SPARTA

D1.1

Bootstrapping a CCN Pilot

Project number	830892
Project acronym	SPARTA
Project title	Strategic programs for advanced research and technology in Europe
Start date of the project	1st February, 2019
Duration	36 months
Programme	H2020-SU-ICT-2018-2020

Deliverable type	Report
Deliverable reference number	SU-ICT-03-830892 / D1.1 / V1.0
Work package contributing to the deliverable	WP1
Due date	January 31st – M12
Actual submission date	17th February, 2020

Responsible organisation	CEA
Editor	Florent Kirchner
Dissemination level	PU
Revision	V1.0

Abstract	This deliverable reports about how governance, R&D&I, community and exploitation activities have been organized to launch SPARTA.
Keywords	Research governance, Mission-oriented innovation, Leadership management, Collaboration incentives

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 830892.

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"*Shift from total confidence in the existence of a fundamental solution for social and economic problems to a more questioning, pragmatic attitude – from ideological certainty to more open-ended, eclectic, skeptical inquiry*"

Albert Hirschman, 1987

Executive Summary

Innovation is a process that takes time and is influenced by multiple factors. It tightly involves two complementary facets: on the one hand, *technical capabilities* that gather the resources and functional competencies required to meet competitive challenges. Here scientific and technical assets combine to advance the state-of-the-art in specific domains.

On the other hand, *policy capacities* are tools that support identifying, implementing and sustaining research efforts. These rely on expert advice to perform rigorous organizational analyses, public outreach and issue advocacy.

This deliverable reports on SPARTA's policy capacities in its initial phase. It describes how governance, R&D&I, community and exploitation activities have been organized, highlighting the value of transversal and interdisciplinary milestones, and discussing new findings and replicability of the structures.

It demonstrates the ambitious alignment of these initial capacities with modern policy designs at the intersection of mission-based innovation, technological procurement, and strategic autonomy. Far from being performed *in abstracto*, the positioning of these choices in the international landscape of innovation is analysed based on the state-of-the-art in policy research.

More than anything, SPARTA advocates for the implementation of self-aware capacities, with honest feedback loops and dynamic features, as a sound and sustainable basis for European excellence in innovation.

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Chapter 1 Introduction

1.1 Purpose

This deliverable reports on how governance, R&D&I, community and exploitation activities have been organized to launch SPARTA and discusses new findings.

1.2 Context and scope

The text of the SU-ICT-03-2018 call for proposal draws a quite complete picture of the context and scope of European cybersecurity research. It highlights the initial work performed by the Public Private Partnership on Cybersecurity, and the remarkable progress achieved in gathering key large industries, SMEs, and authorities and helping them get access to H2020 programs over the 2018 – 2020 period. It also underscores that "*the scale of the investment under way in other parts of the world suggests that the EU needs to do more in terms of investment and overcome the fragmentation of capacities spread across the EU*".

Simultaneously, in September 2018 the European Commission proposed a draft for a regulation of the European Parliament and of the Council establishing the European Cybersecurity Industrial, Technology and Research Competence Centre and the Network of National Coordination Centres[1]. This proposal set out key legal principles for the creation and operation of a central European body, and the associated network of national entities, which could handle the implementation of cybersecurity research and innovation funding in the EU in the coming years.

In this context the SPARTA, ECHO, CYBERSEC4EUROPE and CONCORDIA, laureates of the SU-ICT-03-2018 call, constitute four pilot networks – grouped together under the Cyber Competence Network[2] denomination. They are tasked with helping the EU scale up its investments in cybersecurity, with the specific goal of developing innovative technologies and skills to support the European industry, and contribute to the objective of European strategic autonomy. In doing so, these pilot networks would support through first-hand experiences the legislative and political processes that frame discussion around the EU Proposed Regulation 2018/0328.

A key element of the success of these tasks is to propose a governance structure, including business model, operational and decision-making procedures/processes, technologies and people. Pilots are expected to perform concrete implementations of these structures, to test them and validated them in demonstration cases involving all partners in the network. In SPARTA, we chose to perform this experimentation on the structure of the project itself. In the end, the goal is to showcase their performance and optimise the future governance structure of a future Cybersecurity Competence Network and European Cybersecurity Research and Competence Centre.

1.3 Objectives

The SPARTA pilot, from its inception in February 2019, chose to directly and reflexively experiment with governance choices, implementing them across its internal scientific, technical, and support actions. The SPARTA proposal stated an ambitious demonstration objective[3]:

[1] https://ec.europa.eu/digital-single-market/en/news/proposal-regulation-establishing-european-cybersecurity-industrial-technology-and-research
[2] https://cybercompetencenetwork.eu
[3] Section 1.1.1, Strategic Programs for Advanced Research and Technology in Europe, Proposal ID 830892

The project's consortium is committed to demonstrate that a research governance based on expertise, coopetition, and diversity can out-innovate Europe's competition.

This deliverable aims at identifying the initial governance choices performed by the SPARTA pilot over its first year of execution. It documents how the structures and mechanisms foreseen in the project proposal have been instantiated since the start of the pilot, and how they have been operating over this period.

The governance choices that SPARTA is experimenting have strived to draw from the state-of-the-art in research and innovation organization, mission-oriented policies, and public procurement management. A first analysis of several key contributions anchors the governance choices of SPARTA into previous work, quantified results, and modern principles.

Governance is described over multiple levels of decision-making, ranging from top-level strategic directions to operational management of tasks. This work encompasses, not only the research-focused aspects of the SPARTA pilot, but also its transversal facets, and the ways it spills over into the European cybersecurity ecosystem.

1.4 Structure of the document

Chapter 2 documents key elements of the state-of-the-art in research and innovation governance. Along the way, it clearly identifies significant elements and priorities that need to be addressed in the governance of the pilots in general, and in SPARTA in particular. The following chapters then translate these priorities into the concrete instruments and actions that are carried out at all levels of the SPARTA network. Chapter 3 describes the governance of SPARTA's three major instruments: Roadmap, Partnerships, and Programs. Chapter 4 dives into the structures in SPARTA that are foundational enablers of the previous instruments. Finally, Chapter 5 draws over lessons learnt and future directions.

Chapter 2 Key takeaways from the state-of-the-art

The state-of-the-art that can guide the implementations of the pilots is rich as diverse. The recent years have seen the emergence of new concepts in innovations bodies and policies, modern takes on public procurement, and a revisit of strategic autonomy and its requirements.

This first chapter of the document now synthesizes some of these key emerging ideas, providing a tentative frame of reference for the governance inquiries and implementations performed in the pilots in general, and in SPARTA in particular.

As the following sections unfold, paragraphs formatted in italics with a sidebar identify notable priorities for the pilots in general (and when explicitly mentioned, SPARTA in particular).

2.1 A typology of innovation bodies

When looking at the state-of-the-art of research and innovation (R&I) governance practices, a set of notable examples lies in of innovation agencies. These agencies are, in many instances worldwide, powerful tools for technological and economic change, helping establish long-term prosperity through the well-recognized objective of enhancing innovation. In other words, they exhibit characteristics that are key for SU-ICT-03-2018 pilots in their mandate to contribute to strengthen cybersecurity capacities across the EU.

In "*Mission critical: The ends, means, and design of innovation agencies*", Breznitz, Ornston, and Samford look at these bodies in an attempt to identify specific patterns.

"Mission critical: The ends, means, and design of innovation agencies", Breznitz, Ornston, and Samford

Industrial and Corporate Change, Volume 27, Issue 5, October 2018, Pages 883–896,

https://doi.org/10.1093/icc/dty027

Published: 19 September 2018

They first take stock of the diversity of options available, and at their relationship with various public and private stakeholders:

> *Effective innovation agencies include large, powerful, pilot organizations as well as small, lightly funded ones. Some public agencies have clear technological objectives and manage much of the research themselves, whereas others have delegated these decisions to private sector actors. Some organizations have thrived by insulating themselves from political and industrial networks, while others have successfully promoted innovation by embedding themselves within these same structures.*

This diversity, although confusing at first, can be cut through from multiple angles. First, the authors argue that a common tenant of innovation agencies is that they fill an important role, not only in the design and implementation of high-quality technological advances, but also by connecting actors and defining markets (more on this in Sections 2.2 and 2.3). Numerous examples of this latter role can be found, e.g., in Israel or the United States.

Second, the authors propose to distance the study from the natural tropism towards novel product R&D, and take a broader look at the whole process, from new technology development to the progression of existing products and processes in mature markets. Similarly, they propose to examine the full scope of innovation activities. This yields a *typology of innovation agencies* that relies on two specific distinctions:

1. Radical vs. incremental innovation, distinguishing between efforts to develop new technologies and improvements to existing products and production processes.

2. Narrow vs. maximized sets of objectives, separating mission- or prize-oriented efforts from decentralized, varied R&D efforts.

Combining these two axes yields four categories of innovation agencies, and key elements of governance for each of them (level of public sector involvement in industrial R&D, positioning of the agencies within the public sector, degree of embedding within private industry). Eight successful examples (A*Star in Singapore, CORFO in Chile, DARPA in the United States, the GTS Institutes in Denmark, IRAP in Canada, ITRI in Taiwan, OCS in Israel, and Sitra in Finland), each with their own patterns, are taken from around the world to illustrate each identified category. Table 1 summarizes their findings.

	Radical innovation Shielded from interference	**Incremental improvements** Embedded in industries	
Targeted objectives	**State-led disruptors** *Radically innovative technological breakthroughs along a narrow, focused approach* Examples: DARPA, ITRI Governance goals: design new domain-specific technologies up to the level of early stage products with key industries	**Directed Upgraders** *Incremental innovation mobilizing resources around a relatively narrow range of industries and activities, facilitating large-scale change* Examples: A*Star, CORFO Governance goals: steer technological development, attract investments in key sectors	Mission-oriented and prize- driven innovation Significant resources Targeted technology fields
Wide-ranging objectives	**Transformation enablers** *Radically innovative, large number of small-scale experiments* Examples: OCS, Sitra Governance goals: develop clusters of innovative, high-productivity, research-intensive enterprises	**Productivity facilitators** *Small-scale, incremental product and process innovations across a wide range of established industries* Examples: GTS Institutes, IRAP Governance goals: creating local networks and organizing R&D communities	Delegated innovation objectives and R&D Modest resources Maximized application fields

Table 1: Typology of innovation agencies

Note that many differences exist between all these examples, even when they inhabit the same quadrant of the table. Therefore, this typology does not automatically yield blueprints for innovation organisms and their governance. It does, however, offer important clues on how to choose key principles based on robust first principles, depending on the type innovation that is targeted and the scope of innovation objectives that it serves.

