

# Acknowledgements

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representatives who took part in research interviews. Appendix A of the Technical Annex lists their affiliations and, in some cases, their names: some interviewees' identities have been anonymised at their request. Thanks are also due to the Member State (MS) and industry survey participants for their valuable insights, as well to those who attended the stakeholder workshop held in Warsaw, Poland, on 5 September 2017.

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# 1. Introduction

This report presents the results of a RAND Europe study examining the setup and management of border security research within and beyond the European Union (EU). Commissioned by the European Border and Coast Guard Agency (Frontex)<sup>3</sup> in December 2016, this study aims to inform possible alternatives to the current model of contracting and managing border security research, and explore the role that Frontex could play in facilitating uptake of research outputs by end users ('border guards').<sup>4</sup> This chapter provides an overview of the study context, its purpose and scope, and the research approach employed.

## 1.1. Study context

### 1.1.1. Diverse threats highlight the need to strengthen EU border security

Today, the EU faces a range of pressures on its external and internal borders. In 2016, Member States (MS) reported more than half a million detected illegal border crossings. While this figure represents a significant decrease from the number of illegal crossings detected in 2015 (over a million), it is markedly higher than any annual total between 2010 (around 100 000) and 2014 (around 290 000).<sup>5</sup> An increase in people-smuggling activities has contributed to this

continued pressure on EU borders, with 96 per cent of immigrants arriving in the Central Mediterranean region in 2016 stating that they had used the services of illegal smuggling networks.<sup>6</sup> According to the European Union Agency for Law Enforcement Cooperation (Europol), many of the organised crime groups involved in migrant smuggling are 'poly-criminal' and engage in a range of other criminal activities, including document counterfeiting, property crime, drug trafficking, excise fraud, and trafficking in counterfeit goods. Other forms of organised crime posing security problems at EU borders include weapons smuggling and trafficking in human beings (THB).<sup>7</sup>

Recent attacks in France,<sup>8</sup> Germany<sup>9</sup> and Belgium<sup>10</sup> also highlight that terrorist threats are becoming more international and cross-border in nature.<sup>11</sup> In particular, the Syrian conflict has attracted thousands of so-called 'foreign fighters' from Europe, many of whom are likely to return as the Islamic State (IS) continues to lose territory.<sup>12</sup> As some of these individuals may pose a threat to internal security, the role of Frontex<sup>13</sup> and European border authorities in monitoring their cross-border movements is increasingly important.<sup>14</sup>

Given the scale, severity and cross-border nature of these security threats, integrated border management (IBM) remains a strategic priority for the EU. IBM is a concept that consists of five elements:

- Border control (checks and surveillance);
- Detection and investigation of cross-border crime;
- Inter-agency cooperation for border management and international cooperation;
- Coordination and coherence of activities of MS and institutions; and
- Four-tier access control model': this model supports the detection and investigation of cross-border crime through a combination of measures in third countries, cooperation with neighbouring countries, border control at the external border, and control measures within the Schengen area.<sup>15</sup>

By assigning strategic importance to border security, the EU aims to ensure that EU citizens' freedom and security are protected in full compliance with the Union's values, including the rule of law and fundamental rights.<sup>16</sup> Border security is central to two of the European Commission's *Ten Priorities for Europe*,<sup>17</sup> and two of the three strategic priorities set out in the *European Agenda on Security*.<sup>18</sup> Under the *European Agenda on Migration*,<sup>19</sup> a number of measures have been taken to reinforce the security of the EU's external

3 While Frontex is now officially named the 'European Border and Coast Guard Agency', it is still widely referred to as 'Frontex'. In this report, 'Frontex' and 'the Agency' are used interchangeably to refer to the organisation.

4 An 'end user' in the context of this study refers to the national or multinational authority responsible for border management. The terms 'end user' and 'border guard' are used interchangeably throughout this document.

5 Frontex (2017).

6 Europol (2017).

7 Frontex (2017).

8 The Guardian (2017); BBC (2016); BBC (2015a); BBC (2015b).

9 The Guardian (2016); The Telegraph (2016a); The Telegraph (2016b).

10 France 24 (2017).

11 European Commission (2015c).

12 Frontex (2017).

13 Established in 2004, Frontex promotes, coordinates and develops European border management in line with the EU fundamental rights charter and the concept of Integrated Border Management. See Frontex (n.d.).

14 While Frontex (2017) highlights IS as the main terrorist threat to EU borders, al-Qaeda, its affiliates and other terrorist groups may similarly pose a threat to border security.

15 Council of the European Union (2006).

16 European Commission (2015d).

17 These priorities are 'justice and fundamental rights' and 'migration'. See European Union (2015).

18 These priorities focus on supporting a strong EU response to terrorism and foreign fighters and on tackling serious and organised crime, which both pose cross-border challenges. See European Commission (2015e).

