EARTO Working Group
Security & Defence Research

Towards Horizon Europe:
Bridging the Valley of Death in Security Research

26 May 2020

The "valley of death" is a term frequently used also in the EU Research Framework Programmes, describing the missing bridge between the research and development of novel solutions and their market uptake. It is the main reason for the general steps taken from FP7, through Horizon 2020, to Horizon Europe, towards closer to the market actions and the increased request for results at higher Technology Readiness Levels (TRLs)[1] in line with actual user needs. The focus has been rightly shifted from delivering results to achieving impact for citizens, end users, industries and society at large. However, it is well known that going from table-lab proof of concept to fully developed commercial products is a complex nonlinear process. It fails often as it requires a set of prerequisites, such as structured gaps and needs assessment, fair market conditions, structural investments, involvement and commitment of end users and a feasible exploitation strategy, not always considered.

1. The challenges at hand

The EARTO Working Group Security & Defence research acknowledges the efforts made by the EC in the relatively young field of Security Research, notably the strengthened involvement of practitioners in Research, Development and Innovation (RD&I) activities. These efforts have already resulted in several success stories, with high TRLs commercially competitive products based on results of EC funded projects. New instruments under Horizon Europe such as the European Innovation Council (EIC) seem useful to foster innovation ambitions, especially if it will further leverage RTOs deep-tech start-ups[2]. To further maximize this, it is of utmost importance to better understand and consider the particularities of the Security Research process at the European level, and to strive for implementing appropriate supportive elements.

The security market is different from most others: it is to a large extent, a governmental market with less prominent market pressure. Public procurement typically follows a limited risk approach, supported and determined by the larger providers and system integrators. Their prime interest is, quite naturally, on developing, improving and exploiting their (existing) products and less on independent needs assessments, objective product testing and neutral recommendations for the public sector. This can lead to governmental organizations and (operational) Security practitioners in charge of managing crises, using outdated technologies, missing skills and capabilities. Security practitioners have the knowledge, experience or ability needed to effectively and timely respond to a crisis/security event in order to minimize damage to society. They can be be a very diverse group (e.g. operational, strategic) of many different disciplines (e.g. civil protection, LEA, cyber, border), involved in various phases of crisis and security events (mitigation, preparedness, response, restoration).

The EC approach of fostering the development of standards in the field of Security Research as a tool to enforce market uptake by governmental organisations is an ongoing process, not yet formalised. Furthermore, having Security practitioners successfully involved in RD&I requires them to be aware of their future needs: not only within the next 3-5 years but also in 10-15 years. However, governmental organisations usually do not have the time or resources to have proper long-term capability/innovation planning. Today, their understanding of applied RD&I is just growing. Accordingly, more support to Security practitioners in identifying and understanding their future RD&I needs and aligning upcoming their RD&I programs accordingly is very much needed. In parallel, these Security practitioners must strengthen their innovation capacity, enabling them to engage in RD&I processes and implement outcomes of research projects. The focus of RD&I projects is less on current problems "right here, right now": capacity building projects or other more procurement related financial instruments are better suited to produce customised solutions.

[1] The TRL Scale as a Research & Innovation Policy Tool, EARTO Recommendations, 2014
[2] How to Exploit the Untapped Potential of RTOs' Deep-Tech Start-Ups in Europe, 2017

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Current activities in Security Research facilitating training and experimenting in field labs and real-life situations are a promising way for developing robust, validated and implementable solutions to bridge the valley of death. Another important step forward in this regard is the improved reflection of contextual factors including ethical, legal and societal aspects: these are specifically important in Security Research for a future market uptake, due to its sensitive topics that may directly affect citizens in many (also negative) ways.

2. Success stories and lessons learned

It is important to note that capabilities providing security for European citizens consist of more than individual technological products and tools. Capabilities have more than one dimension and include aspects like organisation, personnel, training, policy, procedures and cooperation schemes. In many cases, the technology is already available and requires hardly any RD&I. It is the non-technological part of the capability that needs to be developed and combined with a technological solution to deliver a capability.