> *The research question, we argue, should not be, "What is the one most effective model?" but instead, "Which model works best to achieve specific […] innovation missions?"*

An important takeaway from this work is that there is strength in combining the diversity of these models, and their complementary uses and trade-offs. Any healthy academic and industrial ecosystem would benefit from a combination of such models and agencies.

We would point to the importance of developing an innovation system in which a multitude of agencies advance different missions rather than pinning one's hopes on a single organization.

Here the concrete reality behind the motto *In varietate unitas*, "United in diversity", holds a strong promise: the Europe's cybersecurity ecosystems have the opportunity to leverage one of the world's richest ecosystem of agencies. This is a unique, if challenging, state of play in the world.

SPARTA aims at creating disruptive, radical innovations, on the topic of cybersecurity. It thus appears to belong to the first column of the table, and its governance enables large-scale, multi-year research that can transform whole industries. Its status regarding the scope of innovation is also clear: by focussing on industry pure-players, e.g. with the choice of Leonardo, SAP, and Thales as key partners, SPARTA shall aim at targeted objectives. It should be noted, however, that the Associates mechanism could also serve as a support system towards wider-ranging impacts.

2.2 On mission-oriented research and innovation

Research and innovation are being more and more focused on talking societal grand challenges. From space exploration to climate change and modern care, these challenges in addition to being urgent present complex facets, interconnected sub-problems, and span multiple fields of expertise. The cybersecurity of digital territories, and the related issues of citizen freedom and strategic autonomy, arguably fit this definition of a societal grand challenge.

Tackling these challenges, however, is a complicated issue. It requires coordinating a variety of actors, in the public and private sectors, across multiple domains. But it also has to enable bottom-up experimentation and learning to nurture the innovation process. To be successful, these requirements have to be met through the use of clearly-piloted mission-oriented programs, equipped with the proper policy and governance tools.

"Mission-oriented innovation policies: challenges and opportunities", Mazzucato

Industrial and Corporate Change, Volume 27, Issue 5, October 2018, Pages 803–815,

https://doi.org/10.1093/icc/dty034

Published: 19 September 2018

Mazzucato, in "*Mission-oriented innovation policies: challenges and opportunities*", recalls the four key ingredients necessary to such programs:

***Missions should be well defined**. More granular definition of the technological challenge facilitates the establishment of intermediate goals and deliverables, and processes of monitoring and accountability. When governance is too broad, it can become faulty, and there is a risk of being captured by vested interests.*

***A mission does not comprise a single R&D or innovation project, but a portfolio of such projects**. Because R&D and innovation is highly uncertain, some projects will fail and others will succeed. All concerned should be able to accept failures and use them as learning experiences. Furthermore, stakeholders should not be punished because of failures derived from good-faith efforts.*

***Missions should result in investment across different sectors and involve different types of actors**. To have highest impact, missions should embrace actors across an entire economy, not just in one sector and not just in the private or public realm.*

***Missions require joined up policy making**, whereby the priorities are translated into concrete policy instruments and actions to be carried out by all levels of the public institutions involved. While these missions should involve a range of public institutions, it is crucial that there is a strategic division of labor among them, with well-defined responsibilities for coordination and monitoring.*

The author continues to identify key takeaways that should be present in policy-making toolkits, and that are particularly relevant in the case of the pilot networks:

a. Pick the willing rather that attempt to pick the winners. Leaders and actors in mission-oriented programs need to be committed to transformational change, more than they need to be well-placed in vertical domains.
   Pilot governances should seek to establish and reward leadership all levels of technical and transversal activities.
b. Shape the markets rather than attempt to fix them. In particular, mission-oriented programs should aim at creating new landscapes, where industries can follow. More on this later in this section.
   Pilot roadmaps should gather the community's creating thinking around grand challenges and missions. SPARTA's Associates could extend this link from its roadmap to potential markets.
c. Encourage experimentation rather than seeking to avoid failures. Missions should have a clear vision of *what* they want to achieve, yet *how* to achieve it should, by the nature of innovation, be the result of a learning process built on structural acceptance of uncertainty.
   Pilot scientific governances (e.g. SPARTA's Programs) should pursue clear goals, encourage risk-taking and implement concrete measures to support failure-based learning.
d. Build a quality research finance system. In addition to supporting multiple innovation levels, from basic science to translational and industrial research, the role of patient capital by strategically-thinking organizations is key to solving societal grand challenges.
   Pilots should project themselves beyond the 3-year execution period of this first financing round, into mid- and long-term challenges and missions.
e. Engage a wide range of actors. From civil society to SMEs, from academic circles to policy thinktanks, from big industry to national authorities, a wide set of stakeholders need to work together to create public value in response to grand challenges.
   Pilots should cultivate the engagement of a variety of partners and associates, both on mission-oriented programs and in their transversal activities.
f. Go beyond re-risking innovation, to sharing risk and rewards. This means building a portfolio of low-risk to high-risk programs, and ways to demonstrate the value created from all of them for the citizen.
   Pilots should feature both high-risk and low-risk programs, across a range of technology readiness levels. Its roadmap links technical results with societal expectations.

The four operational capabilities listed above are cornerstones of mission-oriented research and innovation programs. Because they are perceived as the main locus of power, their implementations are usually at the centre of discussions in policy circles and governance thinktanks. But it is also worth noting, as Kattel and Mazzucato in "*Mission-oriented innovation policy and dynamic capabilities in the public sector*", that two additional concepts of have emerged recently in modern mission-oriented policies.

"Mission-oriented innovation policy and dynamic capabilities in the public sector", Kattel, and Mazzucato

Industrial and Corporate Change, Volume 27, Issue 5, October 2018, Pages 787–801,

https://doi.org/10.1093/icc/dty032

Published: 19 September 2018

The first new concept is that mission-oriented policies should strive to re-focus their objectives, from fixing innovation failures and levelling the playing field, to selectively raising the quality of innovation and tilting the playing field towards new directions.

> *As argued already by Nelson (1959) and in particular by Arrow (1962), welfare economics driven market failure approach is good at identifying problems, such as areas with under-investment in R&D, but quite poor guide in identifying areas with the potential highest "social profit". (Nelson 1959: 298)*

Such opinionated leadership from mission-oriented policies creates two effects: first, by increasing expectations around future growth opportunities, it focuses private sector decisions and investments. Second, it creates spill over effects across multiple sectors and entire value chains. Overall, it has the effect of "crowding in" third-party experimentations and innovations around the mission's objectives and expected impact.

Rather than chasing scattered R&D projects across multiple sectors, domains, and applications, SPARTA shall chose to take the lead on four opinionated Programs, and to build links with its Associate to enable spill over effects.

The second new concept is that static innovation systems struggle with the rate of evolution of societal challenges, in particular in the face of widespread digitization and softwarization. This requires a convergence of governance bodies towards dynamic policy toolkits and a fine understanding of technical capabilities, of academic and economic actors and of the inner capacities of innovation governments and organizations. Fortunately, mission-oriented programs appear to be quite successful at overcoming this coordination problem, as long as their modes of governance are able of self-adaptation.

> *The design of a good policy is, to a considerable extent, the design of an organizational structure capable of learning and of adjusting behavior in response to what is learned.*

SPARTA should implement measures to intersect governance and performance actors, especially through its Strategic Direction and Executive Board. Its governance bodies shall implement measures for self-awareness, including an Ethics Committee and internal evaluation mechanisms.

These two emerging concepts are fundamentally critical to the success of the newer grand challenges, less focused on centralized and self-contained topics (defence, nuclear, aerospace) and more geared around societal objectives and a broader ecosystem of actors. More specifically, the current European ecosystem in cybersecurity is currently undoubtedly decentralized, and that cybersecurity has wide-ranging ethical and societal dependencies, making it a posterchild for the latter category.

2.3 On the impact and relevance of public procurement

Pilots within the SU-ICT-03-2018 call, while not directly related to public procurement actions, can arguably learn from the policies of such successful actions, in particular when it comes to spillover effects of research-driven initiatives and large infrastructures. This line of thought was initiated by the Commission in its High-Level Workshop on 22 march 2018, which featured a striking intervention by Dieter Heuer as former Director General of CERN, advocating the value of lightweight governance mechanisms and open cooperation towards shared and ambitious challenges.

It is then interesting to have a look at the impact that the CERN procurement has had over its economic ecosystem. In "*Big Science, Learning and Innovation*", Florio, Giffoni, Giunta, and Sirtori carry out such as study.

"Big Science, Learning and Innovation: Evidence from CERN Procurement", Florio et al.

Departmental Working Papers of Economics - University 'Roma Tre' 0225, Department of Economics.

https://doi.org/10.1093/icc/dty029

Published: 2017

They find that government-funded organization can leverage technological procurement to enact change in their supply chain.

> *Contracts with procuring organisations that require the development of non-routine technologies are likely to cause radical changes in suppliers' activities, challenging them to supply cutting-edge products*

Interestingly, they corroborate Mazzucato's theory on the creation of new markets through disruptive innovation.

> *PPI [public procurement for innovation] is thus likely to lead to radical innovations and lay the foundations for new markets, particularly in areas where market interest is suboptimal owing to high risk and uncertainty*

The authors underscore the mission-oriented aspects of CERN, beyond its function as a laboratory for experimental particle physics.

> *Its mission is not only to study the basic constituents of matter, but also to advance the frontier of technology and maximise the impact of the science, technology and know-how that it produces on industry and the society as a whole*

They argue that science organizations such as CERN are lead-users, i.e., users whose present needs will become prevalent in the market, months or years from then. Therefore, they have a responsibility of seeding the market with next-generation requirements and learning opportunities. Yet beyond these opportunities, it is key to quantify the level and quality of innovation that stems from procurement actions. Here the paper's authors demonstrate that the innovation are closely correlated to the relationship that is established between CERN and its suppliers. Beyond purely market-driven governance, in which simple and quantified transactions require little cooperation, they unequivocally show that the relational governance – required to handle complex knowledge-sharing – also relates positively to innovation and learning outcomes.

> *Actually, the variable Relational is strongly correlated with the development of new technologies and new products, whereas market-type governance is linked to the use of CERN as marketing reference or gaining increased credibility on the market*

Through relational governance, CERN thus influences its suppliers' propensity to innovate, which is in turn associated with increased levels of economic performance.

