FRONTEX
EUROPEAN BORDER AND COAST GUARD AGENCY

Frontex/OP/515/2020/AH

Technology Foresight on Biometrics for the Future of Travel

Annex 02

Terms of Reference

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Terms and Definitions

The terms in the table below, appearing either in the complete or in the abbreviated form, when used in this document and its appendices, shall be understood to have the following meaning:

Term	Abbreviation	Meaning
Technology Foresight on Biometrics for the Future of Travel	Research Study, Assignment or Project	The set of activities foreseen to be performed by the Contractor as described in this Terms of Reference.
Shall, Should, May, Shall Not		The terms shall be used in specification of requirements in line with RFC2119[1].
European Border and Coast Guard Regulation	Regulation	Regulation (EU) 2019/1896 of the European Parliament and of the Council of 13 November 2019 on the European Border and Coast Guard and repealing Regulations (EU) no 1052/2013 and (EU) 2016/1624.
Member States	MSs	Member States of the European Union.
Schengen Associated Countries	SACs	Countries being associated members of the Schengen Area but not members of the European Union.
Direct Service Contract	Contract	Direct service contract that Frontex will conclude with the selected Tenderer for the provision of the Research Study on Technology Foresight on Biometrics for the Future of Travel described in the present document.
Technology Foresight	TF	Assessment of the future of technology and science with the aim to identify the technologies that will in a medium and long-term perspective have the most significant impact on society or specific stakeholder communities. It provides inputs for the formulation of technology policies and strategies that guide the development of the technological infrastructure. In addition, technology foresight provides support to innovation, and incentives and assistance to enterprises in the domain of technology management and technology transfer.
Research and Innovation Unit	RIU	The Frontex Research and Innovation Unit.

[1] https://www.ietf.org/rfc/rfc2119.txt

1. General Information

1.1. Frontex

The European Border and Coast Guard (EBCG) Agency (Frontex) is governed by the Regulation (EU) 2019/1896 of the European Parliament and of the Council of 13 November 2019 on the European Border and Coast Guard (OJ L 295, 14.11.2019). Frontex promotes, coordinates and develops European border management in line with the EU fundamental rights charter and the concept of Integrated Border Management, and participates in the development and management of research and innovation activities relevant for the control of the external borders.

The Regulation establishes a European Border and Coast Guard to ensure European integrated border management at the external borders with a view to managing those borders efficiently in full compliance with fundamental rights and to increasing the efficiency of the Union return policy.

Within Frontex, the Research and Innovation Unit (RIU) participates and contributes to the development of technology, operational and border security research. It actively introduces and promotes innovation and provides for standardisation and harmonization of border management capabilities, including the support to developing the capacities of third countries. The ultimate goal is to consistently develop the capabilities of the European Border and Coast Guard in line with the Capabilities Development Plan (CDP), which includes those of the Member States and of the Agency itself.

The main tasks of the Research and Innovation Unit include:

a) developing and promoting a European border security research capability for the Agency;

b) developing and driving innovation in methodologies, processes, procedures and technical solutions for border management, testing and validating these through relevant pilot projects, collecting ideas by deploying Innovation Cells that capture and inspire further research;

c) conducting operational assessments on the effectiveness of border control processes, systems and technical solutions, thereby supporting the operational activities of the Member States and of the operational units of the Agency, including on the acquisition of technical equipment by Frontex, EU Member States and/or third countries in close cooperation with the International and European Cooperation Division;

d) harmonising requirements for border management capabilities, in accordance with the EBCG Regulation, by establishing benchmarks and developing best practices for border management, in line with the CDP;

e) supporting the implementation and exploitation of EU-funded research and innovation related activities relevant to border management.

The Research and Innovation Unit is also strongly committed to mobilise research and foster innovation to accelerate the shift of the Agency towards piloting green technological solutions to be implemented into its operations, in-line with policies and measures needed to achieve the European Green Deal[2]. Conscious that digital technologies are a critical enabler for attaining the sustainability goals of the Green deal in many

[2] *See the "Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions - The European Green Deal", COM(2019) 640 final, 11.12.2019 - https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf.*

different sectors, the Research and Innovation Unit intends to explore measures to ensure that digital technologies can accelerate and maximise the impact of policies to deal with climate change and protect the environment.

Further information about Frontex can be found on the Agency's web site www.frontex.europa.eu.

1.2. Contract Type

This procurement procedure aims to conclude a direct service contract with the selected tenderer for the provision of a Research Study in the area of Technology Foresight on Biometrics for the Future of Travel.

These Terms of Reference will become an integral part of the contract that will be awarded as a result of this open tender procedure.

1.3. Working Environment and Conditions

Frontex will provide to the Contractor access to all necessary documentation and information in its possession that are necessary to conduct the tasks.

The Contractor must ensure that its Experts are adequately supported and equipped. In particular it must ensure that there is sufficient administrative and secretarial provision to enable Experts to concentrate on their primary responsibilities.

The Contractor must comply with applicable environmental, social and labour law obligations established by Union law, national legislation, collective agreements or the international environmental, social and labour conventions listed in Annex X to Directive 2014/24/EU[3].

[3] *Directive 2014/24/EU of the European Parliament and of the Council of 26 February 2014 on public procurement and repealing Directive 2004/18/EC (OJ L 94, 28.3.2014, p. 65).*

2. Subject and Background

2.1. Subject and Background

Technology Foresight (TF) is increasingly part of contemporary policy-making and capacity building strategies, and Frontex recognizes the importance of forward planning. Having a systematic understanding of evolving technological trends and their impact on future EBCG capabilities is of great significance for the successful implementation of Frontex activities as outlined in the EBCG Regulation.

Checks at the external borders remain one of the main safeguards of the Schengen area. Every year, millions of EU citizens and travellers from third countries (including bona-fide travellers[4]) cross the external borders of the Schengen States, and estimations point to ever-increasing traveller flows. Some of the third-country visitors have a short-stay visa, while others come from countries where no visas are required. This requires modern, effective and efficient management of the external borders which strikes a balance between facilitation for travellers and internal security. For this reason, border management is currently going through significant transformation and the need for the Schengen Area to move towards more modern and efficient border management must be properly addressed by adopting innovative technological solutions (e.g. that increase the reliance on automated verification and identification methods) in the operational environment of border checks capable to enable a seamless or near-seamless, improved border crossing experience for travellers crossing the external border of the EU.

Biometric technologies play a major role in enhancing and strengthening identity checks at external borders as well as the overall security of border controls, and research is currently advancing the capabilities to capture and use biometrics of travellers without them having to stop at physical barriers in the contexts of border checks, in full respect of fundamental rights and considerations to safeguard data and integrity.

Within the described framework, the main objective of this tender is the delivery of a Research Study with a focus on the future of **biometrics** for implementation in border control systems that may, in a short (1-5 years), medium (5-10 years) and long term (10+ years) perspective, benefit the work of the Agency and the EBCG community. The contractor shall also present in detail the utilized Technology Foresight methodology. This initiative aims at responding to the need for creating a common forward-looking vision, promoting a more technology-oriented focus among the relevant EBCG stakeholders and providing clear, independent and up-to-date knowledge-based evidence in support of the Agency's decision-making processes.

In general, the Technology Foresight component of this study should provide support to research and innovation in the domain of technology management and technology transfer, refocusing from current paradigms to venturing into new ideas and opportunities. TF raises awareness of how upcoming disrupting technology is reshaping supply and demand, mapping out potential development paths for such innovations, and building appropriate capabilities. Thus, it assumes that the future is not pre-determined. It brings together various sources of knowledge in order to develop strategic visions and anticipatory intelligence.

The ultimate outcomes of TF are not only enhanced innovation capacity and capability building, but also better strategic decision-making. The work of Border Guards (BGs) and their work environment are constantly affected by changes in society caused by the proliferation of information technology, communications and transportation. Therefore, the results should serve as background information to guide the development of technological infrastructures and internal policies. They should point to the future

[4] *"Bona-fide travellers" are low-risk travellers from non-EU Countries to which a "Registered Traveller" status could be granted. This status, would allow them to benefit from a simple and automated border check upon arrival in the Member State of destination.*

technology developments, their interactions with society and the environment for the purpose of guiding actions designed to produce more desirable operational benefits.

The cooperative and consensus building elements of the TF are fundamental to its success, bringing together a large number of experts from the EBCG community and the stakeholders, such as the EU institutions, national law enforcement, custom and public health authorities, science, industry and civil society. The results of the TF will be shared within this community in order to stimulate mutual learning, shared understanding of future European and national challenges and identification of promising technologies where pooling resources and launching joint activities can make an operational difference.