In addition to developing capabilities that in the end lead to concrete and implementable solutions, research in the heterogeneous Security domain also contributes to innovation and growth in more significant indirect ways such as: a better shared understanding of crisis management in Europe, improved day-to-day cross-border collaboration between agencies, stimulating the positive societal impact of technological solutions, developing new training courses for graduates, and reinforcing the innovation capacity of practitioner organisations. This impact is likely to become visible only years after the closure of individual projects while remaining highly relevant in time.

Research and Technology Organisations (RTOs) are well-positioned in the Security innovation ecosystem to develop relevant, science-based and field-tested solutions. Notwithstanding the challenges identified above, the FP7 and H2020 Secure Societies program resulted in several success stories demonstrating critical mass in R&I. These stories, involving members of the EARTO Security and Defence research Working Group are presented in a separate document: EARTO success stories[3].

From all collected experience and feedback, the EARTO WG Security & Defence has identified several lessons learned that could be further used to prepare the next Horizon Europe programme in this current period of programming:

- **Going from idea to market asks for a coherent development trajectory, reflecting all stages of technology readiness and maturity to be achieved to come up with a final innovative solution**. This cannot be covered by one single R&I project: this trajectory comprises multiple, often sequential projects, partly involving different partners. It calls for a harmonised set of instruments and funding mechanisms to develop projects from early stage concept up to advanced prototype solutions to optimize the chances for a successful implementation and market uptake.
- **Research simply takes time**. It needs time to acquire and apply the knowledge generated in building robust and reliable solutions, not only for technology-intensive solutions, but also for less or non-technological solutions. A successful implementation requires to consider many conditions during the development and testing of new solutions, like operational context, policies, procedures and the human factor, etc.

- **Keys to success are a clear vision of the market needs, the barriers to market uptake, a go-to-market strategy planned at the early stage of ideation**. Since the Security domain is defined by its complex nature, including multidisciplinary players on all levels from operational to political, successfully developing solutions in real-life use cases requires a well-coordinated multi-stakeholder approach.

- **The enhanced involvement of Security practitioners, not only within the projects but early in the writing of the work programme, effectively steering the expected research outcomes, is already paying off. It is an essential part in Security Research**. However, the follow-up after

[3] Stories of Success Gained through EU Secure Societies Projects

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a project's closure and the involvement of a wider network of Security practitioners in the uptake of the results needs further attention.

3. Research and Technology Organisations

RTOs are applied research driven organisations that harness science and technology to develop innovations which positively impact society and quality of life and stimulate economic competitiveness and growth. To do so, they closely cooperate with large and small industries, a wide array of public actors and universities. In this respect, RTOs are in a pivotal position in the innovation ecosystem, as demonstrated for example by leading roles in operating Digital Innovation Hubs (DIHs)[4]. According to EARTO economic footprint study, each job created in an RTO leads to four additional ones in the entire EU economy[5]. RTOs tend to be closer to industry, especially to SMEs, than academies and, in many cases, working together with universities and other fundamental research bodies, they can smoothly streamline technology transfer to industry and users. Moreover, RTOs have a strong focus on creating business value thanks to robust Intellectual Properties policies, used as assets for collaboration with industry and/or creating new business through spin-offs or start-ups. RTOs play a key role in disseminating research opportunities to industry and gathering strategic stakeholders, public and private, across Europe to create competitive consortia and critical mass. Many RTOs have strategic collaboration agreements with policy makers and practitioners at Member State level establishing a firm link between policy, needs and research. This makes RTOs a key pillar for bridging the "valley of death" in European Security Research.