SPARTA should implement governance instruments for interactions with its ecosystem: one (Friends) that uses SPARTA as a market, and another (Associates) that commit to more complex knowledge-sharing.

2.4 On strategic autonomy and the global competitive landscape

A key concept in the SU-ICT-03-2018 call for proposal appears at the end of the first paragraph of the call: "*[Pilots] should contribute inter alia to achieve the objective of European strategic autonomy*". It is then necessary to build a clear understanding of the meaning of these terms, and of their implication when it come to the scientific and technological landscape.

Here the article "*European Strategic Autonomy: Actors, Issues, Conflicts of Interests*" by Lippert, von Ondarza, and Perthes comes quite helpful. It dissects the notion, at times with an eye towards implications in German politics, but often in a broader context.

"European Strategic Autonomy: Actors, Issues, Conflicts of Interests", Lippert, von Ondarza, and Perthes.

Stiftung Wissenschaft und Politik - Research Paper 4.

https://doi.org/10.18449/2019RP04

Published: March 2019

The authors start by recalling the global context worldwide, and highlighting the multiple emerging threats to the existing rules-based multilateral order. To illustrate their purpose, they underscore that over the past few years, international norms and principles have been explicitly or implicitly called into question – e.g. prohibitions on torture, on the use of force in international relations or on the use of chemical weapons. In the face of these threats, upholding and bolstering rules-based multilateral order clearly represents a key interest in Europe.

From this context follows the definition of strategic autonomy:

> *Fundamentally, we understand strategic autonomy as the ability to set one's own priorities and make one's own decisions in matters of foreign policy and security, together with the institutional, political and material wherewithal to carry these through – in cooperation with third parties, or if need be alone*

Note that this definition encompasses the two cornerstones of innovation policies, capacities ("*institutional, political wherewithal"*) and capabilities ("*material wherewithal*"), as well as the notion of opinionated priorities and decisions discussed in the previous sections.

In contrast, the absence of strategic autonomy implies being a rule-taker, subject to the strategic decisions made by others. Cleary the scope of autonomy encompasses a wide spectrum of activities – and not just defence – and it involves defending its values and interests. Hence autonomy is an objective and not a state of facts; a process, not an absolute condition.

The paper then studies the conditions for strategic autonomy in the framework of the European Union. It discusses the tension that exists in the current political organization between efficiency and action on the one hand, and inclusivity and legitimacy on the other, proposing both an incremental (majority voting) and a transformational (directorate) option to expand European policies to address this tension. While the discussion focuses on Defence and Foreign policies, the authors remark:

> *Given the centrality of economic/technological and monetary power in international politics, they are also central to any internal transformation.*

In addition to efficiency, the authors tackle the issue of leadership, from an understandably (from the perspective of Defence and Foreign policy) French-English-German perspective. They note that:

> *proposals for "re-founding Europe" name central fields of action, capabilities and resources that the EU must establish and develop if it is to become more strategic and autonomous in external policy terms.*

This applies, in particular, to:

> *private and public investment in research, new technologies and the strengthening of innovation and competitiveness*

and, quite interestingly, a leading role in international climate policy – i.e., a societal grand challenge as discussed in the previous sections. This leadership would lead to a robustification of international relations (and in particular transatlantic relations) in the medium term, as Member States assume greater financial and operational responsibility. However, the authors underline differences in approaches, as some Member States press for exclusivity and capacity to act while others look more to inclusivity and legitimacy, looping back to the matter of efficiency.

In addition to efficiency and leadership, the authors argue that the third precondition for strategic autonomy is the capacity to act. Here they differentiate two facets: internal and external political legitimacy. The first requires Member States, and perhaps more importantly, European citizen, to recognize the EU's political decisions as "worth supporting". This raises the question of the awareness processes through which these decisions, and their rationale, are communicated.

Pilots should implement mechanisms to contribute to citizen and local engagement. SPARTA shall carry out monthly meetings in Member States, discussing innovation challenges and research priorities. Its dissemination and awareness committee shall be active across the EU, and in particular it is starting to reach out to the EU's Outermost Regions.

When it comes to the external dimension "the desire to strengthen strategic autonomy is bound up with the EU's legitimacy as an international actor". The authors note that part of this legitimacy is tied to its promotion of the principles of peace, human rights, democracy and the rule of law:

> *Strategic autonomisation must therefore also be dedicated to realising these goals and values; to that extent it is a means to an end.*

From the identification of preconditions to strategic autonomy, the authors then shift into potential areas of action, and the identification of instruments, capabilities, and resources for each of these areas. They cover topics including collective defence, diplomacy and intelligence, sanctions, arms control, international organizations, energy, and monetary union. In the area of trade and the single market, they note:

> *the strongest power resources Europe places on the international scales are its economic and technological weight and its single market. Greater strategic autonomy requires not only that these resources be preserved, but also that the question be addressed of how Europe can become more action- and conflict-ready not least in the monetary and financial sphere*

Technology is also identified as an area of action, as the authors affirm that Europe "possesses known strengths in fields such as pure research and applied industrial technology", but that it faces difficulties when it comes to generating "rapid innovation-driven growth". The ruthless international competition, in particular with China and the United states

> *makes the focus on invention and innovation all the more important, where technological capabilities form the basis for creating global influence and reducing dependencies*

In particular they note that

> *Europe can only influence standardisation processes and technology utilisation if it possesses the necessary knowledge and relevant research and manufacturing capacity.*

The authors cite examples such as the new 5G cellular network standard, artificial intelligence, and robotics/autonomous systems.

(Interestingly, while cybersecurity is not directly mentioned here, it appears under the area of arms controls. This can be interpreted as a willingness by the authors to view cybersecurity technology more from a cyberdefense perspective, and only marginal consideration for its civilian usage – an understandable hypothesis given the scope of this work.)

Finally this work offers several items for conclusion, with the following being most relevant in the context of SU-ICT-03-2018. Foremost:

> *A shift towards greater European strategic autonomy is necessary, in order to participate in shaping the international environment on the basis of European values and interests, rather than accepting a role as the recipient of strategic decisions made by others.*

This general position of European strategic autonomy within the current international environment is accompanied by an impetus to act quickly:

> *A shift towards greater strategic autonomy is a matter of urgency, because Europe is already having to assert itself in a new multipolar international constellation today.*

And in particular, the article notes that other international actors are already in movement on topics of strategic autonomy, and that they "will not wait until Europe has its internal act together". And while Member States can only achieve strategic autonomy in concert with their European partners, the authors commend:

> *A development towards greater strategic autonomy is possible because the EU already exists and represents the most suitable framework for Europe to pursue such a path.*

The article recommends to use opportunities in the 2019/2020 timeframe to produce concrete developments on key decisions for strategic autonomy, noting in particular that:

> *The negotiations about the Multiannual Financial Framework offer a possibility to match spending priorities and funding criteria to the requirements of strategic autonomy.*

Overall the SPARTA pilot should operate mission-oriented innovation Programs and Activities, in the cybersecurity domain, to support the objective of European strategic autonomy as defined above. In addition to technological capabilities, it shall aims at contributing innovation policies and governance structures to the capacities of the European Union. SPARTA should strive to build on core European values of peace, human rights, democracy and rule of law; it could also suggest key instruments in the preservation and advancement of these values.

2.5 Assessment of full potential

This synthetic state-of-the-art in cybersecurity governance bring together a clear understanding of the typology of innovation frameworks, key elements of mission-oriented innovation policies, an analysis of the impact of large-scale innovation instruments, and a better understanding of the scope, instruments, and potential impacts of European strategic autonomy. It underscores the potential that can be achieved by bringing together a diversity of actors around cybersecurity missions, tied to societal grand challenges, with opinionated objectives and the ambition to produce radical innovation, with the help of efficient leadership and dynamic governance structures.

The task at hand is immense: Europe's innovation ecosystem needs to compete with a wide variety of approaches, and a slew of well-funded actors (see Figure 1). It will be able to build on strong European values, to rely on recognized research capabilities and a rich internal market, and a commitment by the European Commission to support multiple innovation levels, from basic science to translational research and industrial applications.

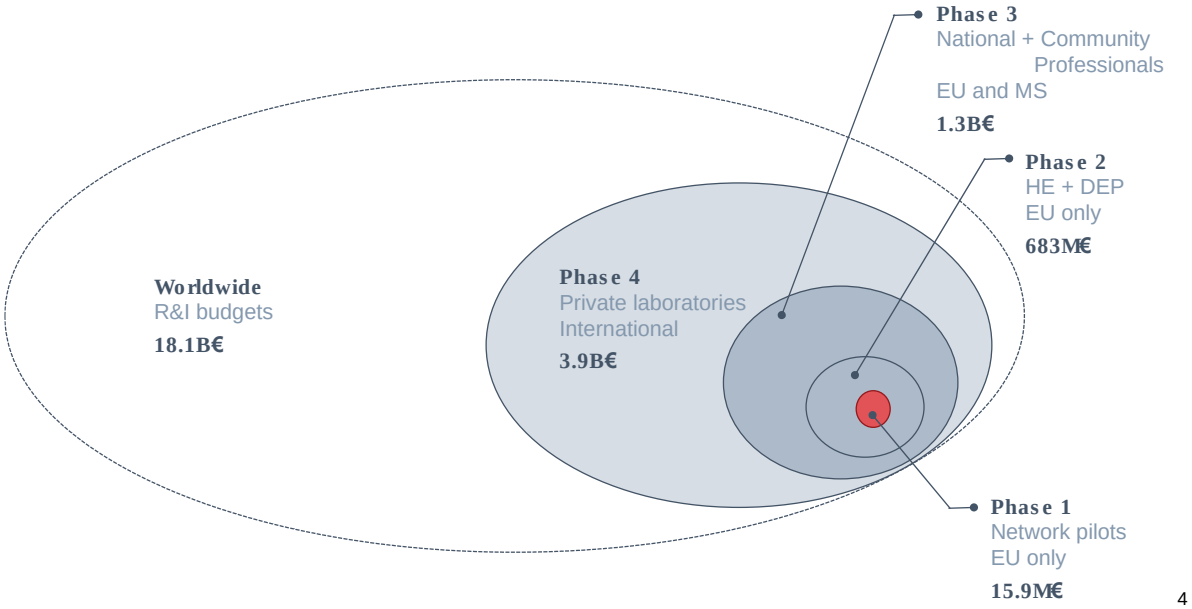

Figure 1: Estimate of yearly cybersecurity R&I investments (2019)

SPARTA's governance endeavour is, in itself, an exercise in risk-taking. The internal implementation of bodies and procedures can raise difficulties or lead to undesirable effects, and its status as an

[4] Sources: US FY2019 federal cybersecurity R&D strategic plan implementation roadmap; ENISA consultation paper - EU ICT industrial policy: breaking the cycle of failure; Proposal for a regulation of the European parliament and of the council 2018/0328

H2020 Research and Innovation Action might not be sufficient to shield the pilots from external influences, despite the strong support provided by both its partners and its sponsors. Yet as SPARTA completes the initial stretch of its run, the following Sections show how it now comes equipped not only with functioning structures, but – we believe quite importantly – with built-in processes for self-awareness.