The following Frontex documentation is available for consultation:

- Regulation (EU) 2019/1896 of the European Parliament and of the Council of 13 November 2019 on the European Border and Coast Guard (OJ L 295, 14.11.2019);
- Regulation (EU) 2016/399 of the European Parliament and the Council of 9 March 2016 on a Union Code on the rules governing the movement of persons across borders (Schengen Borders Code);
- Technical and operational Strategy for European Integrated Border Management;
- Decision (EU) 1082/2013 of the European Parliament and of the Council of 22 October 2013 on serious cross-border threats to health;
- International Health Regulations (2005).

3. Specific Requirements

3.1. Objectives of the assignment

The general objectives of implementing a Technology Foresight on Biometrics for the Future of Travel are to:

- Maximize the opportunities provided by technological developments in supporting the management of the EU external borders;
- Prospect the impacts of technology trends on biometrics for border control in order to refocus selectively on technologies which will impact the work of the EBCG community as well as start monitoring and conducting detailed research in these fields;
- Understand where the identified emerging technologies have been implemented until now globally in the border security domain (representative examples, best practices, costs, actors);
- Understand which are the main fora, institutions, initiatives and related events in the Biometrics domain globally, which focus on future biometrics-enabled technological solutions for border checks;
- Identify the specific research and innovation initiatives that could accelerate the integration of novel biometrics-enabled technological solutions in the domain of systems for border checks.
- Provide solutions to relevant operational problems within the EBCG community that can be addressed through the appropriate application of current and future technology;
- Understand how to maximize the benefits of technology in the border management environment while minimizing its risks, especially those associated with the existing legal, ethical and technological constraints;
- Propagate TF results within the EBCG community to develop a common vision, mobilize joint actions and strengthen knowledge and capabilities;
- Raise awareness of the critical importance of TF for improving anticipatory knowledge by exploiting emerging and future trends in technology and science in border security areas.

The general objectives of this tender should be achieved by producing the following deliverables:

- **Research Study:** a Technology Foresight study on Biometrics for the Future of Travel. The study shall include the prioritization and roadmapping of emerging relevant technologies which have the strongest potential to influence, in a medium or long-term perspective, the strategic components of the Integrated Border Management and the work of Border Guards. A special focus should be given to future technologies which will enable secure and seamless travel.
- **Technology Foresight Methodology:** propose and adopt an integrated and comprehensive TF methodology.
- **Technology Foresight Supporting Tool**: The Contractor shall provide access to a technology foresight supporting tool (or a set of tools or applications) based on the Contractor's proprietary solutions or on open source solutions fitting to the needs and requirements of the Agency.
- **Comprehensive Technology Taxonomy:** Develop a thorough, extensive and detailed technology taxonomy for future biometrics and biometrics-enabled technological systems. A technology taxonomy is understood as the mapping of all the related research topics, sub-topics and technologies potential to

find applications in operational fields of interest for the EBCG community in a categorical and logical manner. The goal is to establish a common understanding and create a reference document which will used by the Agency in research and innovation activities.

- **Technology Foresight Collaborative Activities:** The Contractor shall organize events (e.g. workshops) involving the EBCG community and other relevant stakeholders in line with the proposed TF methodology and specific needs and objectives of the Agency.
- **Documentation**: the contractor shall produce draft/final planning and scoping documents, meeting minutes, presentations, documents for the events (e.g. read-ahead packages, presentations, event reports, technical dissemination and communication documentation), progress reports, intermediate and final reports and research studies, etc. (as better specified in section 3.2).

For the performance of these services the contractor will work in collaboration with the Frontex Project Manager (PM - see par. 5.6) and other designated representatives of the EBCG community. Frontex PM will monitor all deliverables and the quality of the consultancy services.

3.2. Description of the assignment

3.2.1. Duration and Schedule

The duration of the contract period shall be up to **8 months from the date of the kick-off meeting**.

The below listed Work Packages (WPs, paragraphs 3.2.2 and 3.2.3) and activities are suggested to achieve the general objectives of this tender, and must be executed following the timing described in paragraph 3.2.4. For executing the mentioned Work Packages, the Contractor must:

- Address the needs expressed in this Terms of References;
- Follow an appropriate methodology design techniques and project management life cycle;
- Use up-to-date data and information based on reliable, objective, accurate and traceable sources and collection methods and tools;
- Provide credible, comprehensive and valid findings and conclusions derived from a sound analysis of the gathered data;
- Produce timely and high-quality outputs.

As also indicated in the Tender Specifications (in paragraph III.5.1), the Tenderer shall provide in its Offer, among other, a **Work Plan** that, if the Tenderer will be contracted, will also be further discussed and agreed at the kick-off meeting.

The following requirements are obligatory for the Contractor, and the Tenderer is required to declare compliancy with these requirements in its offer.

3.2.2. Work Package 1 – Technology Foresight Methodology and Supporting Tool

3.2.2.1. WP1 General Description

Under WP1, the Contractor shall provide an integrated and comprehensive TF methodology and supporting tool[5] that facilitates (and allows gathering the data for) its implementation. The methodology and the tool

[5] *Although we will generically refer to this component as "Technology Foresight supporting tool" or simply "TF tool", in general the Contractor is free to propose a single tool or a set of multiple tools or applications properly configured to match the required specifications.*

shall be subsequently used by the Contractor in WP2 for performing the specific TF exercise, and autonomously by Frontex at least for the duration of the contract. As not all foresight approaches are suited to all contexts, it is necessary to select the TF methodology by taking into account existing organizational opportunities and limitations. Therefore, during the kick-off meeting (see par. 3.2.4) the Agency along with the Contractor will agree on the components / techniques of the TF methodology to be utilized within the contract as well as the main requirements for the supporting tool. The results of the meeting shall be documented by the Contractor in the form of a **Scoping Document** (***"D1.1 - WP1 Scoping Document - Technology Foresight Methodology and Supporting Tool",*** see par. 3.2.2.2) which will be part of the Final Management Plan (see par. 3.2.4.1) and will summarize the additional information gathered during the kick-off meeting about the organizational context, elicited expectations and needs of the Agency. In the Scoping Document the Contractor shall also include detailed descriptions of all the tasks planned under WP1 along with their timelines and milestones.

The proposed TF methodology and the supporting tool shall meet at least the following requirements:

- be grounded in the best available foresight knowledge;
- the TF methodology should allow the identification and collection of technology trends, emerging and disruptive technologies, the assessment of their importance and prioritization linked to specific organizational needs;
- be designed to capture complex operational variables, involve stakeholders from the EBCG community and provide a durable basis for developing internal policies;
- should facilitate the implementation of a repeatable, cyclical and consistent TF exercise to be autonomously carried out by the Agency after the end of the contract;
- the basis of the future oriented planning associated with technologies is an in-depth analysis of existing technological landscape; thus, the methodology should include the element of extensive technology research in the form of scanning and synthesis of literature, analysis of data sources, scanning the past and current environment, scanning resources internal and external to the EBCG community;
- the Contractor shall propose a TF supporting tool for data collection and analysis, as well as knowledge management, associated with the proposed methodology; the data collection shall include the generation of a list of new and emerging technologies with varying degrees of applicability to border security, whereas the data analysis should narrow down the list into specific solutions whose application to border security would be considered relevant to the IBM strategic components and EBCG specific tasks. The results should map the current technological landscape and lead to the development of technology taxonomies tailored to the needs of the EBCG community.

When defining the TF methodology to be utilized and the supporting tool, the following main requirements for their characteristics should be taken into consideration:

- **Product oriented**: the outcomes of the application of the proposed TF methodology should be in the form of specific, tangible outputs, such as the key features, criteria, processes and indicators implemented in the TF tool and the Research Study requested in WP2 which will compile the results of a TF exercise constructed on the bases of the designed methodology. The knowledge generated through the TF exercise should be turned into information that can improve organizational decision-making.
- **Continuous and cyclical**: the TF methodology proposed by the Contractor should facilitate the implementation, at Frontex, of a persistent TF cycle also beyond the duration of the contract. In this

respect the Contractor, through a proper knowledge transfer process on the proposed TF methodological approach, should smooth the path towards the realization, within the Agency, of an organized and structured collection of information on disruptive technologies of interest, as well as the assessment and usage of the outputs obtained for decision-making.