19 European Commission (2017a).

borders and to support the national border guards deployed by MS. One such measure was the creation in October 2016 of a European Border and Coast Guard (EBCG), comprising Frontex and the various national authorities responsible for border management at the MS level.<sup>20</sup>

To support these strategic objectives, the funding, personnel and remit of Frontex have been increased since the EBCG came into force in 2016. EU funding for Frontex is set to increase from €281m in 2017 to €322m in 2020, with the number of staff members expected to rise from 400 in 2016 to 1 000 by 2020.<sup>21</sup> The role and activities of the Agency have been strengthened with, for example, a new Rapid Reaction Pool of 1 500 border guards and other officers being placed at the Agency's immediate disposal since December 2016, alongside a Rapid Reaction Equipment Pool consisting of helicopters, vessels and other equipment to carry out rapid border interventions.<sup>22</sup>

Additional measures have been taken to improve situational awareness at the EU's external borders and to support the detection of cross-border crime. For example, under the EU's earth-observation programme 'Copernicus', the European Commission has agreed to provide €46.7m to Frontex between 2015 and 2020 in order to implement satellite services dedicated to border surveillance.<sup>23</sup> With the agreement finalised on 10 November 2015, the European Commission has entrusted Frontex with the border surveillance component of the Copernicus programme. This involves supporting the European Border Surveillance System (EUROSUR) by providing real-time data on activities on land and sea around EU borders. Satellite data has already been used in combination with ship reporting systems to identify smugglers and save lives at sea.<sup>24</sup>

### 1.1.2. Research is important for border security

Research<sup>25</sup> can help security officials understand and respond to these threats to border security, as well as supporting the development of evidence-based security policies and operational tools.<sup>26</sup>

An important part of Frontex's mandate involves monitoring and contributing to research developments relevant to the Agency's area of operations in order to bridge the gap between technological and research advancements and the needs of border control authorities. Responsibility for monitoring developments in these areas lies with the Research and Development Unit (RDU).<sup>27</sup> Through projects, workshops and conferences, the RDU aims to facilitate engagement and exchange of information between border management authorities and providers of research, including research institutes, universities and industry. Frontex is also responsible for keeping MS and the European Commission up to date with developments, and provides input to policy development.<sup>28</sup>

Beyond the border security research projects awarded directly by Frontex, several EU funding mechanisms for research and innovation<sup>29</sup> support the priorities of the *European Agenda on Security*.<sup>30</sup> These priorities focus on countering terrorism, organised crime and cyber-crime as interlinked areas with a strong

cross-border dimension.<sup>31</sup> Horizon 2020 (H2020), which replaced the Seventh Framework Programme (FP) for Research and Technological Development (FP7) (2007–2013), is the biggest EU R&I programme, with around €80bn of funding available over seven years (2014–2020).<sup>32</sup> Border security research sits within the 'Secure Societies' strand of the H2020 programme,<sup>33</sup> with a maximum amount of €73m and €55m available for border security research projects in 2014–2015 and 2016–2017, respectively.<sup>34</sup> 'Secure Societies' was set up to focus on 'multi-disciplinary, mission-oriented research' which combines 'end users and suppliers in project definition and execution'.<sup>35</sup>

### 1.1.3. Challenges remain in incorporating research into operational practice

Despite the millions of euros invested in EU border security research each year, challenges remain in achieving 'impact' through research; that is, improving operational practices, contributing to an enhanced understanding of policy issues, and building capacity through skills development.<sup>36</sup> There is already some evidence to suggest that the 'pull-through' of border security research can be challenging and that many promising insights are never incorporated into practice. In some cases, research projects can be 'overtaken by events' and lose their relevance over time, particularly given that EU research funding tends to be long-term in nature, while political priorities and personnel can change more rapidly. A lack of understanding among research providers of the operational context and constraints affecting end users can also reportedly limit the relevance of research outputs to the end user community.<sup>37</sup>

<sup>20</sup> European Union (2016).

<sup>21</sup> European Commission (2015a).

<sup>22</sup> European Commission (2016b).

<sup>23</sup> Frontex (2015).

<sup>24</sup> For example, 350 people were rescued after Copernicus helped identify four rubber dinghies leaving the coast of Libya on 7 October 2015. See Copernicus (n.d.-a).

<sup>25</sup> 'Research' is the detailed study of a subject, especially in order to discover information or reach a new understanding (see 'Glossary of key terms', and fuller definition provided in Chapter 3). While a core focus of this report is the integration of research findings into operational practice across these case studies, the report focuses on both 'basic research', which is driven by interest in expanding knowledge rather than on developing new products, and 'applied research', which is designed to address practical problems.

<sup>26</sup> European Commission (2015a).

<sup>27</sup> European Union (2011).

<sup>28</sup> European Union (2011).

<sup>29</sup> 'Innovation' refers to a process that is able to transform new ideas into products, services and processes, also encompassing the process of invention with a focus on ensuring that such new ideas are applied to the benefit of end users. See Chapter 3 and the glossary of key terms.

<sup>30</sup> European Commission (2015d).

<sup>31</sup> European Commission (2015a).

<sup>32</sup> European Commission (n.d.-a).

<sup>33</sup> European Commission (n.d.-b).

<sup>34</sup> European Commission (2015e); European Commission (2016a).

<sup>35</sup> European Security Research Advisory Board (2006).

<sup>36</sup> Economic and Social Research Council (ESRC) (2017).

<sup>37</sup> Startup project meeting at Frontex offices, Warsaw, 19 January 2017. See Section 3.2 for a more in-depth discussion of these challenges and constraints.

## 1.2. Purpose and scope

Given the challenges inherent in pulling through operationally relevant research, Frontex is interested in developing a better understanding of how border security research is set up, managed and operationalised by agencies operating at the national level within and beyond the EU. This is intended to increase awareness of alternative or new ways of setting up, managing and using research outcomes that enable the faster integration of relevant research, make research more focused on operational needs, and ensure that its potential for positive impact on EU and MS border security is fully realised.