From these elements, the emergence of the SPARTA network of competence centres focused on disruptive innovation holds a tremendous potential for a greater European strategic autonomy. Because it is designed to build efficient relationships across the European cybersecurity ecosystem, it will be instrumental in tilting the technological field toward the emergence of new markets, helping lead private investments in areas where public funds can demonstrate interesting risk-reward trade-offs and guide high-value learning and transfer.

Chapter 3 SPARTA Instruments

The initial SPARTA proposal identified three governance Instruments[5] that were needed in order to create a culture where the pursuit of transformative opportunities and strong international collaboration are thriving: a Roadmap Instrument, which included an Associate subpart, a Program Instrument, and a Governance Instrument.

The execution of the pilot has yielded a slightly different governance structure: while Roadmap and Programs remained as core Instruments, Associates grew in importance and became the Partnership Instrument. As for the Governance Instrument, it is now better categorized as an Enabler, and presented in Chapter 4.

3.1 The Roadmap Instrument

3.1.1 Governance: balancing strategic goals and adaptation to changes

3.1.1.1 The purpose of the SPARTA roadmap

The purpose of the SPARTA roadmap is to provide European decision makers and the European Commission in particular with mission-driven, strategic guidance for defining future projects and investments in cyber security. The objective is to close the cyber-skill gaps and prepare for future challenges, in both research, education and certification. The roadmap helps to develop mid-long term vision on cybersecurity related issues to cover emerging challenges, in alignment with the EC strategy for Horizon Europe.

The roadmap operates on several levels:

- the **mission** of SPARTA (e.g., "securing the EU digital society"),
- the mission is structured into mission projects, in SPARTA these are called **Programs** (e.g., security of quantum information technology)**,**
- the **scientific challenges** of each Program, that can be translated into a set of specific tasks with clearly identified, verifiable goals (e.g., post-quantum cryptography).

A list of "Grand Challenges" has been laid out by the commission of the EU (see https://ec.europa.eu/info/news/commission-launches-work-major-research-and-innovation-missions-cancer-climate-oceans-and-soil-2019-jul-04_en). These "Grand Challenges" are taken as external input to the roadmap of SPARTA.

The roadmap is being based on a clearly stated mission to be achieved. A mission should thus fill the gap between the Grand Challenges (e.g., the 17 Sustainable Development Goals, Societal Challenges, etc.) and concrete scientific and technological challenges. The mission of the SPARTA network is defined taking into account existing EU priorities such those currently being formulated e.g. by ECSO for Horizon Europe and the Digital Europe Programme.

The mission of SPARTA is being defined to meet the following objectives:

- to build a secure digital society in Europe,
- to ensure European cybersecurity autonomy,
- to establish a trusted digital single market.

The final mission of SPARTA has still to be formulated. We list these three options because they have been stated by member partners, but they are provided as a basis for the discussion.

[5] Section 1.3.2, Strategic Programs for Advanced Research and Technology in Europe, Proposal ID 830892

From this mission statement, we then identify a number of Programs that, when achieved and put together, will provide a way of accomplishing the mission. A Program has a clearly defined scientific and technological challenge and is divided into tasks for solving this challenge. Each Program will achieve a number of scientific objectives. In this way, a mission provides the means to focus R&I and investments on solving critical problems.

The existing SPARTA Programs are:

- Cyber threat awareness,
- Continuous security assessment,
- Intelligent infrastructures,
- Secure and reliable AI.

They come with a clearly identified research agenda, whose solution will contribute to the overall SPARTA mission. These Programs are however only part of the whole picture and will be complemented by future Programs that address complementary issues, including:

- next-generation architectures,
- network infrastructure, and
- quantum communication and computation among others.

Identification of new Programs is part of the SPARTA Roadmap process presented below.

Each of the existing SPARTA Programs has its own specific roadmap, defining tasks in terms of research, education and certification, and a timeline for achieving these tasks.

3.1.1.2 The SPARTA Roadmap process

The SPARTA Roadmap design process is intended to be *agile*, considering emerging trends and technologies, and *open*, considering ongoing workshops and consultations with partners and associates in all partner countries. The design of the SPARTA Roadmap is led by the Roadmap Committee (see Section 3.1.3). The role of the SPARTA Roadmap Committee is to coordinate, discuss, analyse and provide feed-back on the input from workshops and consultations.

The roadmap will be structured in accordance with the JRC taxonomy. Its evolution will involve both monitoring EU and national initiatives and projects, and horizon scanning for emerging cybersecurity challenges. Important elements of the roadmap process are:

- defining the SPARTA mission,
- identifying new Programs and scientific challenges,
- reviewing and revising the SPARTA roadmap.

The tools used in the roadmap process include:

- workshop with associate partners,
- the SPARTA challenge form, reproduced in 0.

3.1.1.3 Defining the SPARTA mission

The SPARTA network should be guided by one, clearly stated mission. This mission should be defined taking inspiration from some of societal grand challenges facing our world, such as cancer, climate change, healthy oceans, climate-neutral cities and healthy soil and food. Such a list of challenges has been laid out by the commission of the EU, as described in the document on major research and innovation missions (see https://ec.europa.eu/info/news/commission-launches-work-major-research-and-innovation-missions-cancer-climate-oceans-and-soil-2019-jul-04_en).

3.1.1.4 Identifying the Programs needed to accomplish the SPARTA mission

Experiences from previous missions, such as the “Man-on-the-Moon” missions, underline the value of combining a clearly stated overall goal, defined top-down, with bottom-up experimentation to

contribute to the overall success. This is also visible from the priorities extracted from the state-of-the-art in Chapter 2.The SPARTA Roadmap is being established through a mixture of a bottom-up and a top-down approach. The division of the SPARTA mission will be defined in a top-down manner but will be based on input from the whole network, in a way similar to how the initial SPARTA Roadmap was defined[6].

3.1.1.5 Identifying scientific/educational challenges to implement a Program

The implementation of a SPARTA Program will be done by addressing and solving specific scientific and technological challenges. These challenges will be identified in a bottom-up fashion, using the expertise of the partners of the network. In addition, the associates of the network will be invited to provide new or updated challenges, reviewed and integrated by the Roadmap Committee. This part of the process will rely on the Associate Partners workshops, as described in Section 3.1.1.7.1.

3.1.1.6 Roadmap review and revision

The SPARTA Roadmap will be established through an iterative process that reviews and integrates the existing roadmap with respect to novel input from partners and associates. A roadmap iteration involves the following sequence of steps:

1. Internal discussion in the SPARTA network of Programs and scientific challenges. This process is initiated and supervised by the Roadmap Committee.
2. Discussion with Associates in specially organised brain-storming workshops (described in Section 3.1.1.7.1)
3. Aligning the roadmap process between network pilots. Each of the four cybersecurity network pilots develops their individual roadmap. This step is intended to identify complementarity as well as synergies between these roadmaps in order to provide a coherent proposal to communicate to decision makers.

The SPARTA Roadmap is thus a living document that will be updated periodically throughout the duration of the project considering the latest technical, educational and societal) developments, as well as identification of emerging Programs.

3.1.1.7 Instruments of the SPARTA Roadmap process

3.1.1.7.1 The workshops with SPARTA Associates

The organisers of associates workshops are encouraged to present the SPARTA Roadmap during the workshop have the audience react to it. The sessions shall include:

- feedback to existing Programs;
- brain-storming to identify emerging Programs.

The organisers are invited to keep

- minutes of the discussion that are to be shared with the Program committee;
- and identify interesting information that may lead to new SPARTA challenge/feedbacks.

It is key to note that the elements collected from these workshops might contain sensitive information, both separately or in aggregate. They shall be treated with the appropriate level of confidentiality.

3.1.1.7.2 The SPARTA challenge/feedback form

Feedback to the roadmap and identification of emerging challenges shall be formalized in a "SPARTA challenge/feedback form", which may be updated/complemented over-time. This will be primarily used by Program committee to discuss updates to the roadmap, and keep track of the feedback provided. It shall include:

[6] Initial SPARTA SRIA (Roadmap v0.1), SPARTA deliverable D3.1, July 2019.

- description feedback/emerging challenge
- submitter info (to get more info, and provide info on the status)
- responsible Program committee
- status (i.e. integrated, rejected, in-progress)

There will be an online form that is continuously available to allow stakeholders to provide feedback to the roadmap, or identify emerging challenges/Programs. In addition, results from a SPARTA Associate workshop (see Section 3.1.1.7.1) may provide basis for a SPARTA challenge/feedback form.

3.1.2 Scope and objectives in current time horizon

A unified timeline of the SPARTA Roadmap is being kept to provide a general overview from a birds-eye perspective. The timeline combines the dimensions *technology*, *education*, and *certification* and aligns SPARTA's short- and midterm goals with these domains. The short- and midterm goals consider a timeline until the official end of SPARTA.

Further, the timeline includes the project's as well as long term goals that go beyond SPARTA and is designed to be pursued after the pilot period (as a H2020 project) ends. The goals are based upon the comprehensive feedback provided by SPARTA Programs and work package leads. Besides, the timeline further includes emerging challenges that base upon the 60 initial challenges and have been identified by the pilot's partners. Figure 2 describes the timeline with final goals, establishing a long-term overview of the SPARTA Roadmap. It also shows a timeline with transitions as dependencies between stages that are envisioned as milestones during the work on achieving the final goals. The stages that are expected to be achieved during the development of SPARTA pilot are shown for each year and at the end, the final goal is displayed.