- **Anticipatory**: the proposed TF methodology along with the supporting tool should have the potential to identify not only megatrends, but also opportunities or hazards significantly early in their development before the issues become mainstream. Early warning mechanisms should allow the identification of weak signals of emerging technological innovations as well as opportunities and threats connected with technology through constant environment observations. Additionally, as part of the TF methodology, the Contractor shall propose a systematic method, based on multiple decision-making criteria, to prioritize the emerging technologies relevant for the EBCG community in close consultation with the Frontex PM.
- **Participatory and consensus building**: the TF methodology should not only include the prediction of technological changes, but also networking and workshops, events and initiatives for information sharing and dissemination, opinion collection from stakeholders and their assessment. In particular, the Contractor will have to ensure the design of the format of high quality **TF workshops** (see par. 3.2.4.1) focused on the topics relevant for this study involving Frontex, Member States representatives and, upon agreement with Frontex, experts from stakeholders (e.g. industry, practitioners, academics and research organizations), which will deliver added value to the proposed methodology.
- **Comprehensive**: Within the TF methodology, the choice of a singular foresight method would reveal limitations in practice, therefore the combination of methods should be proposed by the Contractor (e.g. qualitative, quantitative or semi-quantitative). The goal of the proposed TF methodology is not to simply analyse known and obvious technologies but, more pertinently, to assess those issues that are unknown, uncertain and nonlinear; therefore, the choice of the combined methods should work comprehensively under these assumptions and in Frontex organisational landscape. The Contractor is flexible in the choice of the methodology to adopt, but a clear and convincing justification should be provided to rationalise the choice.
- **Attentive to socio-economic factors**: it should be emphasized that the proposed TF methodology should not be narrowed down to the assessment of the sole technical and economic factors. Attention needs to be also paid to socio-economic factors that are known to influence innovations. For example, these might include issues related to the social acceptance of the identified emerging technologies, potential consequences of their operational implementation for border control, and risks and opportunities of the future dependencies and social impacts created by a high level of technological development.

3.2.2.2. WP1 Deliverables

The main outputs of the WP1 shall be the following deliverables[6]:

a) **D1.1 - WP1 Scoping Document – Technology Foresight Methodology and Supporting Tool** (as part of the Final Management Plan, see par. 3.2.4.1), due at T0+0.5.

   The aim of this document is to agree on generally developed specifications for WP1, about which a reasonable consensus should be obtained among the key actors of the exercise, and should be sent out to the Frontex PM for approval within two weeks after the kick-off meeting as part of the Final Management Plan. The WP1 scoping document shall:

[6] *The **indicative delivery time** is specified as (T0+number of months), being T0 the date of the Kick-off meeting (see par. 3.2.4.1).*

- include detailed descriptions of all the activities planned under WP1, resources and timelines;
- serve as the basis for defining the specifics of the TF methodology and the supporting tool to be utilized;
- be concise and clearly articulated, and present possible options, identify constraints and risks, assumptions as well as key success factors related to the formulation of the methodology and the definition of the basic requirements for the TF tool;
- describe how the final outputs of the WP1 will be disseminated and enhanced within the Agency and among the EBCG community.

b) **D1.2 – Technology Foresight Supporting Tool** (first draft due at T0+2, final version due at T0+4).

This shall be a supporting tool (or a set of tools or applications) properly configured by the Contractor, to which the Agency is granted access at least for the duration of the contract, that can be autonomously used by Frontex. This tool for data collection and analysis, as well as knowledge management (tailored software, Delphi, open source, etc.) should ideally be in the form of a cloud or a contractor hosted platform, capable to easily assist the Agency in capturing technology developments from a variety of identified sources and perform technology watch with the final scope of gathering value-added information in support of the envisaged TF methodology. The choice of the tool should exhibit a significant degree of automation, be user-friendly and tailored to the EBCG organizational context and clearly justified by the Contractor. In practice, the Agency should be equipped with a practical and user-friendly tool for a wide and systematic overview of the EBCG technological landscapes of interest, also beyond the specific technological domain explored in this research study.

c) **D1.3 - Technology Foresight Manual** (first draft due at T0+2, final version due at T0+4).

The Contractor shall prepare a **TF Manual** which will clearly describe the methodology implemented in WP1 and provide technical guidance on the implementation of the same methodology and the use of the proposed methods and tool.

Additionally, the Contractor shall organize 2 separate **awareness workshops** for the Agency's staff**: one on the Technology Foresight methodology and one on the supporting tool** (see details in par. 3.2.4.1), not exceeding 2 days in total, (at the Contractor's own expenses) to deliver a training about the proposed TF methodology and tool.

3.2.3. Work Package 2 - Technology Foresight on Biometrics for the Future of Travel

3.2.3.1. WP2 General Description

Based on the TF methodology and the tool proposed under WP1, within this work package the Contractor will be asked to provide a **Technology Foresight Research Study on Biometrics for the Future of Travel**.

Biometrics refers to an individual's biological and behavioural characteristics from which distinguishing and repeatable biometric features can be extracted for the purpose of biometric recognition. Based on these unique identifiable attributes, a variety of technologies can be used to create and maintain reliable identity repositories, and for the automated comparison of individuals (e.g. verification 1:1 and identification 1:N). For the purposes of border checks, the most important technologies so far have been based on biometric samples of the face and the fingers. However, other biometric technologies exist, that have been so far only marginally considered for applications in border control, including for example those based on: iris, hand

geometry, voice, vascular patterns, dynamic signature verification, keystroke dynamics, vein/palm scans, DNA, gait, body photogrammetry, etc.

Biometrics plays a key role in the digitalisation of border management, especially in relation to the systems and the processes involved in border checks for immigration control at the external borders, due to the growing mobility of individuals and the need to reliably link the physical person to the claimed identity.

In border checks, its primary function is to strengthen (improving automatization, security, simplicity, quality and effectiveness) identity checks at external borders being essential to verify whether the document holder equals the legitimate document owner. Therefore, once the technology foresight exercise per se has been done, a focus must be put on those key scientific and technological factors and related developments in biometrics potential to contribute to this strengthening. These factors might include for example: security (in terms of accuracy of identity checks and defence against identity fraud attacks), vulnerability/risk assessment of biometric systems to attacks (e.g. biometric Presentation Attacks and the need for Presentation Attack Detection [PAD] methods), impact on traveller's BCP (Border Crossing Point) crossing time and travellers' flows (queues), perception of the border crossing experience by the passenger, applicability of novel research to solve operational challenges (complexity of the operational implementation at BCPs), human-machine interaction at biometrics-enabled Automatic Border Control (ABC) systems and self-service kiosks implementing advanced biometric solutions, impact on the European Smart Borders strategy[7], integration of future biometric solutions within the Entry/Exit System, costs, interoperability, harmonization and standardization issues, management of sensitive information and data protection, legal and ethical issues, etc.

The research should also focus on any cutting-edge and emerging technological solutions for integrated and interoperable systems based on biometric technologies potential to enable or advance the implementation of the "seamless traveller experience" concept at BCPs, intended as the capabilities of biometric systems to capture and verify the biometrics of travellers without them having to stop at any physical barriers (like at the traditional border checkpoints), in full respect of fundamental rights and considerations to safeguard data and integrity.

Among other, areas of emerging research to be explored in the study shall include those related to: biometric sensors, cutting-edge and next-generation ABC gates and self-service border check kiosks, biometric capture and verification devices, document security, document readers, document verification and fraud detection, manipulation attack detection (i.e. techniques to detect manipulated biometric data, for example image morphing) and protection against attempts/techniques to falsify biometrics, Morphing Attack Detection (MAD) and Presentation Attack Detection (PAD) at border checks, the application of biometrics to privacy-preserving and privacy-enhancement for the security of identity, biometric data manipulation driven by artificial intelligence (e.g. Adversarial Networks), application of artificial intelligence in biometric systems, autonomous and semi-autonomous robotics embedding biometrics, biometric-based contactless technologies, predictive analytics, multimodal biometrics or biometrics fusion (combining multiple biometric inputs to identify individuals), advanced and high-quality biometric databases construction, automated biometric identification systems (ABIS), automatic next-generation rapid hand-held and mobile small-scale solutions for border checks, advanced systems for seamless biometric acquisition/verification from seated drivers in cars or trucks at land BCPs, methodologies for the operational

[7] *See https://ec.europa.eu/home-affairs/what-we-do/policies/borders-and-visas/smart-borders-background_en*

performance assessment of biometric-based technological systems, solutions for biometric-enabled Digital Travel Credentials[8], etc.