To support this overarching objective, this study addresses three research questions (RQs):<sup>38</sup>

- RQ1: How is research and innovation in the area of border security set up, conducted and operationalised by EU organisations and MS?
- RQ2: What approaches are used in the US, Canada and Australia to fund and apply research in this area?<sup>39</sup>
- RQ3: What 'good practices' from these different approaches could be incorporated into the EU approach?

While a central focus of the study is on the integration of research findings into operational practice, this report focuses on both 'basic research', which is driven by interest in expanding knowledge rather than on developing new products,<sup>40</sup> and 'applied research', which is designed to address practical problems of the modern world rather than to acquire knowledge for knowledge's sake.<sup>41</sup>

## 1.3. Research approach

To achieve the objectives of the study, the project team deployed a structured

approach combining data-collection activities with a rigorous analytical process. Figure 1.1 presents the overall research approach, which is structured around three Work Packages (WP) linked to the three RQs above.

The RAND Europe project team used two main research methods to conduct this study: case studies (drawing on document reviews, research interviews and – for WP1 only – surveys) and workshops. As shown in Figure 1.1, the case studies were conducted in two separate phases and with different purposes.

### Case studies

In the first phase of the study, the WP1–2 case studies were used to answer the first two research questions (RQ1 and RQ2) described in Section 1.2. As part of this analysis, these case studies helped generate a high-level understanding of good practices and common challenges relating to the operationalisation of border security research. As per WP1 and WP2, this first set of case studies focused exclusively on institutions or organisations involved in border security research in the following countries and regions: the EU, the US, Canada, Australia, Turkey and selected parts of North Africa (Egypt, Morocco and Tunisia).<sup>42</sup> These case studies are presented in Figure 1.2 on page 26, along with an overview of the main governmental actors and EU institutions responsible for the setup and management of border security research. Detailed descriptions of the EU and non-EU case studies are presented in Chapters 2 and 3, respectively, of the Technical Annex.

In the second phase of the study (WP3), to inform the development of recommendations for Frontex, the project team conducted a more in-depth investigation of

six organisations also operating in other domains – namely defence and space – with a view to understanding different functional roles for R&I.

The case studies conducted in WP3 focused on the following six organisations:

- **European Space Agency (ESA):** The ESA is the coordinating entity for European civilian space activities. It is an intergovernmental organisation of 22 MS, dedicated to the exploitation of space science, research and technology.
- **European Institute of Innovation & Technology (EIT):** The EIT is an independent EU body set up to support innovation in Europe. The EIT brings together universities, research labs and companies to form partnerships ('Knowledge and Innovation Communities').
- **Defense Innovation Unit – Experimental (DIUx):** Headquartered in Silicon Valley in California, DIUx is a US Department of Defense (DoD) organisation focused on accelerating commercial technology development for the US military.
- **Department of Homeland Security (DHS) Small Business Innovation Research (SBIR):** The DHS SBIR programme aims to increase small business participation in US federal research that has the potential for commercialisation.
- **Homeland Security Innovation Programs (HSIP):** The HSIP aims to generate innovation in hubs across the US in order to solve DHS's most complex challenges through outreach to investors and funding for innovative start-ups.
- **Centers of Excellence (COEs):** COEs refer to a coordinated, university-based programme that aims to harness expertise from US academic institutions in order to support research efforts and deliver tools, technologies, knowledge products, training and expertise for the homeland security enterprise.

The WP3 case studies were selected at an internal analysis session. At this session, the study team identified research organisations for further, more in-depth analysis from the first phase of the study (SBIR, HSIP and COE), before agreeing on organisations from other sectors with

<sup>38</sup> More detailed information in response to RQ1, RQ2 and RQ3 can be found in Chapters 2, 3 and 4, respectively, of the Technical Annex.