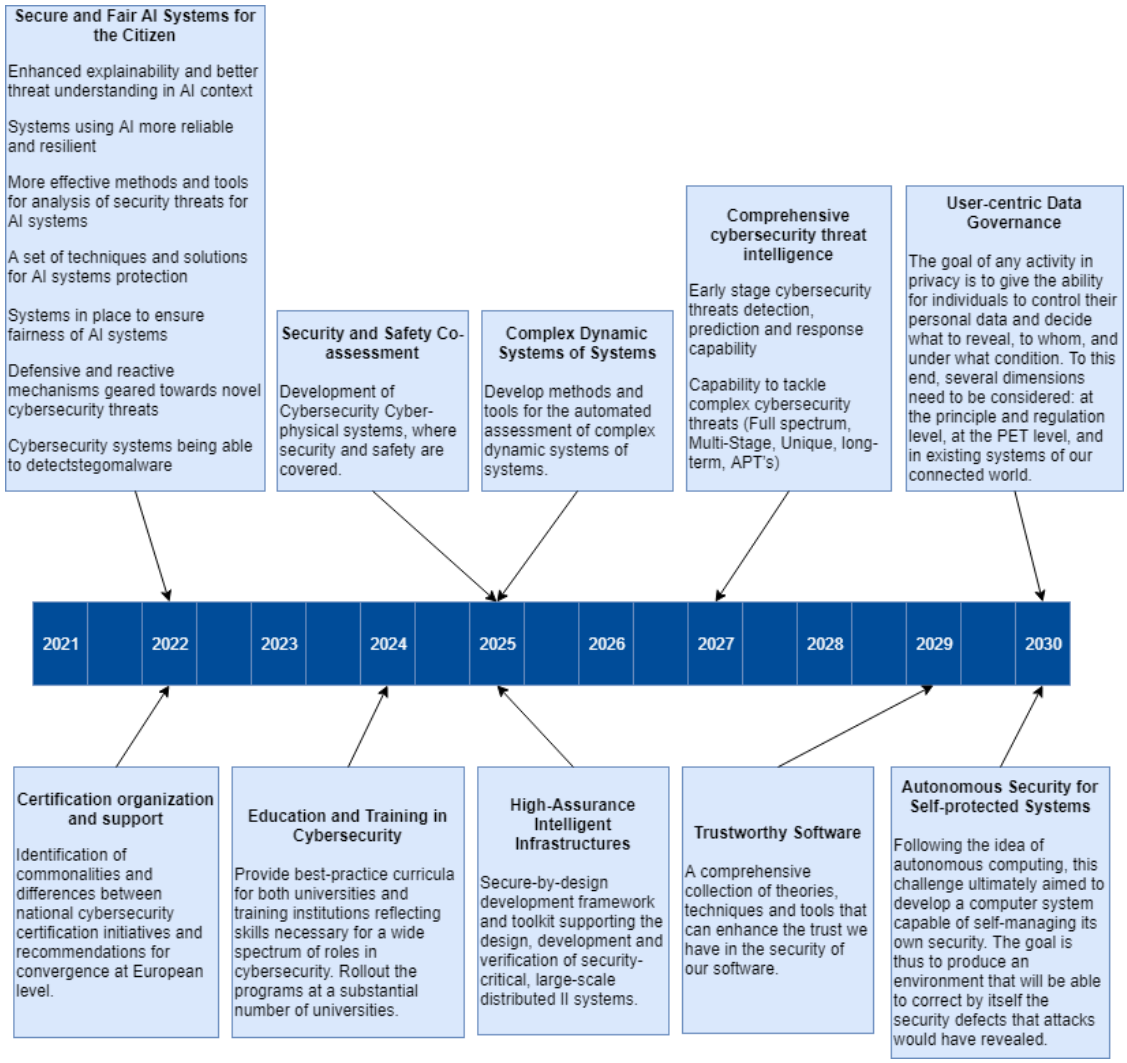

Figure 2: SPARTA Roadmap with the final goals of solving the identified challenges

3.1.3 Roadmap Committee

SPARTA's Roadmap Committee is constructed of:

- Roadmapping task leaders;
- Program leaders and representatives;
- Activity leaders and representatives, in particular for Partnerships, Exploitation, and Dissemination; as well as
- SPARTA's Strategic and Executive Directors.

The Committee provides a 360 degree view on the discussions and the development of the roadmap, including top-down and bottom-up integrated approaches, and contributes to identify potential new missions and challenges.

An ongoing question is – should it be organized as more multistage approach introducing also lower level similar type of governing structures in order to maintain more expert level governance and decision-making process on the road mapping?

3.1.4 Interfaces

Interfaces to various SPARTA groups and to external stakeholders are organized on the following levels:

- **Program Challenges,** long-term challenges identified from and related to the four Programs currently running in SPARTA. While these challenges and their final goals are based on the four Programs, they are not limited to the research plans for the SPARTA pilot period. Instead, they show a broader description and possible timeline of missions that would be important to complete as part of long-term initiatives (also called Moonshots).
- **Transversal Challenges** covering "cybersecurity training and awareness" and "certification organization and support". These challenges are also based on the SPARTA Activities (not its Programs), but also give a broader picture of goals that the Activity Leaders found important for the EU.
- **Moonshot Challenges**, are an additional instrument for providing the inputs to the SPARTA roadmap, produced by either the SPARTA Programs or the SPARTA Activities. It serves as focused description of disruptive topics that can influence most mid- and long-term future EU cybersecurity and demanding for strategic planning on all levels of the European cybersecurity ecosystem.

3.1.5 Lessons learnt and recommendations

The first year of activity has highlighted the need for two-way collaboration with SPARTA Partners and Associates. Currently Roadmap activities are starting to operate as an efficient interface the SPARTA pilot, extracting knowledge and delivering it to the various SPARTA Associates and stakeholders working on cybersecurity challenges, future developments, and existing gaps and roadblocks[7].

However, for the success of SPARTA's priorities and future development, the implementation of a feedback loop in the opposite direction of the information flow is mandatory. This should complement the collection of challenges from the Associates Workshop, and account for other strategic roadmapping efforts performed outside of SPARTA. The coming months will work to strengthen the mechanism to ensure that information about parallel initiatives, strategic decisions made, and other developments not known or not directly in the reach of the SPARTA Partners reach roadmap developers in timely and efficient fashion.

[7] See for instance "1st Workshop with Member States about Research and Deployment Priorities and Joint Actions in the context of the Commission proposal for a Cyber Security Competence Centre and Network", 29/11/2019

3.2 The Partnership Instrument

3.2.1 Governance

The SPARTA pilot network consists of 44 core partners. This seems to be an optimal size w.r.t. manageability and creation of the critical mass to achieve its objectives. One of the main goals being community building, in particular to meet the priorities extracted from the state-of-the-art, it is useful to also consider other forms of involvement in the pilot network, accounting with different levels of commitment and trust.

The SPARTA Partnership Instrument supports this construction, and provide tools to bring together people and infrastructure, in an effort to create a vibrant competence network in the field of cyber security:

- In addition to the 44 partners, SPARTA is building a community of Associates and Friends (see Section 3.2.6) willing to work together in the interest of the European Cyber Security community.
- This network and its extended community also need cooperation and common working tools, represented by the Joint Competence Centre Infrastructure JCCI.

This will support the creation of a wider research and innovation community, strongly linked to the pilot networks.

3.2.2 Scope and objectives in current time horizon

The objective of the Partnership during the first year was to bootstrap the creation of the Associate and Friends communities, to setup the SPARTA monthly workshops, to specify the JCCI, and to support building relationships with all the relevant projects. All these aspects have been covered (although not all with the same degree of coverage).

3.2.3 Partnership Committee

The committee consists of the following members:

- The Partnership is managed by a Committee chaired by the Partnership Director (CNR).
- CEA as SPARTA coordinator is part of this committee.
- All the partners with formal effort in the WP8 (Partnership Activity) are part of this committee.
- The leaders of the 4 Programs are part of this committee in order to ensure that the JCCI can host the tools developed in the Programs.

The committee meets at least twice per year. The committee looks at consensus building, in the case a formal vote is necessary a 2/3 majority rule applies.

For matters related to Associates selection, a sub-committee is established and consists of CEA and CNR.

3.2.4 Associates Council

In order to allow the participation of SPARTA Associates and Friends to the activities an “Associates Council” is set up, where all the Associates and Friends have an opportunity to meet and cooperate with SPARTA, proposing new ideas in a collective manner.

In the initial phase of the network, Associates and Friends will be selected by the Partnership Committee based on the needs of the network as well as the expression of interest of organizations in Europe.

The Council has a representative for each Associate or Friend (if not otherwise stated the point of contact).

The Council has a steering committee made of 5 representatives (either associates or friends). The Council and its steering committee is chaired by CNR.

The Council looks for consensus based decisions. When a vote is required, a 2/3 majority of the present members is enough.

The council meets at least one per year after the bootstrapping phase.

3.2.5 Collaboration framework

The SPARTA Partnership Instrument contributes to the national, European and international clustering activities. Of specific relevance are coordination efforts with the other 3 pilot Networks, ECSO, and EU stakeholders, described as part of D8.1[8].

3.2.6 Levels of commitment

Associate partners are granted the following benefits:

- Events:
  - Associate partners are allowed to attend SPARTA Days and Workshops.
  - Associate partners are allowed to attend SPARTA meeting upon invitation from Coordinator
  - Associate partners will be to access the training and education facilities at privileged conditions.
- Roadmap and Programs
  - Associate partners can provide inputs to the Roadmap
  - Associate partners are entitled to receive early information on Roadmap outputs
  - Associate partners can provide contributions to the Programs
  - Associate partners are entitled to receive early information on Program outputs
- Communication:
  - Associate partners logos will appear on the SPARTA web site
  - Associate partners will be featured on the SPARTA social media
  - Associate partners are invited to use the SPARTA Associates logo
  - Associate partners will be included in the appropriate SPARTA mailing lists upon request.
- JCCI:
  - Associate partners will be granted access to the project collaboration platform and the SPARTA Web Portal (based on certain conditions)

Duties for Associate partners:

- Associate partners can actively participate into the Programs and Activities of SPARTA.
- When requested, sign a Non-Disclosure Agreement (NDA) for seeing confidential information of the SPARTA partners or of other associated partners.
- Associate partners are required to deliver reports documenting their involvement in the SPARTA activities in which they participate.
- Associate partners should acknowledge the SPARTA project if they receive funding for those activities.
- Associate partners need to produce original invoices/receipts when claiming for the refund (the actual reimbursement method will be defined for each partner).
- Associated partners should in any case not harm the SPARTA consortium partners with their activities.

SPARTA might provide a symbolic funding for associate partners, for reimbursement for travel and accommodations expenses, in attendance of the SPARTA monthly workshops. The travel must be eventually approved by the project coordinator.