In addition, considering that, as the recent COVID-19 pandemics made evident, novel technological solutions must also be suitable to enhance the preparedness and response capacities of the Agency and the EBCG operational units in the context of cross-border health threats at air, maritime and land BCPs, as well as between BCPs, and capable to guarantee an effective, efficient and coordinated border management at the external EU borders also in case of disease outbreaks, the research shall also explore the impact that policies and measures typically taken by governments in case of pandemics (e.g. the use of personal protection devices such as face masks, social distancing, measures to reduce the risks of biological contamination, etc.) might affect the technical characteristics, design principles, performances, validation and implementation of future biometrics-enabled technological solutions.

During the kick-off meeting (par. 3.2.4.1), the Contractor will meet with the Agency to reach a common understanding of the activities and deliverables under the WP2. The results of the meeting shall be documented by the Contractor in the form of a **Scoping Document** (“***D2.1 – WP2 Scoping Document - Technology Foresight on Biometrics for the Future of Travel”***, see par. 3.2.3.2) which will be part of the Final Management Plan (see par. 3.2.4.1) and will summarize the additional information gathered during the kick-off meeting about the organizational context, elicited expectations and needs of the Agency. In the Scoping Document the Contractor shall also include detailed descriptions of all the tasks planned under WP2 along with their timelines and milestones.

The consultancy services provided by the Contractor under WP2 shall include, but not be limited to the following:

- the execution of the TF exercise on Biometrics for the Future of Travel, including all the needed processes, methods, tools and **TF workshops** (see details in par. 3.2.4.1), as proposed under the WP1;
- support the problem solving processes working in close cooperation with the Agency and the EBCG community;
- formulate insightful and actionable recommendations, presentation and dissemination of findings.

3.2.3.2. WP2 Deliverables

The main outputs of the WP2 shall be the following deliverables[9]:

a) **D2.1 – WP2 Scoping Document - Technology Foresight on Biometrics for the Future of Travel** (as part of the Final Management Plan, see par. 3.2.4.1), due at T0+0.5.

   The aim of this document is to agree on generally developed specifications for WP2, about which a reasonable consensus should be obtained among the key actors of the exercise, and should be sent out to the Frontex PM for approval within two weeks after the kick-off meeting as part of the Final Management Plan. The WP1 scoping document shall:

   - include detailed descriptions of all the activities planned under WP2, resources and timelines;
   - serve as the basis for developing the Research Study;

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[8] Digital Travel Credentials are intended as the next generation of "virtual" credentials securely stored in mobile devices or cloud hosted and accessed via biometric authentication giving travellers the opportunity for document-free travel between participating countries. The introduction of Digital Travel Credentials would inevitably impact the way in which travellers will be checked at BCPs, including their biometrics, likely requiring additional or entirely new technologies at the BCP.

*[9] The **indicative delivery time** is specified as (T0+number of months), being T0 the date of the Kick-off meeting (see par. 3.2.4.1).*

- be concise and clearly articulated, and present possible options, identify constraints and risks, assumptions as well as key success factors related to the realization of the Technology Foresight exercise;
- describe how the final outputs of the WP2 will be disseminated and enhanced within the Agency and among the EBCG community.

b) **D2.2 - Research Study - Technology Foresight on Biometrics for the Future of Travel** (first draft due at T0+5, final version due at T0+7)**.**

This deliverable consists of the TF specific **Research Study** described in paragraph 3.2.3.1, compiling the results of the conducted TF exercise for the specific research topic: Biometrics for the Future of Travel. The focus should be placed on analysing disruptive trends and providing technology-related insights needed for actionable advice to help Frontex decide about the adoption of related novel technological solutions. The study should focus on future technologies and applications, and how they are potentially relevant to solving real business problems and exploiting new opportunities for the EBCG community.

The Research Study shall include, but not be limited to the following:

- The identification of critical technological building blocks and components for the planning of future high-priority capabilities for the Agency.
- The results of the TF exercise in the relevant scientific and technological domains, with a focus on disruptive strategic trends in scientific and technological developments of interest for border control (more specifically biometric-enabled seamless border checks), including the outcomes of the prioritization exercise. Three timeframes should be taken into account for producing trends, roadmaps, capability landscaping, and priorities in technology developments: short (1-5 years), medium (5-10 years) and long term (10+ years), ideally also including relative cost predictions and business models. The findings should go beyond a simple analysis of technological areas, including an indication of the main technological objectives and milestones as well as the technology readiness levels, and the level of resources (financial, human, IT, training, etc.) required for their implementation and effective adoption. The identification of emerging technologies for scenario-based exercises shall also be included.
- A thorough assessment of the scientific, technological and manufacturing feasibility within the European ecosystem; in particular, key players of the entire relevant value chains must be considered, including: industrial producers of systems and components, research institutions and EU-funded R&I framework programs, EU international bodies and national governmental authorities, infrastructure operators and end-users.
- A thorough analysis of technology enablers for future border security capabilities, mapping activities in the academic, industrial and institutional communities, and including potential correlation with socio-economic factors (including geopolitical, economic and environmental aspects). Scientific and technological topics should be properly linked with the results of technological taxonomy. The study should not only position higher-level trends and ideas, but also address aspects such as strategies, harmonization and standards, management concepts, competencies and capabilities related to these technological developments. This analysis should also map the most recent and relevant outcomes of research projects funded under the EU Research and Innovation Framework programmes.

- A complete set of information sufficient to suggest, sustain and motivate, at the strategic level, decisions for the implementation of research and innovation as well as capacity building actions, complemented by the effective graphic representation (with proper graphics, dashboards and any other suitable means) of the results for trends, roadmaps, capability landscaping, and priorities in technology developments, suitable for distribution to the upper-level management, decision-support processes and policy-making. The graphic representation should give a view of how a technology or application will evolve over time, providing a source of insight to manage its deployment within the context of the Agency's specific organisational goals. The Contractor should also submit at least one PowerPoint presentation for the study, which will compile and summarize the findings of the TF exercise.

3.2.4. Meetings, Workshops, Reporting and Delivery Timelines

3.2.4.1. Meetings and Workshops

The Contractor shall regularly report on the progress of the work to Frontex, which will be represented by a **Steering Committee** to be appointed by Frontex after the signature of the contract. It is expected to be composed at least of the **Project Manager** (Research Officer, see also par. 5.6), the Head of the Research and Innovation Unit and a representative of the Legal and Procurement Unit. The working language is English.

At least the following foreseen meetings have to be considered in the Tenderer's Technical Offer:

- **Kick-off Meeting (T0).**

  The kick-off meeting is intended to finalize and agree on the details of the WPs tasks, on the implementation plan and the timelines, also on the basis of the **Work Plan** presented in the Contractor's Technical Offer. The date of the kick-off meeting (T0) will be set by Frontex in agreement with the Contractor and it is expected to be held at Frontex premises within 2 weeks after the signature of the contract. The date of the kick-off meeting will constitute (T0) and will be used as reference for planning the timelines of the study milestones.

  The Contractor is expected to deliver the draft agenda for the kick-off meeting at least one week before the meeting, and the final agenda, including Frontex comments, at least one day prior to the meeting.

  At the kick-off meeting the Contractor shall present a **Draft Management Plan** to be followed throughout the project, which shall be commented by the responsible Frontex Project Manager.

  Also, as better explained in par. 3.2.2.1 and 3.2.3.1, during the kick-off meeting the Agency along with the Contractor will establish, by mutual agreement, the objectives and arguments of the TF methodology and supporting tool (WP1) as well as those of the Technology Foresight on Biometrics for the Future of Travel (WP2), in order to reach a common understanding of the activities and deliverables under WP1 and WP2 that will then be detailed by the Contractor in the **D1.1 - WP1 Scoping Document** and the **D2.1 - WP2 Scoping Document**.

  Taking into account the outcomes of the meeting and, especially, the additional information gathered about the organizational context, elicited expectations and needs of the Agency, fourteen days after the kick-off meeting the contractor shall submit to Frontex the minutes of the kick-off meeting, gathering the relevant information discussed during the meeting and any presentations made, along with the **Final Management Plan**. With the Final Management Plan the Contractor is expected to demonstrate its capability to effectively plan and manage the contract in order to deliver all of the required services, and it shall include as a minimum the following information and documentation:

- provide evidence that the Contractor takes responsibility for the general objectives of the study, demonstrates a good understanding of the subject matter, and of the required deliverables to be produced;
- propose any potential relevant modification in the logic of the project to improve its results;
- explain the organization, methods and means intended to be used in the project;
- two specific sections containing respectively the **D1.1 - WP1 Scoping Document** and the **D2.1 - WP2 Scoping Document**, where the requirements specified in par. 3.2.2.2 and 3.2.3.2 are fulfilled;
- provide a detailed risk management plan;
- explain the reporting structure for: work progress, achievements, risks and difficulties, mitigating measures to reduce and manage risk levels (including those factors that might impact negatively on meeting the timelines of the study) and report on corresponding actions, updates proposed to the project structure and schedule;
- quality control system applied to the service foreseen, concerning the quality of the deliverables, the language quality check, and continuity of the service in case of absence of a member of the team;
- provide an analysis of the structure and the preparation/organization of the planned meetings during the study.

