculation of the number of productive hours per year corresponded to the usual costs accounting practice of the Beneficiary. 17. The calculation of the standard number of workable (working) hours per year was corroborated by the documents presented by the Beneficiary. 18. The number of productive hours per year used for the calculation of the hourly rate was at least 90% of the number of workable (working) hours per year.
E. Hourly rates The hourly rates are correct because: XXIII. Hourly rates are correctly calculated since they result from dividing annual personnel	**Procedure** ✓ The Auditor has obtained a list of all personnel rates calculated by the Beneficiary in accordance with the methodology used. ✓ The Auditor has obtained a list of all the relevant employees, based on which the

Please explain any discrepancies in the body of the Report.	
Statements to be made by Beneficiary	**Procedures to be carried out and Findings to be confirmed by the Auditor**
costs by the productive hours of a given year and group (e.g. staff category or department or cost centre depending on the methodology applied) and they are in line with the statements made in section C. and D. above. *[If the statement of section 'E. Hourly rates' cannot be endorsed by the Beneficiary they should be listed here below and reported as exception by the Auditor:* - *…]*	personnel rate(s) are calculated. For 10 full-time equivalent employees selected at random (same sample basis as Section C: Personnel costs): ✓ The Auditor recalculated the hourly rates. ✓ The Auditor verified that the methodology applied corresponds to the usual accounting practices of the organisation and is applied consistently for all activities of the organisation on the basis of objective criteria irrespective of the source of funding. **Factual finding:** 19. No differences arose from the recalculation of the hourly rate for the employees included in the sample.
F. Time recording XXIV. Time recording is in place for all persons with no exclusive dedication to one Horizon 2020 action. At least all hours worked in connection with the grant agreement(s) are registered on a **daily/weekly/monthly** basis *[delete as appropriate]* using a **paper/computer-based system** *[delete as appropriate]*; XXV. For persons exclusively assigned to one Horizon 2020 activity the Beneficiary has either signed a declaration to that effect or has put arrangements in place to record their working time; XXVI. Records of time worked have been signed by the person concerned (on paper or electronically) and approved by the action manager or line manager at least monthly; XXVII. Measures are in place to prevent staff from: i. recording the same hours twice, ii. recording working hours during absence periods (e.g. holidays, sick leave), iii. recording more than the number of productive hours per year used to calculate the hourly rates, and	**Procedure** ✓ The Auditor reviewed the brief description, all relevant manuals and/or internal guidance describing the methodology used to record time. The Auditor reviewed the time records of the random sample of 10 full-time equivalents referred to under Section C: Personnel costs, and verified in particular: ✓ that time records were available for all persons with not exclusive assignment to the action; ✓ that time records were available for persons working exclusively for a Horizon 2020 action, or, alternatively, that a declaration signed by the Beneficiary was available for them certifying that they were working exclusively for a Horizon 2020 action; ✓ that time records were signed and approved in due time and that all minimum requirements were fulfilled; ✓ that the persons worked for the action in the periods claimed; ✓ that no more hours were claimed than the productive hours used to calculate the hourly

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Statements to be made by Beneficiary	**Procedures to be carried out and Findings to be confirmed by the Auditor**
iv. recording hours worked outside the action period. XXVIII. No working time was recorded outside the action period; XXIX. No more hours were claimed than the productive hours used to calculate the hourly personnel rates. *[Please provide a brief description of the time recording system in place together with the measures applied to ensure its reliability to the Auditor and annex it to the present certificate[4]].* *[If certain statement(s) of section "F. Time recording" cannot be endorsed by the Beneficiary they should be listed here below and reported as exception by the Auditor:* *- …]*	personnel rates; ✓ that internal controls were in place to prevent that time is recorded twice, during absences for holidays or sick leave; that more hours are claimed per person per year for Horizon 2020 actions than the number of productive hours per year used to calculate the hourly rates; that working time is recorded outside the action period; ✓ the Auditor cross-checked the information with human-resources records to verify consistency and to ensure that the internal controls have been effective. In addition, the Auditor has verified that no more hours were charged to Horizon 2020 actions per person per year than the number of productive hours per year used to calculate the hourly rates, and verified that no time worked outside the action period was charged to the action. **Factual finding:** 20. The brief description, manuals and/or internal guidance on time recording provided by the Beneficiary were consistent with management reports/records and other documents reviewed and were generally applied by the Beneficiary to produce the financial statements. 21. For the random sample time was recorded or, in the case of employees working exclusively for the action, either a signed declaration or time records were available; 22. For the random sample the time records were signed by the employee and the action manager/line manager, at least monthly. 23. Working time claimed for the action occurred in the periods claimed; 24. No more hours were claimed than the number productive hours used to calculate the hourly

[4] The description of the time recording system must state among others information on the content of the time records, its coverage (full or action time-recording, for all personnel or only for personnel involved in H2020 actions), its degree of detail (whether there is a reference to the particular tasks accomplished), its form, periodicity of the time registration and authorisation (paper or a computer-based system; on a daily, weekly or monthly basis; signed and countersigned by whom), controls applied to prevent double-charging of time or ensure consistency with HR-records such as absences and travels as well as it information flow up to its use for the preparation of the Financial Statements.

Please explain any discrepancies in the body of the Report.	
Statements to be made by Beneficiary	**Procedures to be carried out and Findings to be confirmed by the Auditor**
	personnel rates; 25. There is proof that the Beneficiary has checked that working time has not been claimed twice, that it is consistent with absence records and the number of productive hours per year, and that no working time has been claimed outside the action period. 26. Working time claimed is consistent with that on record at the human-resources department.

[official name of the** [Beneficiary] [Linked Third Party]**]	***[official name of the Auditor]***
[name and title of authorised representative]	***[name and title of authorised representative]***
[dd Month yyyy]	***[dd Month yyyy]***
<Signature of the** [Beneficiary] [Linked Third Party]**>	***<Signature** of the Auditor**>***

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