Similarly for Friends, benefits include:

- Events:

[8] Section 3.3., “Initial results of the clustering, platforms, and ecosystems activities”, D8.1, 2020

  - SPARTA Friends are allowed to attend SPARTA Days.
  - SPARTA Friends are allowed to attend SPARTA Workshops upon invitation from Coordinator
- Roadmap and Programs
  - SPARTA Friends can provide inputs to the Roadmap
  - SPARTA Friends are entitled to receive late information on Roadmap outputs
  - SPARTA Friends are entitled to receive late information on Programs outputs
- Communication:
  - SPARTA Friends logo will appear in the main Sparta web site (Sparta.eu)
  - SPARTA Friends are invited to use the SPARTA Friends logo
  - SPARTA Friends will be included in the appropriate SPARTA mailing lists upon request.
- JCCI:
  - SPARTA Friends will be granted access to the project collaboration platform and the SPARTA Web Portal based on general conditions

Duties for SPARTA Friends:

- When requested, sign a Non-Disclosure Agreement (NDA) for seeing confidential information of the SPARTA partners or of other SPARTA Friends.
- SPARTA Friends are required to deliver reports documenting their involvement in the SPARTA activities in which they participate.
- SPARTA Friends should acknowledge the SPARTA project if they receive funding for those activities.
- SPARTA Friends need to produce original invoices/receipts when claiming for the refund (the actual reimbursement method will be defined for each partner).
- SPARTA Friends should in any case not harm the SPARTA consortium partners with their activities.

3.2.7 Framework for shared resources

SPARTA Associates and Friends can access or contribute to the JCCI (these conditions may vary over time, as we adjust for exploitation and strategic autonomy constraints).

Level	Benefits
Friends	• Receive early access to closed alpha and beta versions of software developed under the Consortium. • Gain insights into applications areas for Consortium-developed software. • Participate in user group discussions with other Consortium members.
Associates	• Receive early access to closed alpha and beta versions of software developed under the Consortium. • Gain insights into applications areas for Consortium-developed software. • Participate in user group discussions with other Consortium members.
Associates that are contributors to the JCCI	• Receive early access to closed alpha and beta versions of software developed under the Consortium. • Gain insights into applications areas for Consortium-developed software. • Participate in user group discussions with other Consortium members. • Receive early access to analysis, case studies and integration studies and deployment learnings. • Receive complimentary access to Consortium-related Best Practices white papers to be generated by SPARTA.
Partners	• Receive early access to closed alpha and beta versions of software developed under the Consortium. • Gain insights into applications areas for Consortium-developed software. • Participate in user group discussions with other Consortium members.

	• Receive knowledge transfer on implementation of the Consortium-developed software by SPARTA. • Voting member on the JCCI. • Receive early access to analysis, case studies and integration studies and deployment learnings. • Receive complimentary access to Consortium-related Best Practices white papers to be generated by SPARTA.

3.3 The Program Instrument

3.3.1 Governance: balancing strategic risk-taking and competition

In a mission-based organization, the roadmap decomposes the targeted innovation into a portfolio of mission projects, running bottom-up experimentations. In the SPARTA network pilot, these mission projects are called *Programs*. An overview of the proposed mechanism for deriving and executing Programs from the roadmap is shown in Figure 3.

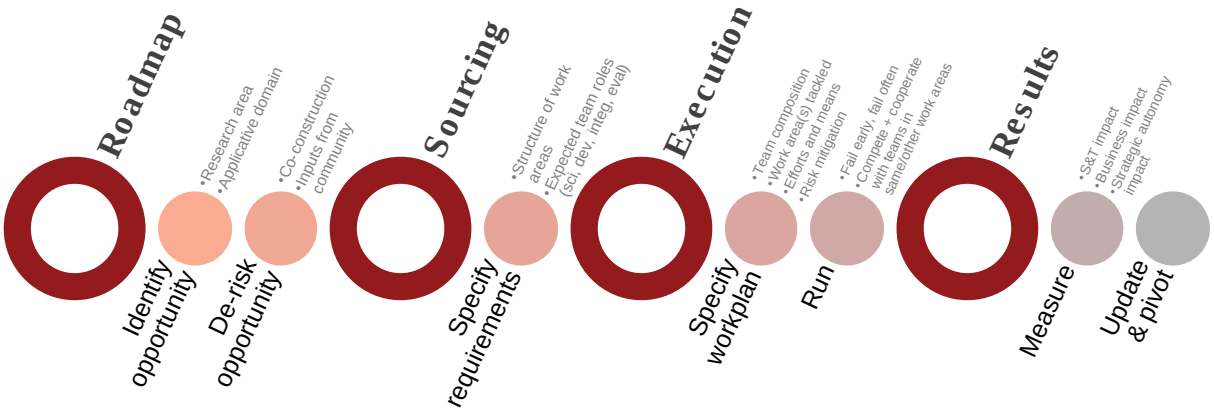

Figure 3: SPARTA's Program derivation mechanism

As part of the SPARTA pilot phase, in the scope of SU-ICT-03-2018, four Programs are executed to demonstrate how research and innovation collaborations take place in the network. Given the constraints of the grant agreement, the identification of the Programs was executed internally to the consortium, prior to submission.

Notwithstanding the constraints of this pilot phase, the general mechanism for defining and executing Programs starts by identifying strands of the roadmap that present opportunities for radical innovation. The identified topics are then matched with a recognized scientific expert from the appropriate domain, who endorses the role of Program Lead. Under their full-time leadership, the Program is executed in the following phases:

1. **Preliminary analysis**: from a roadmap strand, a research and innovation topic is identified, along with detailed research areas and application domains in vertical and horizontal industries. Already at this early stage, diversity is encouraged through multi-disciplinarity, geographical variety, and the combination of heterogeneous levels of technological readiness. The topic is de-risked through interactions with the community, and co-construction with Associate Members. From this identification and de-risking, the Program

Lead build an argument for funding the Program and submits it to the network's strategic direction to validate the opportunity to launch a call for proposal.

2. **Call for proposal**: the topic identified is decomposed into work areas and participant roles. Here the diversity detected in the previous phase is articulated into a coherent approach, with well-identified tasks and their respective milestones, progress metrics, and demonstration cases. The expected collaborations between work areas are highlighted, as well as ethical, legal, and societal assessments and contributions, and expected capacity building results. The call is made public and within a few weeks, proposal selection takes place between the Program Lead and the Strategic Direction, under the supervision of the Ethics Committee.
3. **Program execution**: once proposals have been selected, teams start performing under the supervision of the Program Lead. The execution mixes cooperation aspects, for instance between complementary domains, and supervised competition aspects, to allow the exploration of different implementation solutions for key work areas. By following closely on scientific and technical developments, by validating key decisions, and by encouraging out-of-the-box thinking, the Program Lead creates the conditions for constructive competition and controlled risk-taking. In particular, SPARTA Programs implement a "fail early, fail often" philosophy that explicitly rewards negative results as well as positive ones. Concrete progress metrics and milestones, defined in the call for proposal, are monitored and refined all along the Program's execution; progress is consolidated by the Program Lead and reported to the strategic direction. When necessary, efforts are re-distributed between teams, to optimize scientific impact and final capacity building. Execution is supervised for ethical, legal and societal impacts, as well as anticipated or spontaneous developments useful to certification, training, and awareness purposes.
4. **Result analysis**: scientific, technological, and business impacts are regularly reported to the Roadmap Committee and strategic direction, with a focus on the Program's key milestone timings. When appropriate, feedback is collected from Associate Members to enhance the network's evaluation, for instance on spill-over, exploitability issues, and SME impact. Results are used to update the roadmap with confirmed positive or negative results, giving rise to either further developments of successful roadmap strands, or pivoting off of unsuccessful efforts.

3.3.2 R&I&D governance model implementation

The time horizon for the completion of SPARTA's mission is forecast to be 2030, meaning that during the project, concrete foundational work should be established in the scope of continued R&I and experimentation. Figure 4 depicts the tools and processes that support this work in SPARTA.

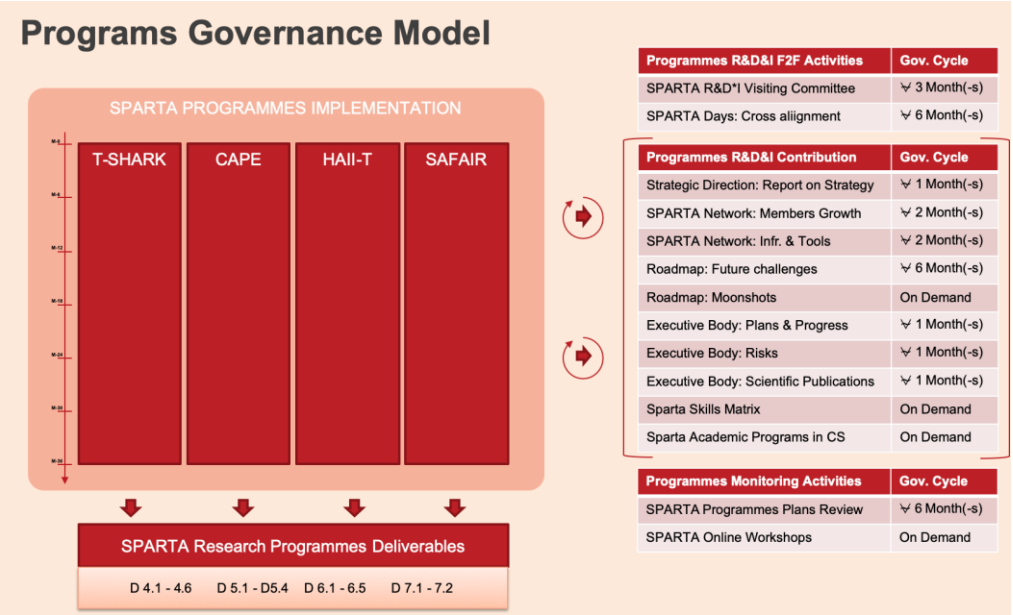

Figure 4: SPARTA Programs governance model

In addition to Milestones and KPIs from the DoA, SPARTA has implemented two governance instruments to coordinate and challenge the Programs:

- SPARTA Meeting
- SPARTA Program Visiting Committee

3.3.3 SPARTA Meetings

SPARTA organizes internal events called SPARTA Meetings, twice a year, regrouping all project members across all Activities and Programs. These meetings feature:

- Program and Activity working sessions, organized by the Program / Activity Leads, encouraging bottom-up transversal collaborations.
- Interventions by invited speakers in internal all-hands meetings. A key intervention at the September 2019 SPARTA Meeting featured researchers from the CANVAS project[9] on "Ethics and value-driven cybersecurity".
- In some cases, open-public SPARTA Days

3.3.4 Program Visiting Committee

The main purpose of the Program Visiting Committee is to ensure continuous strategic alignment and coordination between SPARTA Programs as well between Programs and other Community activities (training and awareness, partnerships) and Exploitation activities (certification, exploitation, dissemination).