The Draft Management Plan and the Final Management Plan will also be contractual deliverables. The Final Management Plan will be updated also as required by the Agency during the duration of the study.

- **Interim Progress Review Meeting (T0+4).**

  An Interim progress review meeting shall be held approximately at T0+4 months at Frontex premises, unless otherwise agreed between Frontex and the Contractor, where the Contractor will present an overview on the progress of the work and of the remaining activities, as well as collect any comments from the audience and discuss/agree on the action points related to decisions to be adopted for the future course of the service if needed. This meeting is also intended to be preparatory to the delivery of the Intermediate Study Report at T0+5 (see 3.2.4.2).

- **Final Meeting (T0+7).**

  A Final meeting shall be held at T0+7 months at Frontex premises. During the meeting, the contractor will present, to Frontex and Member States representatives, the results of this study (as collected and described in the Final Report – see par. 3.2.4.2) with special emphasis on the TF methodology adopted, the supporting tool delivered and the findings of the TF exercise.

At least the following foreseen workshops have to be considered in the Tenderer's Technical Offer:

- **Awareness Workshops on Technology Foresight Methodology and Supporting Tool (T0+2).**

  The Contractor shall organize and conduct 2 separate **awareness workshops** for the Agency's staff**,** not exceeding 2 days in total**,** to be held within around a week one each other at Frontex premises, with the main objective of performing a proper transfer of knowledge to Frontex on the proposed TF methodological approach and the supporting tool to be utilized throughout the contract, consisting in:

  - a one-day **awareness workshop on the Technology Foresight Methodology**, to present in details the TF methodology that the Contractor intends to propose for adoption in this project
  - a one-day (or half-day, depending on the complexity) **awareness workshop on the Technology Foresight Supporting Tool**, centered around the Supporting Tool that the Contractor intends to use in association with the proposed TF methodology.

- **Workshops on Technology Foresight on Biometrics for the Future of Travel (T0+3, T0+4).**

The Contractor shall consider maximum 4 days in total to conduct 2 separate workshops (to be held indicatively at T0+3 and T0+4) or alternative solutions (including on-site interviews, consultations, etc.) with the participation of Frontex, Member States representatives and, upon agreement with Frontex, involving experts from various stakeholders (e.g. other EU Agencies and bodies, industry, practitioners, academics and research organizations). The workshops should include, but not be limited to, activities such as: experts consultation, definition of future operational requirements and evaluation of potential barriers from the practitioner's perspective, collection of qualitative data, case-study analysis, prioritization and roadmapping exercises in the domains relevant for the conduction of this TF study. The detailed design of the workshops and the related conduction methodology (including data collection methods) shall be proposed by the Contractor, and agreed by Frontex, within the Final Management Plan as part of the **WP2 Scoping Document.**

Apart from the meetings mentioned above, the contractor shall have regular contacts with Frontex PM to monitor the contract implementation.

All meetings shall include at least a power point presentation of the work progress as well as of the status and overview of the remaining activities.

For all workshops, the Contractor shall deliver power point presentations to give the audience an overview of at least the scope of the project and the event, the methodology, the outcomes of the initiative, etc. A read-ahead package must be prepared and distributed to the participants at least 2 weeks before the event to introduce the audience to the purpose and rationale of the workshop (putting an emphasis on the objectives and the goals that the workshop will enable), the methodology used and role of the facilitators, the use/value of the data and information to be gathered, the technical background information, etc.

Two weeks before each event (meetings and workshops) - in case of the kick-off meeting one week before the meeting - the contractor shall provide Frontex Project Manager with the draft agenda and material to be presented/discussed/approved during the upcoming event. The contractor shall provide the final agenda including Frontex PM's comments the day before the event, at the latest.

The minutes of each event, gathering the relevant information, incorporating issues discussed during the event, and any related documentation (e.g. presentations made, materials distributed, etc.), shall be provided by the Contractor to Frontex within one week from the end date of the event. Before the minutes are finalized, the contractor shall provide draft minutes for review/comments by Frontex.

In case the COVID 19 epidemic situation persists, or whenever deemed necessary by Frontex for any other reasons, Frontex might request the meetings and/or the workshops to take place remotely via video-conference. Therefore, the contractor shall be prepared to conduct those events in a remote way, and have a suitable IT infrastructure for videoconferencing as well as the proper experience in facilitating online meetings and workshops.

For all meetings and workshops, Frontex will bear the cost of the conference room, the catering and IT equipment, as well as will reimburse the costs (travel, accommodation and subsistence) of the Member States' participants and the invited stakeholders.

3.2.4.2. Intermediate Study Report and Final Study Report

The intermediate and final reports listed below will also be contractual deliverables:

Intermediate Study Report (T0+5).

An Intermediate Study Report shall be delivered by the Contractor at T0+5 months, to present Frontex with the interim findings of the present study based on the work developed under WP1 and WP2, as well as a draft of the main expected deliverables in these WPs. This report shall contain at least:

- the **Progress Reports of WP1**, showing all the developed findings pertaining WP1 along with the final version of the main deliverables described in par. 3.2.2.2:
    - D1.2 – Technology Foresight Tool
    - D1.3 - Technology Foresight Manual
- the **Progress Reports of WP2**, showing all the developed findings pertaining WP2 along with a first draft proposal for the main deliverable described in par. 3.2.3.2:
    - D2.2 - Research Study - Technology Foresight on Biometrics for the Future of Travel
- as **Annexes**: all the expected deliverables until T0+5 and all the available documentation related to the Kick-off Meeting, the Interim Progress Review Meeting, and the workshops done until T0+5.

The Intermediate Study Report shall be produced and delivered in electronic form to Frontex for revision and discussions. After the receipt of the report, Frontex will have 15 working days in which to analyse it and either approve it or reject it, formulating in the latter case recommendations, observations, comments that shall be taken into consideration by the Contractor while elaborating a new Intermediate Study Report (in 10 working days) which shall likewise be subject to the just above mentioned provisions. Should Frontex still not consider the new report acceptable, the Contractor shall amend the report (in 5 working days) based on Frontex further recommendations, observations and comments. Should Frontex still not consider it acceptable, Frontex will consider that the Contractor fails to perform its obligations.

The Intermediate Study Report approved by Frontex shall be delivered also on paper in 1 original and 2 copies.

Final Study Report (T0+7).

The Final Report of this research study shall be delivered by the Contractor at T0+7 months, to present Frontex with all the final findings of the present study based on the work developed under WP1 and WP2, as well as the final version of the main expected deliverables in these WPs. The Final Report shall compile all the results of the 2 Work Packages and shall contain at least:

- Specific identifiers provided by Frontex which shall be incorporated on the cover page.
- An **abstract** of no more than 400 words;
- A publishable joint **Executive Summary** of maximum 10 pages (format A4, font size 12); this summary should be edited separately of the Research Study (D2.2), identifying the key conclusions and recommendations of the study; also, the Executive Summary shall not contain any confidential or proprietary information;
- a short **Factual Report** detailing the service provided under the contract;
- the final version of all the **deliverables** foreseen in this study;
- as **Annexes**: all the available documentation related to all the meetings and workshops done.

After the receipt of the Final Study Report, Frontex will have 15 working days in which to analyze it and either approve it or reject it, formulating in the latter case recommendations, observations, comments that

shall be taken into consideration by the Contractor for elaborating a new Final Study Report (in 10 working days) which shall likewise be subject to the just above mentioned provisions. Should Frontex still not consider the new report acceptable, Frontex will formulate further recommendations, observations, comments that shall be taken into consideration by the Contractor for elaborating (in 5 working days) a new Final Study Report. Should Frontex still not consider it acceptable, Frontex will consider that the Contractor fails to perform its obligations.

A PowerPoint presentation on the full project should be delivered at the Final Meeting (see 3.2.4.1), with the objective to use it as reference presentation for future Frontex internal meetings.