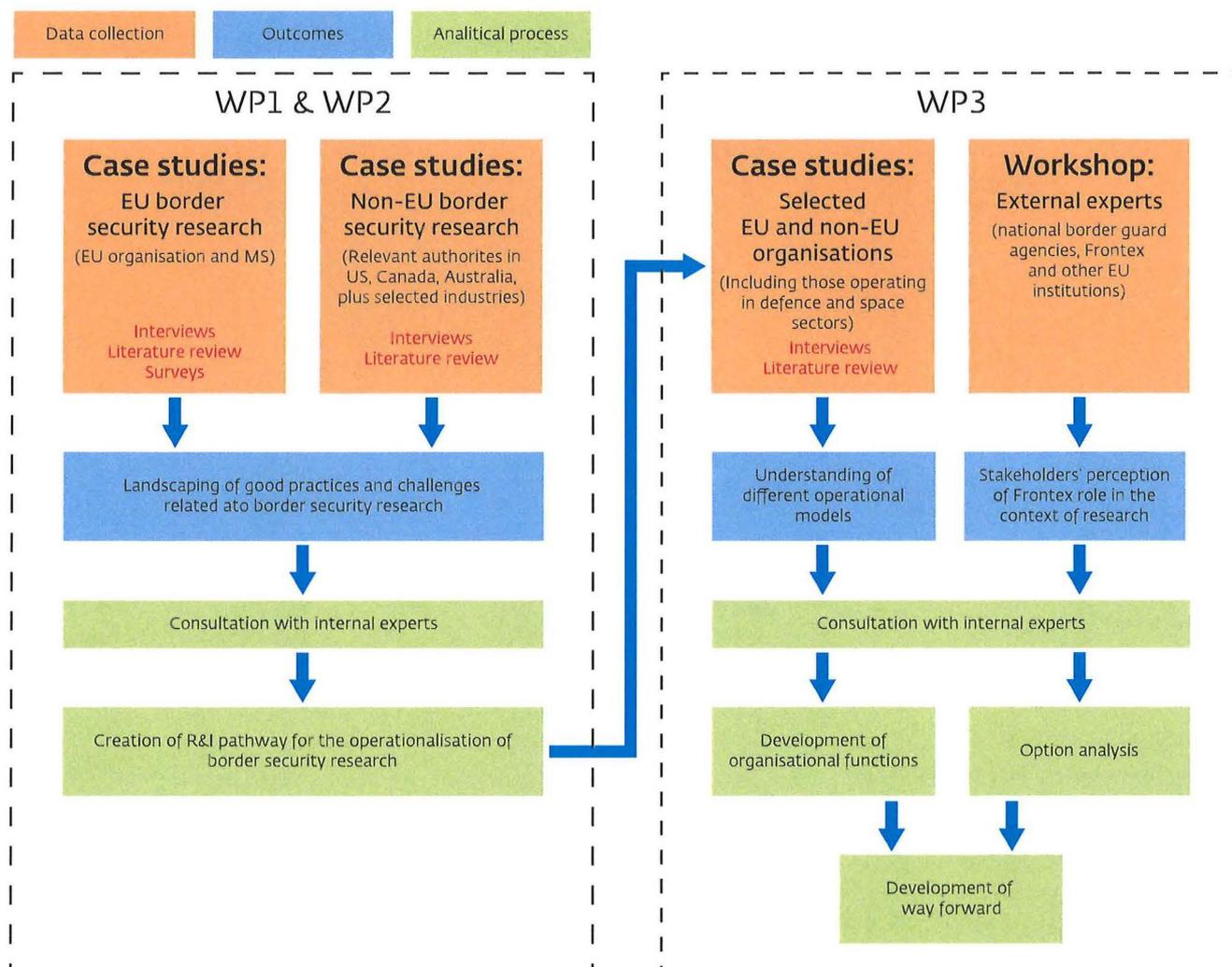
<sup>39</sup> At the client's request, the study's analysis focuses on the EU, US, Canada, Australia and – (to a lesser extent) on Turkey and three North African countries: Egypt, Morocco and Tunisia (see Section 1.3).

<sup>40</sup> Lawrence Berkeley National Library (n.d.).

<sup>41</sup> Lawrence Berkeley National Library (n.d.).

<sup>42</sup> At Frontex's request, the EU, US, Canada and Australia cases studies offer a more granular analysis of how research is set up, conducted and implemented in practice, while the Turkey and North Africa cases offer a 'lighter-touch' analysis that provides a high-level description of: (i) the extent to which border security research is already being conducted and operationalised in these countries; and (ii) any existing or intended involvement in the Horizon 2020 programme.

Figure 1.1 Overview of research approach



applicable lessons for border security R&I (ESA, EIT and DIUx). Literature availability was also considered as part of selection in order to ensure that there was sufficient source material to conduct an informed analysis. Detailed descriptions of the WP3 case studies are provided in Chapter 4 of the Technical Annex.

As the following paragraphs describe in more detail, the WP1–3 case studies are based on a combination of literature review and research interviews, with additional WP1 data collected through two surveys.

#### Literature reviews

Across all WPs, data was collected through structured reviews of peer-reviewed and

'grey' literature.<sup>43</sup> The WP1–2 review focused on literature relating to the institutional setup of border security research across the case study countries and regions, while the WP3 review explored the functional activities of the six case study organisations. Both reviews were conducted through Google and Google Scholar searches and 'snowball' searching.<sup>44</sup> Given the institutional and procedural focus of the study, the study team identified most of the literature reviewed by searching the websites of relevant gov-

<sup>43</sup> 'Grey literature' is produced by organisations outside of academic or commercial publishing channels. Examples of grey literature include government documents, technical reports, working papers, doctoral theses and conference proceedings.

<sup>44</sup> 'Snowball searching' involves using a given document's reference list to identify other relevant documents.