The Program Visiting Committee is structured only from SPARTA key representatives and has the following geometry:

- Coordinator representative
- Chairman of the Strategic Direction
- Chairman of the Roadmap Committee
- Chairman of the JCCI Group
- 4 Program Leads

[9] "Constructing an Alliance for Value-driven Cyber-security", Grant Agreement No 700540, https://canvas-project.eu

For individual sessions and activities, additional experts are invited on the demand.

The role of the Program Visiting Committee is focused on facilitating internal and external SPARTA collaborative actions among performers.

Key functions are advising on:

- Strategic research decisions, key strategic orientations for R&I including expected impacts, cross-sector (cross-Program) issues and required intervention areas.
- Identification and updates of new / existing Program Challenges and Moonshot Challenges.
- Identification of impactful external cooperation, facilitation of contacts to related national and international research programs.
- Evaluation of the balance between research and innovation.
- Integration of Social Sciences and Humanities with Key Enabling Technologies.
- Strategic value chain and priorities for dissemination and exploitation.
- Development of proposals for enhancements and actions to maximise the impact of the Program results.
- Support the development of market and business cases and models based on the integrated outcomes of the Program's deliverables.
- Knowledge that is generated from the Program and can be channelled into other SPARTA Activities.

The Program visiting committee is organized on quarterly based visiting selected SPARTA Programs. It is planned to be organized in synchrony with other WP's face-to-face meetings, workshops and activities in order to optimize travel and related costs as well to increase impact of the actions.

3.3.5 Synergies between Programs

We monitor potential synergies and communalities between SPARTA's four ongoing Programs. It is hard to identify them given the early stage of these developments. More concrete, technical attributed can be defined in later stages as well as cross-integrated experimentation activities – when the solutions will reach higher maturity level.

For early stage, it is identified that synergies can be defined in the following perspectives:

- Integrating Program use cases. Even though each Program addresses a specific challenge in SPARTA's overall mission, sharing use cases strongly increases their impact.
- Exchanging and sharing data sets. Data sets for the experimentation and successful innovation is hard to get access to, especially in the fields of security.

3.3.6 Interaction with external actors and environment

Interactions with the external world are organized on several levels:

- At SPARTA level, based on the SPARTA partnership model (Associates and Friends complementing the 44 SPARTA partners) described in Section 3.2.
- Inclusion in SPARTA can be achieved via common R&I environments: common innovation labs and technical collaboration environments as foreseen in the JCCI.
- Some of the Programs have chosen to implement their own collaboration schemas implemented. As good example here is the T-Shark Arbitrage Group.

3.3.7 Lessons learnt and recommendations

- Enablement of EU level R&I integrated initiatives is possible only by having access to experimental raw data. Currently market fragmentation, regulatory framework and confidentiality demands (or typical practices) of end-users limits very much any larger scale cyber security development with practical experimentation attributes.
- Common technical standards and collaboration space must be implemented in prior to other activities to reach higher potential of re-use between initiatives inside the mission. This is an

ongoing action, with for example technical standards being defined for cyber-range experiments.

Chapter 4 SPARTA Enablers

4.1 Governance and Management Activities

4.1.1 Governance System and Components

SPARTA's governance ties together the Instruments and supports the network's research and innovation activities (see Figure 5: SPARTA's organizational structure). SPARTA's governance structure recognizes leadership and diversity as powerful principles, and instantiates them in the following organs:

- The **Strategic Direction**, let by the Strategic Director, coordinates the governance; it performs the initial interface between external policy-making, research-performing, and third-party entities and SPARTA's internal bodies, and sets up delegated interfaces with the help of the Executive Board. The Strategic Direction is in charge of elaborating strategic analyses and decisions that pertain to the network. It coordinates with the Executive Board to ensure proper tactical implementation of these decisions.
- The **Executive Board**, headed by the Executive Director, supervises the execution of the network's missions and assigns roles in the organization to ensure it stays true to its core principles. It validates the research programs based on the roadmap and on strategic priorities. It coordinates the Program Leads, monitoring progress and risks, incentivizing collaborations both within and across Programs. The Executive Board monitors the progress of the Roadmap and of the Partnerships, and ensures the Taskforces are being fully associated.
- The **Roadmap Committee**, headed by the SPARTA Scientific Director, is in charge of the Roadmap. It proposes the Program Leads to the Strategic Direction, based on strands of interest in the Roadmap, and assists them in extracting Programs from the Roadmap. Program Leads combine a recognized scientific and technical expertise in this strand, with an open-minded approach to problem solving, allowing them to evaluate promising concepts regardless of their field of origin.
- The **Partnership Committee**, led by the Partnership Director, handles the design and maintenance of the network's partnerships, including the Associates Council. It sets ups space, time, and means to enable research collaborations, leveraging the strengths of existing structures and organizations. As such, it takes the operational lead in the organization of the SPARTA workshops, supported by the Taskforces and the Associate Partners. It also creates and updates the map of platforms and infrastructures – pivotal in focusing data, software and expertise resources – based on a rigorous evaluation of the provided human, physical, digital, and virtual capacities; it finally ensures their coordination in serving the interests of European research and innovation teams.
- The **Training and Awareness Taskforce**, under the direction of the Training and Awareness Officer, provides expert inputs on the state-of-the-art, gaps, and advances in the field of cybersecurity skills development. It is instrumental in identifying coherent approaches to a harmonized, European-level cybersecurity training syllabus. It provides insights on the process and tools required in these fields, and helps identify potential areas of the Roadmap and Programs that can be of interest in building these capacities.
- The **Certification Taskforce**, under the direction of the Certification Officer, provides expert inputs on the state-of-the-art, gaps, and advances in the field of cybersecurity certification. It provides insights on the process and tools required in building next-generation certification tools, and helps identify potential areas of the Roadmap and Programs that can be of interest in building these capacities – either directly through progress in evaluation and conformity, or indirectly through advances in the development of specific security functions.
- The **Dissemination Taskforce**, under the direction of the Dissemination Officer, provides communication expertise and tools for the network. It ensures these tools are available across project boundaries, that communication exploits state-of-the-art (in particular digital) mediums

while taking place in full respect of the constraints of the field and its practitioners.

- The **Ethics Committee** addresses the major ethical, legal and societal aspects relevant in the context of large-scale cybersecurity research and innovation in transnational competence networks. It pays particular attention to the topics addressed in the four SPARTA Programs but also investigate the insights' broader relevance for the cybersecurity research and innovation community.

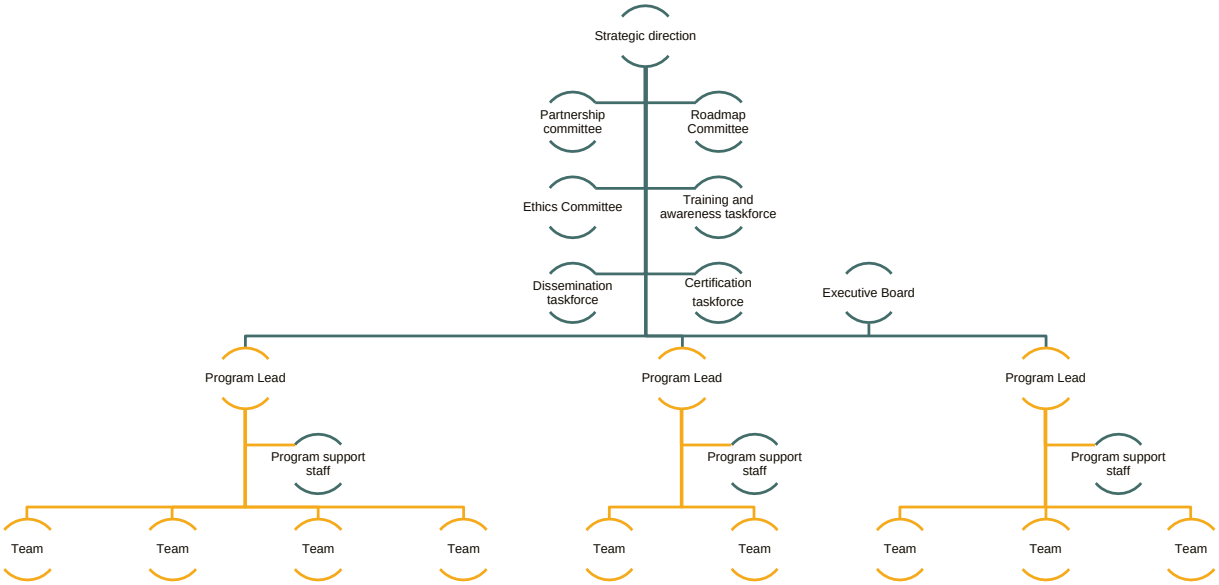

Figure 5: SPARTA's organizational structure

4.1.2 Governance Principles

In addition to formal bodies, the SPARTA governance model is rooted in **concrete, applicable first principles**. These principles structure the SPARTA network, guide conversations, and help navigate complex decisions.

Principle 1 Change the philosophy of risk

The network's Roadmap and Programs will aim at identifying ambitious goals, and implement research towards these goals that produce concrete and actionable results. In doing so, SPARTA is able to investigate new ideas while accurately measuring progress, promoting a "*fail early, fail often*" philosophy. SPARTA aims to recognize the value of negative results that successfully highlight scientific dead-ends and unfeasible technical paths.

Principle 2 Diversity as an asset for innovation

"United in diversity" is the motto of the European Union[10], approved in 2000, and signifies how Europeans have come together, in the form of the EU, to work for peace and prosperity, while at the same time being enriched by the continent's many different cultures, traditions and languages. In a globalized digital world, SPARTA leverages geographic and disciplinary diversity to build knowledge on which to push for a more inclusive, secure and resilient European society.

Principle 3 Create opportunities for open leadership

In a fast-moving field such as cybersecurity, numerous strategic or tactical decisions need to be made efficiently. SPARTA uses these, at all levels of the network, as gender-diverse opportunities for scientists to lead the way for their communities. Such leadership requires a combination of scientific excellence, goal-driven philosophy, open-minded communication, and ethics. It ensures

[10] https://europa.eu/european-union/about-eu/symbols/motto_en

detailed and expert risk monitoring, and as a direct consequence, open additional degrees of freedom in the implementation of research actions.