The reports are to be submitted to the Agency's **Project Manager** (see par. 5.6), who is responsible for approving them.

3.2.4.3. Summary of Deliverables and Delivery schedule

A summary of the requested deliverables, the corresponding work packages and guidance for the expected delivery timelines, can be found in the table below:

WP and Activity	Deliverable	Date (T0+months)
Kick-off Meeting	Draft Management Plan	T0
WP 1/2 Initial Planning	Final Management Plan	T0 + 0.5
WP 1 Initial Planning	D1.1 - WP1 Scoping Document – Technology Foresight Methodology and Supporting Tool	T0 + 0.5
WP 2 Initial Planning	D2.1 – WP2 Scoping Document - Technology Foresight on Biometrics for the Future of Travel	T0 + 0.5
WP 1	Draft Version of: D1.2 – Technology Foresight Supporting Tool D1.3 - Technology Foresight Manual	T0+2
WP1 Awareness Workshop on Technology Foresight Methodology	Minutes of Workshop	T0+2
WP1 Awareness Workshop on Technology Foresight Supporting Tool	Minutes of Workshop	T0+2 (~1 week apart from the previous one)
WP 2 First Workshop on Technology Foresight on Biometrics for the Future of Travel.	Minutes of Workshop	T0+3
WP 2 Second Workshop on Technology Foresight on Biometrics for the Future of Travel.	Minutes of Workshop	T0+4
WP 1	Final Version of: D1.2 – Technology Foresight Supporting Tool D1.3 - Technology Foresight Manual	T0+4
Interim progress review meeting	Minutes of Meeting	T0+4
WP 1/2	**Intermediate Study Report** including the draft version of: D2.2 - Research Study - Technology Foresight on Biometrics for the Future of Travel.	T0+5
Final Meeting	Minutes of Meeting	T0+7
WP 1/2	**Final Study Report** including the final version of: D2.2 - Research Study - Technology Foresight on Biometrics for the Future of Travel.	T0+7

3.3. Profiles of the Experts

To successfully conduct the contract, all the Experts proposed by the Tenderer as members of the Team responsible for providing this service must demonstrate the expertise and knowledge needed for the continuous and satisfactory delivery of the services described in paragraph 3.2 throughout the lifetime of the contract. In particular, the involvement of subject matter Experts in technology foresight as well as in the scientific and technological domains relevant to this contract is considered instrumental in the achievement of the purpose of the assignment.

For delivering the service, the Contractor must provide a Team composed of, **as a minimum, 6 distinct Experts** having the profiles specified below, whose List and CVs shall be included in the Tender Offer according to the modalities described in the Tender Specifications.

The following **minimum requirements** apply to the compositions of the Team of Experts proposed by the Tenderer and their profiles:

Common Requirements

- **Level of Education**: All Experts must possess a level of education which corresponds to completed university studies of (at least) four years attested by university diploma(s) of MSc (Master of Science);
- **Language Skills:** All Experts must be fluent in written and spoken English (native-speaker level, C2). They shall demonstrate their English language skills through a suitable certification or relevant experience.
- **Basic expertise in research methodologies and business processes**: All Experts must demonstrate to have a sound knowledge and experience in applying qualitative and quantitative research methodologies, survey techniques, data collection, statistical analyses, development of technical specifications, business process analysis, operational research, as well as proven experience in drafting scientific and technical research studies and reports in applied science, technology and engineering.

Team Composition and Specific Requirements

a) Service Manager – Senior Expert in Strategic Technology Foresight:

- At least 10 years of demonstrated full-time professional experience (acquired after the university diploma was awarded) in providing consultancy for strategic technology foresight and related methodologies.
- Must hold a certification in the field of project management at least at a practitioner level (e.g. PRINCE 2 Practitioner, PMP certification, PM2 Expert, or equivalent).
- Must demonstrate to have acquired a sound knowledge in project management (including financial management of projects), having managed at least 5 projects in the last 10 years of a similar scale and thematic coverage, coordinating teams of at least 5 people, and including the organisation and moderation of participatory events and/or workshops.

b) **2 Experts in Technology Foresight**:

- At least 5 years of demonstrated full-time professional experience (acquired after the university diploma was awarded) in providing consultancy for the implementation of technology foresight methodologies and supporting tools (e.g. platforms capable to support the identification of emerging technologies, technology watch, horizon scanning, scientometric, etc.).

c) **Expert in Biometrics for border control systems**:

- At least 5 years of demonstrated full-time professional experience (acquired after the PhD was awarded) in academic and/or industrial research and development in the field of biometrics applied to the security domain.
- Must hold a doctoral degree (PhD) in a relevant scientific research field.

- The expert must have a demonstrated track record of relevant research activities documented by at least 10 publications (in internationally reputable peer-reviewed journals, books or conference proceedings) published in the last 5 years (2015-2020) in the field of biometrics and of relevance to the services to be provided.

d) **Expert in Smart and Autonomous Systems:**

- At least 5 years of demonstrated full-time professional experience (acquired after the PhD was awarded) in academic and/or industrial research and development in the field of smart systems and/or autonomous systems capable to assess the most recent developments in the field of advanced solutions for border management.
- Must hold a doctoral degree (PhD) in a relevant scientific research field.
- The expert must have a demonstrated track record of relevant research activities documented by at least 10 publications (in internationally reputable peer-reviewed journals, books or conference proceedings) published in the last 5 years (2015-2020) in the field of smart systems and/or autonomous systems of relevance to the services to be provided.

e) **Expert in Systems Engineering for border control**:

- At least 5 years of demonstrated full-time professional experience (acquired after the university diploma was awarded) in providing consultancy in the field of design and/or implementation of automated border control systems, including at least:
  - systems for the acquisition, storage and use of biometric data
  - system integration, testing and evaluation.

3.4. Continuity and Replacement of Experts

The Contractor must ensure the continuity of service necessary for performing tasks foreseen in this Terms of Reference. Under no circumstances shall the Contractor invoke a change in personnel to justify a failure to comply with contractual obligations, in particular compliance with deadlines and quality requirements.

It is assumed that all the Experts proposed by the Tenderer as members of the Team responsible for providing this service remain assigned to the execution of the same for the whole duration of the Contract also in consideration of the fact that some of the deliverables might require continuity as they may be built on the outcome of previous tasks. It is therefore important that the Contractor presents, in the Technical Proposal, a consistent plan for the **Team Availability Management** (see the Annex 01 – Tender Specifications) that describes, among other, the procedures that will be put in place in case the replacement of Experts is needed during the execution of the Contract.

In general, the replacement of one or more Experts during the execution of the Contract might be necessary in the following situations:

1. Upon request of Frontex in case of underperformance of the Expert.
   If an Expert, during the implementation of the requested service doesn't meet the requirements of Frontex, Frontex can suspend the contract execution and require a new Expert to be proposed by the Contractor within 5 working days of the notification.
2. Upon request of Frontex in case of temporary unavailability of the Expert.
   In case an Expert becomes temporarily unavailable, due to holidays or other periods of planned absences, Frontex may request the Contractor to provide an adequate replacement of the Expert, should the period of unavailability be impactful on the execution of the Contract.
3. Based on the needs of the Contractor in case of illness and short-term absences, planned absences, long-term or permanent unavailability of the Expert.
   In case an Expert is taken ill or, for any other reasons, becomes temporarily (for a short-term) unavailable to perform office work (either for remote or on-site services), the Contractor shall notify, by e-mail, Frontex Contract Manager before h 09:00 on the first day of suspension of the provision of

services, and shall indicate when services will resume. Should the period of unavailability be impactful on the execution of the Contract, Frontex can proceed according to point 2 above.
In any cases the Contractor intends to replace an Expert in a Team, permanently or for a medium/long-term (e.g. in case an Expert has planned absences, becomes for whatever reasons unavailable for a long-term or permanently, in case of redundancy or personnel turn-over), the Contractor shall give at least 1 month prior notice to Frontex. The prior written approval of Frontex must be obtained, and this approval shall only be granted where there are imperative reasons.

Any time an Expert needs to be replaced, the Contractor shall timely notify Frontex in writing and propose a replacement by providing at least 2 best possible candidates (and their CVs) between whom Frontex can choose, who shall have the same profile as the replaced Expert, in line with the requirements of the tender documentation. In particular the newly proposed Expert must meet all the requirements stated in paragraph 3.3 and the applicable Selection Criteria as described in the Annex I-Tender Specifications (Technical and professional capacity - Criteria related to personnel capacity).