4. Recommendations

Based on the experiences of the Secure Societies success stories, the EARTO WG Security & Defence has formulated the following six recommendations for bridging the "valley of death" in Security Research:

1. **Actively promote involvement of all Security RD&I stakeholders in every step of the way (including during design phases):** e.g. by adapting respective evaluation criteria. Usability and marketability should also be considered from the earliest phases. The level of involvement of stakeholders can vary depending on the phase of the research trajectory. To have an as strong chain of Security RD&I projects leading to a successful implementation of new solutions, key actors of the following projects should already be actively engaged by the end of the previous projects.

2. **Stimulate further participation and involvement of practitioners in Security RD&I projects in taking up and implementing results after (a series of) RD&I projects**: to support this, a better alignment of H2020/HEU programs with other funding mechanisms (e.g. capacity building projects, INTERREG) needs to be established.

3. **Implement a structured capability development approach at Member States level feeding into the research programming at EC level to address validated and broadly accepted practitioners' needs**. The established H2020 Practitioner Networks can play an important facilitating role in this respect. However, this can only be achieved when these Practitioners Networks are adequately supported by RTOs in applying the respective methods and implementing a longer-term vision on innovation management. Besides, these networks must be sustained after the respective projects for which support of national governments may be needed.

4. **Allow for a sufficient duration of Security RD&I projects.** Simply reducing the duration of projects does not lead to shorter times to market. On the contrary: rushing the development and testing of new solutions may lead to suboptimal results, no implementation, and even negative effects on operational performance. In the end, such duration reduction strategy results in a disinvestment and loss of time.

5. **Actively promote a dedicated area within the publicly available EU Research Results Platform[6], containing all public Security Research projects' key exploitable results**. This can be linked with the Gaps Explorer[7] which is an online overview of targeted recommendations,

[4] European Innovation Hubs: An Ecosystem Approach to Accelerate the Uptake of Innovation in Key Enabling Technologies
[5] Economic Footprint Study: Impact of 9 RTOs in 2016
[6] https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/horizon-results-platform
[7] https://drmkc.jrc.ec.europa.eu/knowledge/Gaps-Explorer

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tailored to different stakeholders' profiles (policymakers, practitioners and scientists), based on results of EU-funded projects[8]. Further integrating this with repositories developed by other EC-funded projects (e.g. DRIVER+, ASGARD, SPARTA) will create a more complementary overview of projects and results, leading to improved policies and validated RD&I topics.

6. **Lift the coordination of useful project interactions to DGs level rather than keeping it as agency level to allow further policymaking to draw from the learnings in the Security RD&I projects performed**. This could be organised via a dedicated CSA organising a platform to facilitate synergies and to avoid duplication in efforts managed by the DG directly. As reflected in the Security Union, the high interdisciplinary of research topics in Secure Societies also asks for recognition of several other activities, e.g. under DG ECHO, DG SANCO, DG DEFIS, EDA, and ESA, which is difficult to achieve from the view of a single project.

EARTO Working Group Security & Defence research Experts remain of course ready to further discuss these recommendations with the European Institutions' representatives.

RTOs - Research and Technology Organisations*: From the lab to your everyday life. RTOs innovate to improve your health and well-being, your safety and security, your mobility and connectivity. RTOs' technologies cover all scientific fields. Their work ranges from basic research to new products and services development. RTOs are non-profit organisations with public missions to support society. To do so, they closely cooperate with industries, large and small, as well as a wide array of public actors.*

EARTO - European Association of Research and Technology Organisations
Founded in 1999, EARTO promotes RTOs and represents their interest in Europe. EARTO network counts over 350 RTOs in more than 20 countries. EARTO members represent 150.000 highly-skilled researchers and engineers managing a wide range of innovation infrastructures.

EARTO Working Group Security and Defence Research *is composed of 55 EU Affairs Specialists working within our membership to elaborate and to voice consolidated positions of RTOs and address them to the EC and other bodies.*

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[8] https://drmkc.jrc.ec.europa.eu/knowledge/PROJECT-EXPLORER