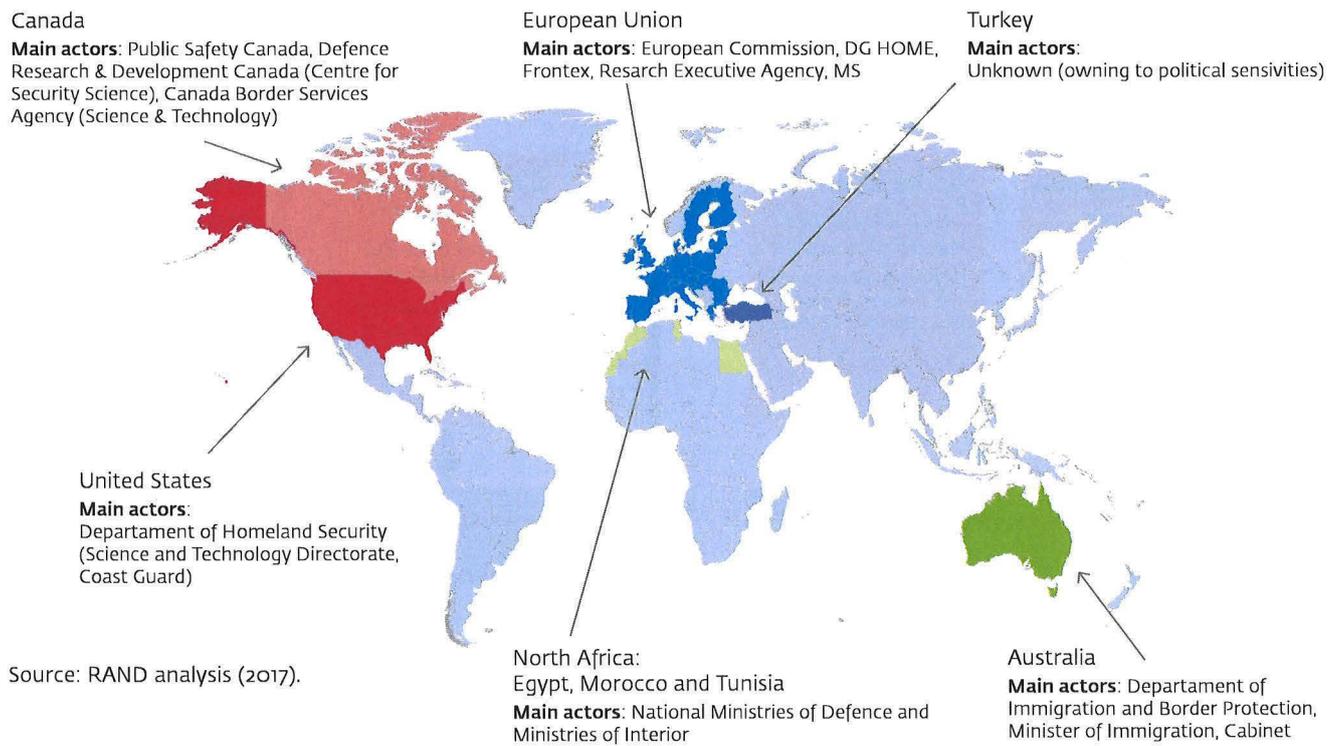
ernment agencies and other stakeholders involved in the setup, management and operationalisation of research. The team included literature in the review on the basis of relevance to the research questions and to the scope of the study, and findings were written up in a narrative synthesis.

#### Research interviews

Complementing the literature review, a total of 32 semi-structured<sup>45</sup> telephone in-

<sup>45</sup> Semi-structured interviews combine the use of an interview protocol containing specific questions with flexibility to ask unplanned follow-up questions. By contrast, structured interviews follow an interview protocol with all interviewees asked exactly the same questions in the same order, while unstructured interviews consist of a free-flowing conversation on a given topic.

Figure 1.2 Overview of WP1 and WP2 case studies



Source: RAND analysis (2017).

Interviews were conducted across all WP. Interviewees were policy officials, border guard practitioners, academic experts and industry representatives with expertise relating to the case studies under analysis.<sup>46</sup> Interviewees were identified by conducting online searches and leveraging RAND’s contact networks, and through recommendations from Frontex. An interview protocol was used to conduct these interviews (see Appendix B of the Technical Annex). This guidance document was designed to help interviewers cover all the desired topics while allowing scope for flexibility, and was adjusted for each of the case studies. It was also designed to ensure that all topics of discussion were, as far as possible, covered with all participants.

We conducted 14 interviews focused on EU border security research (WP1), 14 interviews focused on non-EU border security research (WP2), and 4 interviews with representatives from R&I organisations (WP3). The majority of interviews focused on WP1–2, given that the WP3 case studies were intended to be based primarily on a literature review. Table 1.1 presents the distribution of interviewees across countries and regions.

<sup>46</sup> A full list of interviewees is included in Appendix A of the Technical Annex.

### Surveys

To support the WP1 analysis, the study team distributed two electronic surveys. The first survey was circulated to National Frontex Points of Contact (NFPOC) within all 28 EU MS, with a 39 per cent response rate (11 of 28 MS).<sup>47</sup> In order to complement the MS survey data with perspectives from research, academic and industry representatives, Frontex circulated a second survey to 52 of their contacts from industry and academia, with a 10 per cent response rate (5 of 52 contacts). The purpose of these surveys was to expand on and validate the emerging findings of the WP1 literature review and interviews, as well as to provide further details about EU border management processes and the roles of different agencies that were not otherwise captured through the literature review.

<sup>47</sup> 7 NFPOC (Surveys A–G) provided completed survey responses: 3 NFPOCs (Surveys H–J) informed the study team that they do not perform activities related to border security research, and 1 NFPOC (Survey K) was unable to complete the survey due to other work commitments.

### Workshops

In addition to the case studies, an external stakeholder workshop was held at Frontex premises in Warsaw, Poland, on 5 September 2017 with the participation of 30 experts from national border guard agencies, Frontex and other EU institutions.<sup>48</sup> The purpose of this external stakeholder workshop was to analyse different types of functional role that Frontex could play in order to support the operationalisation of border security research (see Chapter 5).