Frontex can assess the profile and the technical competences of the proposed replacement candidates through the analysis of their CVs, tele/videoconference interviews and/or referral to previous clients. Frontex may either accept the replacements, or request the Contractor to provide alternative CVs to the ones proposed. Once the replacement Expert is agreed, the Contractor must ensure that the new Expert has received adequate training in order to guarantee that she/he is sufficiently prepared and ready to work on the contract as soon as the original Expert leaves, thus guaranteeing the continuity of the service provided to Frontex.

Any of such replacements of Experts must be carried out by the Contractor with no additional costs to Frontex.

3.5. Place of Performance

The tasks foreseen for the implementation of this contract shall be performed outside Frontex premises (at the Contractor's premises) except for the the meetings and the workshops (see paragraph 3.2.4.1) planned to take place in presence, at Frontex premises located in Warsaw-Poland, or, in some occasions, in the territory of any of the EU MS/SAC.

In general, communication and collaboration with Frontex can be done in presence or via technical means like online working spaces, conference call, remote videoconference sessions and email.

No additional costs will be reimbursed by Frontex under any circumstances for travel, accommodation and subsistence of the Contractor's Team of Experts.

With regard to the security situation, the contracting authority reserves the right to request background security checks for personnel of the Contractor providing services which require regular access to Frontex premises or any other location.

3.6. Security and Declaration of Confidentiality

During the execution of the Contract, the information to be handled by the Contractor is expected to be marked, at the most, as "SENSITIVE"[10], non-classified according to the Commission Decision (EU, Euratom) 2015/444 of 13 March 2015 on the security rules for protecting EU classified information.

The Contractor involved in the execution of the Contract, its sub-contractors (if any) and the Experts assigned to its implementation shall sign a Declaration of Confidentiality (see Appendix 01), prior the start date of their direct involvement therein.

[10] *A document marked as "**SENSITIVE**" can only be released on a need-to-know basis and cannot be released outside the EU institutions and Member States public administrations. The document may not be released to third parties or published either in physical or electronic form without the express written consent of the European Border and Coast Guard Agency (Frontex).*

4. General Requirements

4.1. Deliverables and Tasks

4.1.1. Quality of Deliverables and Tasks

The deliverables foreseen in this service have to meet the terms and conditions, as well as goals and approaches as specified in this Terms of Reference.

The tasks foreseen in each Work Package must be executed by the Contractor in a professional manner, in a way and at performance levels not lower than those offered by the Contractor in its Technical Proposal submitted for this tender.

4.1.2. Deliverables Format and Disclaimer

Unless otherwise specified by Frontex, the Contractor shall deliver at least one (1) paper copy of the final versions of the deliverables and annexes, and at least one (1) electronic copy of each deliverable with all relevant data.

Upon completion of the Contract, the Contractor shall deliver to Frontex two (2) pen-drives containing all the deliverables and one (1) hard copy of them. Each pen-drive shall also include a registry file (an excel table) reporting, for each deliverable, the task to which the deliverable belongs, the reference number, the issue number, the classification, the date of release, the title, and the html-linked document (all versions).

All the deliverables shall be submitted in English.

Given the peculiar nature of the Deliverable D1.2 – Technology Foresight Supporting Tool (see par. 3.2.2.2), its specific format will be agreed between Frontex and the Contractor within the D1.1 - WP1 Scoping Document.

Frontex reserves the right to request the Contractor to include specific disclaimers in all the documents and publications produced under this Contract.

4.1.3. Acceptance Criteria for Deliverables and Tasks

All deliverables shall be submitted to the Agency's **Project Manager** (see par. 5.6), who is responsible for approving them.

Frontex will have fifteen (15) working days from the receipt of the deliverables to assess their quality, also in accordance with the provision of paragraph 5.1.1, and approve or reject them in full or in part. Upon reception by the Contractor of the comments and/or requests for clarification from Frontex, the Contractor will have ten (10) working days to complete, adapt and correct the deliverables and submit additional information and/or another report and/or clarifications. Should Frontex still not consider the new deliverables acceptable, Frontex will formulate further recommendations, observations, comments that shall be taken into consideration by the Contractor for elaborating in five (5) working days a new version of the deliverables. Should Frontex still not consider them acceptable, Frontex will consider that the Contractor fails to perform its obligations.

The acceptance of all the deliverables and tasks foreseen in the WPs shall be confirmed by handing over of an Acceptance Form signed by the Agency's **Project Manager**. The model form is available in Appendix 02 – Model of Task and Deliverable Acceptance Form and might be subject to modifications by Frontex.

The Contract will be considered fulfilled upon Frontex's written acceptance of all the deliverables and tasks required, and the evaluation of the overall quality of the services against the thresholds for the acceptance of service quality performances as set in paragraph 5.1.

In fact, in addition to the quality of each deliverables and tasks, Frontex will monitor the overall quality of the services provided by the Contractor under this Contract as explained in paragraph 5.1.

4.2. Intellectual Property Rights

Results of the activities performed under the present assignment may be published or released by Frontex to third parties. For this purpose, the Contractor must ensure that there are no restrictions based on confidentiality and/or intellectual property rights imposed by third parties. Should the Contractor intend to use data produced within the execution of this service that cannot be published, such limitation must be explicitly mentioned in the Contractor's Technical Offer.

It is under the Contractor's responsibility to obtain the necessary rights and ensure that all sources utilized for producing the deliverables of the present service may be used by Frontex with unlimited access. All costs incurred in the licensing of the necessary property rights shall be included in the price of the service.

The owner of all the documents produced within this service and of the associated intellectual property rights will be Frontex. Frontex reserves the right to publish these documents (including but not limited to deliverables, reports, studies, presentations, etc.) under its own name.

4.3. Language

All the communication and documentation (both in paper and electronic form) and any other deliverables, shall be in English and adhere to a high standard appropriate for technical documentation, ideally without ambiguities and no mistakes in grammar, spelling or functionality. All members of the Contractor's staff allocated to the execution of any Order Form shall speak and write in English at C2 level, according to the Common European Framework of Reference for Languages[11].

4.4. Documentation

All applicable tools and standards to be used for the documents to be delivered shall be mutually agreed between Frontex and the Contractor.

Frontex requires that all documents created maintain a high quality by:

- using a document structure, i.e. the organisation of the document into chapters, sections, subsections, etc. in a clear way;
- the compliance with standards and a writing style that supports a consistent structure, form and style of documents;
- the completeness of documents, i.e. the complete presentation of the entire scope of the described matter without clear and evident omissions;
- the consistency and coherence of documents, i.e. ensuring mutual accordance of all types of information and lack of logical contradictions of information between the submitted documents or between parts of the same document;
- the proper identification of its title, scope, authors, reviewers, related dates, status, versions, history log, audience, quality or acceptance criteria (if the document is subject to acceptance).

The documentation shall be delivered in editable electronic format and in printed format as described in paragraph 4.1.2. Editable source files for all files shall be supplied.

4.5. Climate and Environmental-Related Conditions

During the implementation of the Contract, the Contractor is required to take into proper consideration the European Green Deal (see paragraph 1.1), recently set out by the European Commission as an important commitment to tackle climate and environmental-related challenges, by at least:

[11] http://www.coe.int/t/dg4/linguistic/Manuel1_EN.asp

- demonstrating a strong commitment towards implementing, during the execution of the Contract, environmentally sustainable business processes, capable to reduce as much as possible any impacts of its own operations on climate and environmental-related issues;
- making sure that the deliverables provided as output to the contracted service contain, whenever possible, information about any viable scientific and technological solutions potential to be implemented by the Agency through Research and Innovation to contribute to its policies and measures to achieve the European Green Deal.

5. Implementation of the Contract

5.1. Service Quality Assessment

5.1.1. Quality Performance Indicators and Requirements

The services carried out by the Contractor under this assignment shall meet high standards of quality that will be measured by Frontex based on the following **Quality Performance Indicators,** during the implementation of the Contract as specified in paragraphs 5.1.2 and 5.1.3:

1) **Understanding of the requirements for the service.**

- Capacity of the Contractor to proper understand and address the objectives of the service, as well as to understand the context of research and innovation in the border security domain and of the work to be carried out. Capacity to seek agreement with Frontex on objectives, resources, timing and deliverables, adjusting them when needed and showing a professional attitude towards Frontex and its stakeholders.