To help structure our research approach and synthesise findings, three internal analysis workshops were held with a RAND Experts Group made up of senior researchers and topic experts in research, innovation and border security at RAND Europe. The purpose of the first internal workshop, held at the early stages of the study, was to develop a draft research and innovation pathway to map the possible processes linking border security research and its

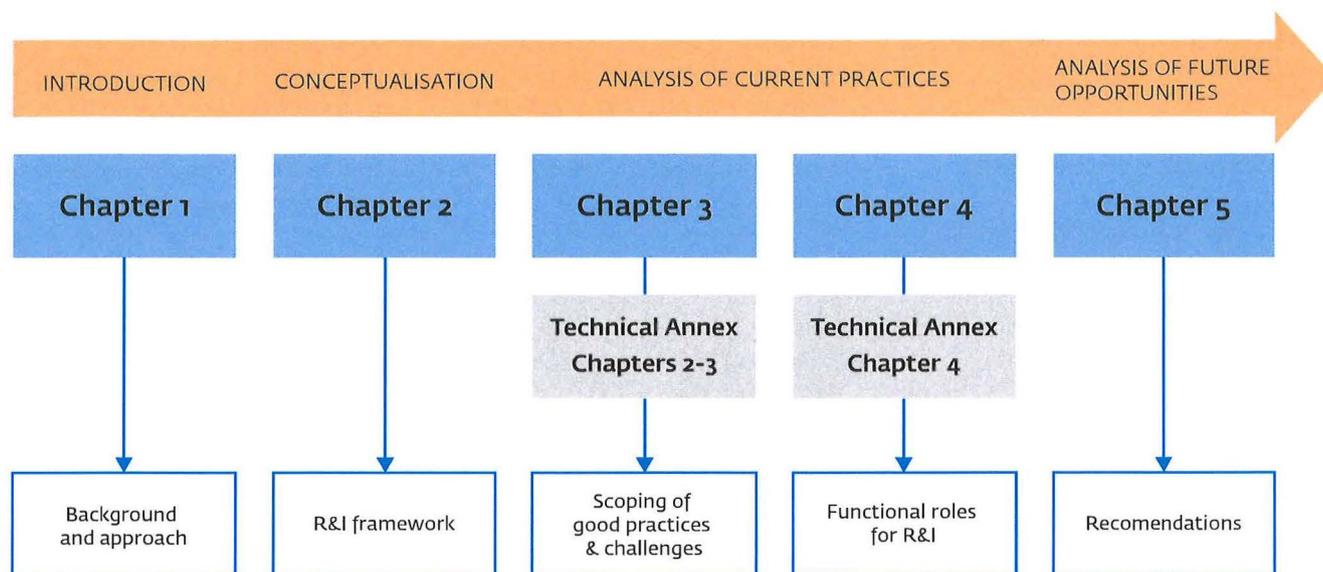
<sup>48</sup> For information on supporting materials used at the workshop and on workshop findings, please refer to Appendices D and E of the Technical Annex, respectively.

Table 1.1 Distribution of interviews across countries and regions (WP1–3)<sup>49</sup>

	EU	US	Canada	Australia	Turkey	North Africa, (Tunisia, Morocco, Egypt)
Interviews conducted	15 (WP1: 14, WP3: 1)	5 (WP2: 2, WP3: 3)	5 (All WP2)	4 (All WP2)	1 (WP2)	2 (Both WP2)

Source: RAND analysis (2017).

Figure 1.3 Structure of this report



implementation by border guard authorities. The resulting framework was used to structure the study team's approach to data collection (see Chapter 2). The second internal workshop focused respectively on refining the research and innovation pathway, and the third on validating the case study and external stakeholder workshop findings.

#### 1.4. High-level assumptions

A number of high-level assumptions should be noted in considering the findings presented in this report:

- From a terminology perspective, this report uses the term 'research and

innovation' to refer to the entire process that leads to the operationalisation of research and its related impact on policy and operational practices. This process includes, but it is not limited to, the 'research & development' phase (see Chapter 2 for more details).

- Across the WP1–2 case studies, more literature and interview data was available for the EU and the US than for other countries and regions.<sup>50</sup> A relative shortage of data on Canada, Australia, and in particular North Africa and Turkey (in part due to political sensitivities)<sup>51</sup> has implications for the depth of analysis on these focus countries and regions.
- In a number of areas, the nature of the data available to the study team means that the WP1–2 case study findings lack granularity. While specific

examples of 'research impact', 'end user involvement' and 'the operationalisation of research' were sought by RAND researchers, in some cases little detail on this could be elicited from the available literature, interviews and survey responses.

- The identification of 'good practices' and 'challenges' in the setup and management of border security research across the case studies is based largely on the views of WP1–3 study interviewees representing policy, practitioner, academic and industry stakeholder communities.
- While the report highlights the main challenges and areas of good practice identified through the WP1–3 interviews and literature review conducted within the study timeframe, the study team recognises that there are likely to be good practices and challenges not captured in this document, and that those listed are not exclusive to the case studies in which they are outlined.
- Relatively low WP1 survey response rates (39 per cent and 10 per cent respectively for the MS and industry

<sup>49</sup> Since submission of the Interim Report in June 2017, additional interviews have been conducted with EU stakeholders (n=3) and Australian stakeholders (n=1) to update WP1 and WP2 content. A total of 4 WP3 interviews have also been conducted (n=3 US interviews comprising 1 with SBIR, 1 with HSIP and 1 with an anonymous US organisation; and n=1 EU interview with an anonymous EU organisation).

<sup>50</sup> While comparatively few interviews were conducted with US stakeholders (n=2), this limitation was offset by the high availability of US literature.

<sup>51</sup> Please refer to Section 2.2.3 of this report and Section 3.4 of the Technical Annex.

surveys) limited the generalisability of the data collected from respondents. However, complementing survey data with data from the research interviews ensured that our analysis was informed by a wide range of stakeholder perspectives.

- Discussions at external workshop were informed mainly by EU border guards and Frontex representatives, given that these stakeholder groups accounted for the majority of attendees.

## 1.5. Structure of the report

This report outlines the findings of this study and provides a set of recommendations for Frontex. In addition to this introduction, this document contains four substantive chapters:

- **Chapter 2** outlines the concepts of research and innovation, and presents the research and innovation pathway developed as part of this study to guide our analysis.
- **Chapter 3** provides a summary of findings across the WP1–3 case studies in relation to good practices and challenges for operationalising border security research.
- **Chapter 4** explores a range of functional roles that organisations can play along the research and innovation pathway described in Chapter 2.
- **Chapter 5** presents a series of forward-looking recommendations for consideration by Frontex.

This report is accompanied by a Technical Annex, the contents of which are as follows:

- **Chapter 1** provides an overview of the Technical Annex.

- **Chapters 2–4** are the ‘core’ chapters of the Technical Annex, presenting case study findings relating to EU border security research (WP1), non-EU border security research (WP2), and the functional roles for R&I within different organisations (WP3).
- **Appendix A** lists the study interviewees.
- **Appendices B–D** present supporting research materials: interview questions (Appendix B), survey outlines (Appendix C), and materials for the external workshop (Appendix D).
- **Appendix E** summarises proceedings and findings of the external stakeholder workshop.

Figure 1.3 on the previous page highlights the links between the chapters of this report and the core chapters of the accompanying Technical Annex.

## 2. Conceptualising research and innovation

This chapter introduces the concepts of research and innovation, explaining how the latter relates to the adoption of research by end users in the border security context. The following sections then draw on established R&I models and theories identified through a literature review to develop a bespoke ‘research and innovation pathway’, which serves two purposes. First, this pathway offers a way of presenting case study findings related to EU and non-EU border security research (WP1–2) in a structured and consistent way (see Chapters 2 and 3 of the Technical Annex).<sup>52</sup> Second, a number of ‘functional roles’ for R&I, identified through the case study research (WP1–3), are mapped onto the pathway (see Chapter 4) in order to inform a set of recommendations for Frontex (see Chapter 5).

### 2.1. Overview of key definitions

Understanding the distinctions between ‘research’ and ‘innovation’ is important for enhancing awareness of how new technology or knowledge can be more efficiently and effectively translated into operational practice. As described in Section 1.2, one possible way of defining research is by splitting the concept into two categories:

- **‘Basic research’** (also referred to as ‘fundamental’ or ‘pure’ research), which is driven by interest in expanding knowledge, rather than a focus on creating or inventing products;<sup>53</sup> and
- **‘Applied research’**, which is designed to solve practical problems of the modern world, rather than to acquire knowledge for knowledge’s sake.<sup>54</sup>

Whether basic or applied, research is part of innovation (though not all innovation requires research), but it is limited to the creation and investigation of new ideas and solutions – in simple terms, it goes only halfway to solving an identified gap since it does not include all the steps that turn ideas into new products, services and processes.

Translating border security research into operational practice goes beyond the success of any individual project and relies on the existence of two main processes:

- **From an industrial and academic perspective**, it requires a process that is able to transform new ideas into new products, services and processes, also encompassing the process of invention with a focus on ensuring that such new ideas are applied to the benefit of end users. This process is usually known as ‘innovation’.<sup>55</sup>
- **From a border security perspective**, the acquisition of a newly available technology is not *per se* a new capability. In most cases, ‘capability’ comprises a range of different constituent parts (e.g. pieces of equipment, infrastructure and knowledge). For example, the North Atlantic Treaty Organisation (NATO) identifies eight elements that collectively make up a capability: Doctrine, Organisation, Training, Materiel, Leadership and Education, Personnel, Facilities, and Interoperability (DOTMLPFI).<sup>56</sup> Even when thinking only about new equipment or technology, it is not enough simply to procure it for border guards to use; there must also be an effective maintenance and support solution in place, in addition to the wider changes to training, policy and

processes set out under the DOTMLPFI framework. While the definition of capability and its constituent parts may vary by sector or country, the principle that it includes more than just new technologies or new knowledge still holds true. The process through which new technologies and new knowledge are integrated fully into operational practice is usually referred to as *capability development*.<sup>57</sup>

Given that the focus of this study is on research (both basic and applied) and innovation, analysis of the capability-development process is beyond the scope of this report. However, Frontex should remain cognisant of these considerations when approaching R&I if it is to take innovative new products and effectively put them into the field as fully matured, supportable new capabilities.

### 2.2. The research and innovation pathway

In relation to research and innovation, it is possible to identify a series of sequential steps that connect the generation of an idea, or the identification of a capability gap, to the adoption of a solution by end users and its related impact on operational practices and its wider societal benefits. These steps are often integrated into the concept of a ‘pathway’ in the literature.<sup>58</sup> Pathways are not linear processes, but are often cyclical, with

<sup>52</sup> See in particular Sections 2.1.4, 3.1.4, 3.2.4 and 3.3.4 of the Technical Annex.

<sup>53</sup> Lawrence Berkeley National Library (n.d.).