2) **Application of a proper methodology for the delivery of the service.**

- **Quality of Planning, Executing, Monitoring and Controlling the service.** Quality of the methodology, tools and processes that have been applied by the Contractor to: analyse the technical documentation and collect data related to the service, plan the service ensuring that the resulting work plan is sufficiently accurate and realistic, execute the service to produce the required deliverables, monitor the progress of work, control the service execution and manage changing situations and contingency needs. Quality of WP1 and WP2 Scoping Documents.
- **Quality of Communications.** Quality of the strategy used by the Contractor for consultations and communications (communication plans) within its Team of Experts, with Frontex and with the stakeholders.
- **Quality of Risk Management.** Quality of the methodology applied by the Contractor for performing the risk analysis for the services provided, i.e. for identifying the potential risks that might have impacted the quality and timely completion of the expected results and deliverables, and the measures put in place to mitigate these risks, as well as for assessing if deliverables were realistic to be achieved. Contractor's ability to achieve continuous improvement by timely identify shortcomings and root causes, reporting them in progress reports and meetings, proposing solutions, and effectively implementing them.
- **Quality Assurance and Quality Control.** Effectiveness of the Quality Assurance methodology that the Contractor applied for the delivery of the requested service, and of the Quality Control processes that have been put in place in order to ensure and measure the required performance levels in the execution of tasks and quality level in the production of deliverables. Effectiveness of the criteria applied to control the quality of draft deliverables before they were released, as well as to handle (and, when required or necessary to remedy) non-conformities, comments and corrections received from the main stakeholders (either at interim or at final stage).
- **Quality of Knowledge Management.** Quality of the methodology and tools applied by the Contractor to ensure the transfer of knowledge to Frontex when requested, to allow Frontex personnel to acquire future autonomous operational capabilities in relation to the service performed, leveraging on the outcomes of the service provided.
- **Quality of Resource management.** Effectiveness of the approach applied by the Contractor for the allocation of time, tools and human resources to the service, with special attention to the approach applied for assigning tasks to the Team of Experts involved and for coordinating them, in order to ensure that they had the correct competence (training, experience and knowledge), roles, responsibilities and workload, that they were immediately effective since the start of the service and suitable to execute the planned activities, and that the Service Manager was properly involved at any stage of reviews.

3) **Technical Excellence and relevance and completeness of the deliverables.**

- **Quality of Technical knowledge and skills**. Level of experience demonstrated by the Contractor, technical knowledge and skills in the execution of the service. Capacity of the Contractor to provide state of the art Technology Foresight methodologies and tools and to deliver the requested Research Study targeted to the context and issues described in this Terms of Reference.
- **Quality of the produced deliverables**. Acceptability of the deliverables, and capacity of the Contractor to make sure that the quality of deliverables is in-line with Frontex requirements as specified in this Terms of Reference. Capacity of the Contractor to produce deliverables of such a quality that they can be used to support policy- and decision-making and directly published by Frontex as a part of its official publications. Capacity of the Contractor in establishing robust means to ensure the reliability, validity and comparability of the information collected as well as the high-quality of its analysis and of its reporting, including a full and standard referencing of the sources used.
- **Clarity of Reports and Presentations**. Capacity of the Contractor to effectively communicate the results (interim and final) of the service to the requested audiences by reports and presentations.
- **Performance of the Experts**. Capacity of each of the Contractor's Experts involved in the execution of the service to effectively demonstrate and implement their expertise. Other aspects that will be evaluated include: the ability of the Expert to maintain appropriate relations with Frontex and its stakeholders, abilities in written and verbal communications, drive and determination, job management abilities.

4) **Ability to document the work.**

- **Quality of Document and Data Management**. Reliability and efficiency of the document management system and procedures put in place by the Contractor. Quality of the methods, tools and procedures applied by the Contractor to collect, classify, analyse and handle data and information during the execution of the service in order to produce the deliverables.

5) **Respect of deadlines.**

- **Capability to react to requests**. Effectiveness of the Contractor's processes in responding to requests formulated by Frontex during the execution of the service.
- **Quality of Time Management.** Capacity of the Contractor to timely achieve the planned milestones and comply with the schedule of production of deliverables. Capacity to implement a timely and transparent reporting process, by ensuring that any deviations (change of resources, scope, schedule, planning, etc.) is timely identified and reported to Frontex.

5.1.2. Quality Performance Evaluation

The output of the service delivered under the present assignment will be subject to a written quality assessment performed by Frontex according to the Quality Performance Indicators described in paragraph 5.1.1 and the Evaluation Grid below. The indicators and the grid may be changed or adapted in accordance with Frontex quality evaluation standards in place during the execution of the service.

The current Quality Performance Evaluation Grid for the evaluation of the delivered services is the following:

1) **Understanding of the requirements for the service**: maximum 10 points;
2) **Application of a proper methodology for the delivery of the service**: maximum 20 points;
3) **Technical Excellence and relevance and completeness of the deliverables**: maximum 30 points;
4) **Ability to document the work**: maximum 20 points;
5) **Respect of deadlines**: maximum 20 points.

5.1.3. Acceptance Criteria for Services

The official acceptance of the service delivered may take place at pre-defined milestones, during the implementation, and at the completion of the service. It shall be conducted against the **Quality Performance Indicators** set in paragraph 5.1.1 and the Evaluation Grid in paragraph 5.1.2 above. The thresholds for the acceptance of service quality performances are set as follows:

- A score not lower than 50% of the maximum points in each of the above mentioned indicators;
- A **Total Quality Score** (sum of the scores in each indicators mentioned in paragraph 5.1.2) not lower than 60.

5.2. Reporting and Payments

The approval of the **Final Study Report** by Frontex is a precondition for proceeding with the final payment for the contract.

If an interim payment is expressly provided for in the Contract, the Contractor shall submit a relevant detailed invoice, indicating the reference number of the Contract and related financial commitment number to which it refers, accompanied by the **Intermediate Study Report** (par. 3.2.4.2).

The Agency shall make the interim payment only after the acceptance of the above mentioned **Intermediate Study Report** submitted by the Contractor.

5.3. Reduction of Payments in Case of Underperformance

The quality of the outputs of the service will be assessed on the basis of the **Total Quality Score** (see paragraph 5.1.3), up to a maximum of 100 points. If the Total Quality Score is less than 60 points, it will be considered as a case of underperformance. In these circumstances, the following will apply:

- Frontex will notify the failures to the Contractor and will set a deadline for the Contractor to remedy.
- If no satisfactory remedy is produced by the Contractor within the deadline set by Frontex (satisfactory implies achieving a Total Quality Score ≥ 60), a reduction of payments up to 100% may be applied, proportional to the scale of the failure, as follows:
    - if Total Quality Score = 0 – 20, a reduction of payment of 100%;
    - if Total Quality Score = 21 – 40, a reduction of payment of 70%;
    - if Total Quality Score = 41 – 50, a reduction of payment of 50%;
    - if Total Quality Score = 51 – 59, a reduction of payment of 40%.

5.4. Escalation

The Contractor shall continuously monitor the progress of work and the risks of underperformance. In case the Contractor registers underperformance or assesses the risk of underperformance under an acceptable tolerance level, the Contractor must report it to Frontex without delay.

In case Frontex observes serious underperformance or a risk of serious underperformance of the Contractor, Frontex may escalate this observation to the Contractor by means of Registered Communications and this requires that the Contractor higher management representative will be available to report on the issue to Frontex and propose countermeasures at short notice.

5.5. Confirmation of Absence of Conflict of Interests

The Contractor and all proposed experts are required to provide a Declaration of Absence of Conflict of Interests, including but not limited to the case of previous, current or anticipated involvement of the Contractor in the commercialisation of border control technologies or equipment.

5.6. Points of Contact

After the signature of the Contract, the Contractor will nominate a **Contract Officer** (other than the **Service Manager** described in par. 3.3**)** who shall act, for the entire duration of the Contract, as a single contact point vis-a-vis Frontex for the contractual matters, and must be available for Frontex requests. All the contractual correspondence and related coordination will be addressed to this person.

Frontex will nominate a **Project Manager (PM)** (who will also be part of the **Steering Committee** – see par. 3.2.4), who will be the single contact point for all the matters related to the Contract implementation including, but not limited to, the initiation, monitoring and evaluation of the services provided by the Contractor, as well as the approval of all the related tasks, deliverables and reports.

Appendices

The following Appendices are included:

Appendix 01 - Declaration of Confidentiality

Appendix 02 - Model of Task and Deliverable Acceptance Form

Appendix 03 - Declaration of Absence of Conflict of Interests