<sup>54</sup> Lawrence Berkeley National Library (n.d.).

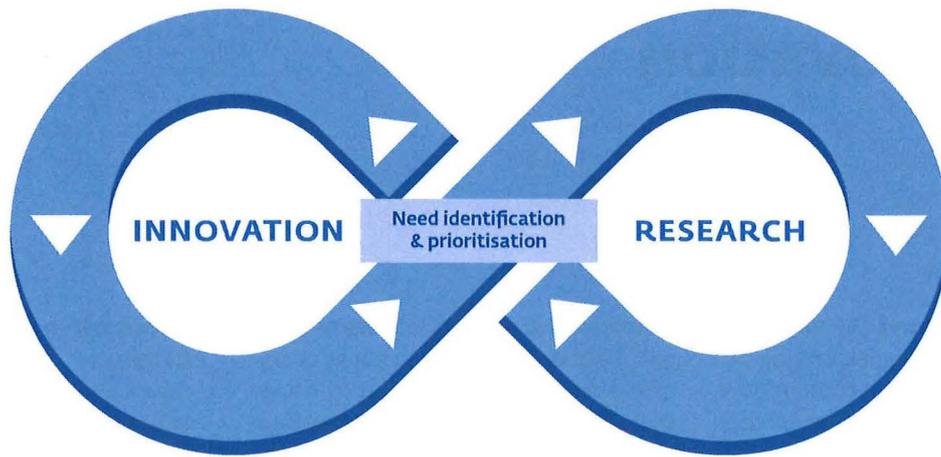
<sup>55</sup> Freeman et al. (2015).

<sup>56</sup> US Army Training and Doctrine Command (TRADOC) (2013).

<sup>57</sup> This refers to the development and operationalisation of a capability. Capability is defined as: ‘The power to achieve a desired operational effect in a nominated environment within a specified time and to sustain that effect for a designated period’ (Australian Government Department of Defence (2014)).

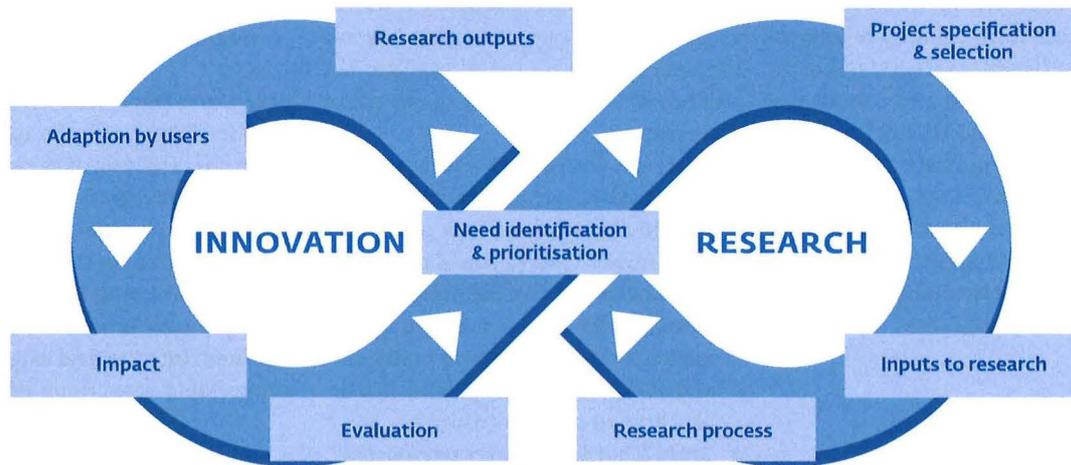
<sup>58</sup> For an example of a research and innovation pathway model, see Donovan and Hanney (2011).

Figure 2.1 Research and innovation as connected processes



Source: RAND Europe analysis.

Figure 2.2 The eight steps of the research and innovation pathway



Source: RAND Europe analysis. Please note that the steps of this graphic should be read in the order described on the previous page (i.e. beginning with 'needs identification and prioritisation', moving clockwise to 'project specification and selection', and continuing in the order indicated by the arrows).

continuous feedback loops between each of the steps.

Figure 2.1 illustrates how border security research and innovation are part of a cyclical process originating from the identification of a capability gap (or area requiring improvement). Figures 2.2 and 2.3 elaborate on this pathway, which was refined through a series of internal workshops with RAND Europe border security and innovation experts.

Several steps follow the identification of a need (e.g. a capability gap) to form the research and innovation pathway. These include:<sup>59</sup>

- **Project specification and selection:** This step includes the creation of technical specifications to be addressed by the research project, as well as the overall selection process of suppliers.
- **Inputs to research:** 'Inputs' are the components that provide a basis for the research process to take place (e.g. funding, technical expertise, relationships, project management, personnel).
- **Research process:** This includes all activities related to the delivery of the research against the technical requirements (see definition of 'basic' versus 'applied research' above).
- **Research outputs:** 'Outputs' are the products that result from project activities (e.g. research publications, toolkits, technologies/prototypes).
- **Adoption by end users:** This step, also referred to as 'operationalisation', refers to the integration of research outputs into operational practice.
- **Impact:** While definitions vary, 'impact' can be defined as the extent to which research improves operational practices, contributes to an enhanced understanding of policy issues, and builds capacity through skills development.<sup>60</sup>

59 RAND Europe analysis.

60 ESRC (n.d.).