Principle 4 Recognize horizontal leverage points

SPARTA recognizes the grounding importance of vertical requirement collection, and organization. These foundations are combined with a special attention to cross-domain leverage: reuse is a significant drive in the history of innovation, and it is even more effective in Computer Science where digital artefacts are easier to disseminate and adapt. SPARTA encourages horizontal developments to ensure the efficiency of its investments, maximize their impacts, and optimize their sustainability.

Principle 5 Build digital platforms for forward-looking stakeholder

The turn of the 20th century factory profoundly changed the way we produce technology. Forward-looking companies are anticipating an equivalent shift with digital platforms today. SPARTA develops and connects digital and physical platforms, as well as streamlines their related operational models. These serve as technological bases for innovation, as training facilities for cyber skills development, and more generally as catalysts and force multipliers in the development of cybersecurity capacities and digital autonomy.

By consistently and fairly applying these principles, the SPARTA project will foster the emergence of a thriving research and innovation model, allowing the development of unique innovation strategies, serving operational teams, industrial competitiveness, and supporting European strategic autonomy.

4.1.3 Roles and processes

This section focuses on elements constitutive of the Governance of the project (WP1), i.e. the Strategic Direction and the Executive Board. Other bodies are described in their respective sections below.

4.1.3.1 Strategic Direction

The Strategic Direction (SD) consists of the Coordinator as Strategic Director, chairing all meetings, and of the leaders of the Governance, Ethics, Roadmap, Partnership, Certification, Training, and Dissemination activities, as well as a representative of the Programs. This geometry can change through the course of the project.

Strategic Direction meetings are held monthly using teleconference facilities; up until M12 there has been a plenary meeting of the SD every six months. Minutes of the meetings are kept by a rotating member of the SD, and approved at the next meeting. High-level topics discussed and decided at the SD meetings include:

- Relations with EU entities
- Relations with other pilots
- Relations with Member States
- Key messages
- Upcoming strategic sequences

The following table summarizes the execution of SD meetings.

20 April 2019	Conference call
06 June 6 2019	Conference call
27 June 2019	Conference call
25 July 2019	Conference call
29 August 2019	Conference call

26 September 2019	Plenary
31 October 2019	Conference call
05 December 2019	Conference call
24 February 2020	Plenary

4.1.3.2 Executive Board

The Executive Board (EB) consists of the Coordinator as Executive Director, chairing all meetings, and of the Activity and Program leaders (Governance, Ethics, Roadmap, Partnership, Certification, Training, Exploitations, Dissemination, and the T-SHARK, CAPE, HAII-T, and SAFAIR Programs).

Executive Board meetings are held monthly using teleconference facilities; up until M12 there has been a plenary meeting of the EB every six months. Minutes of the meetings are kept by Project Management leader.

The following table summarizes the execution of EB meetings.

14 May 2019	Conference call
25 June 2019	Conference call
10 July 2019	Conference call
August 2019	Mail
11 September 2019	Conference call
26 September 2019	Plenary
09 October 2019	Conference call
13 November 2019	Conference call
11 December 2019	Conference call
23 January 2020	Plenary + conference call
12 February 2020	Conference call

4.1.4 Assessment and Performance management

In order to guide their analyses, the Governance and Management activities leverage the information collected during the Executive Board, through the Interim Progress Reports, during General Assemblies, and in bottom-up one-on-one discussions.

A key element of the governance of SPARTA is its self-reflective capabilities, implemented through two mechanisms :

1. An independent ELSA effort, supported by an independent workpackage in the DoA (WP2). The milestone engagement of the Ethics Committee, in the context of the first ELSA audit initiative that took place in December 2019, is further described in Section 4.2.1.5.

2. A separate internal governance assessment, conducted independently, and preparing for an external audit in the follow-up phase of the pilot. A remarkable description of the purpose, methodology, and results of the assessment is delivered as D1.2[11].

4.1.4.1 Risk management

In SPARTA, risks identification was done on a monthly basis during the first year as part of the Program and Activity Leaders reporting during monthly Executive Board meetings. It was also performed in a quarterly fashion by Technikon during the quarterly Interim Management reporting. The risks are regrouped and monitored in SPARTA's common document repository and are periodically analysed by both Coordinator and Technikon. A more detailed reporting on risks management is found in deliverable D13.3 "Risk assessment plan", which details the management process and summarizes its execution in the first year of SPARTA.

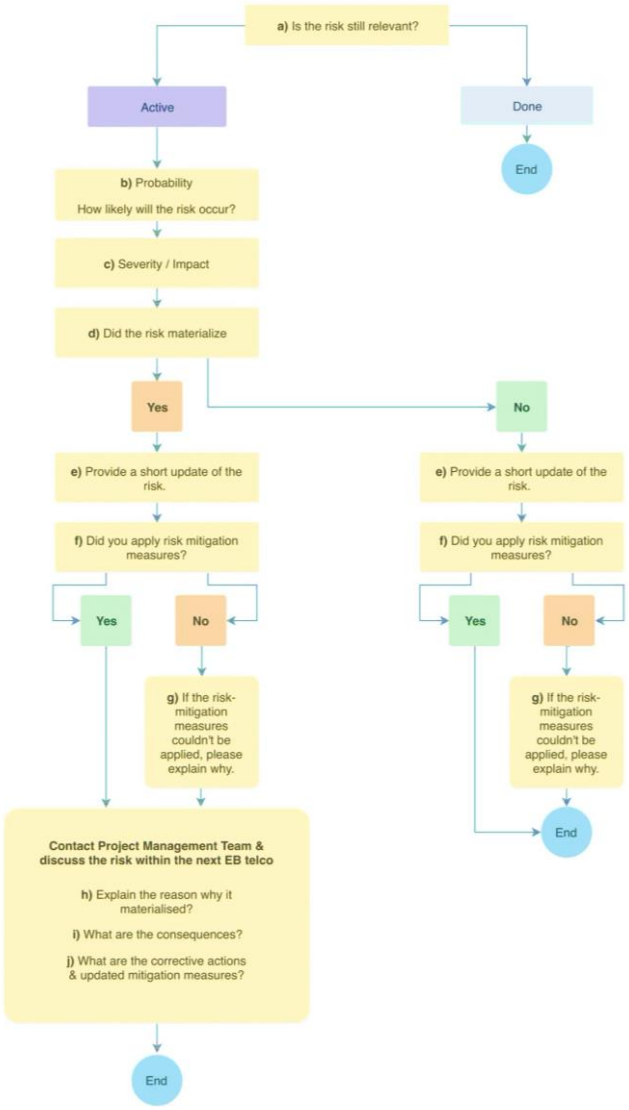

Figure 6: SPARTA Risk Assessment Process

[11] "Lessons learned from internally assessing a CCN pilot", D1.2, 2020

4.1.4.2 Performance indicators and measures

In SPARTA, key performance indicators and measures was performed on a monthly basis during the first year as part of the Program and Activity Leaders reporting during monthly Executive Board meetings.

The following table presents the indicators and measurements monitored at M12 of the pilot phase, followed by key analysis items.

KPI N°	KPI	M12 Objectif	M12 Actual	Comments
Objective 1				
1.1	Governance Structure and decision-making mechanisms defined and implemented before M4 of the project	100%	90%	Associates Council (AC) 90% operational Advisory Board (AB) not yet operational
1.2	# of issues about the governance escalated to the General Assembly	< 3	0	
1.3	Level of satisfaction of the network member (survey - 1-7 Likert scale)	5	-	Will be done soon
Objective 2				
2.1	Quality and sustainability of the roadmap: number of surveys	0		
	# of contributors	20	30-35	
	# of revisions and feedback received	1	1	M12 Updated Version
	# mappings with other initiatives	1	2	JRC, ECSO
2.2	# of calls (national and EU) aligned with SPARTA Roadmap	3	?	
2.3	#	0	(1)	Ensuresec ?
	and amount of funded projects (national and EU) aligned with the SPARTA Roadmap	0		
Objective 3				
3.1	# of SPARTA workshops organized	12	8	
	# of attendees per WS	20	~22	1st MW – ?, 2nd MW – 30, 3rd MW – 27, 4th MW- 19, 5 -8 MWs - TBD
3.2	# of collaborations: liaisons with national	5	5	

	and EU projects, and other projects			
3.3	Share of women in groups and workshops	10%		No precise metrics yet
Objective 4				
4.1	Ranking	1 top rank	3	
	# of publications	4	24	
4.2	# of research results co-authored by both SSH and computer scientists	-	-	
4.3	# of technological assets produced in SPARTA Programs	-	1 tool outsourced to Eclipse	
Objective 5				
5.1	# of certification requirements covered by SPARTA technologies	6		Consolidation ongoing
5.2	# of technologies used in the labs	0		Consolidation ongoing
5.3	# of platforms and access policies formally identified	10	30	From JCCI
5.4	Interoperability and possible joint usage of the labs	3 labs interconnected	3	3 VPN between labs
Objective 6				
6.1	# of courses executed using the curricula developed by the project	-	-	
6.2	Satisfaction	-	-	
	# of trainees who successfully finished security-related courses design within the project	-	-	
6.3	# of directly addressed people (through participation at conferences, workshops, trainings, etc.) by the awareness program by the end of the project	500	>1000	

6.4	# of indirectly addressed people (through advertisements, social media groups) by the awareness program by the end of the project	2000	>10 000	Average of impressions of awareness posts
Objective 7				
7.1	# of SPARTA results licenced	-		
7.2	# of patents produced, software components registered or open-sourced	-		
7.3	# of start-ups created over technological assets produced in SPARTA	-		
7.4	# of responsible research and innovation debates	1 debate	1	WP2 Ethics Workshop in Rome
	# of participants	22 parts		

Concerning KPIs at M12, we notice several tendencies, the first one being some obvious over performing on, for example, the number of publications or the number of people addressed. Other than a good performance on those subjects, we see this as an underestimation of what we could achieve in the first year in SPARTA in those subjects.

A second insight into KPIs would have been to include in those KPIs the time to ramp up the project and its enablers. For example, monthly workshops objectives were indicated at 12 per year but due to this ramp up time only 8 were achieved in the first year whereas 11 are already planned in the second year.

The last tendency we identify is regarding person counts at different events for which exact numbers are difficult to obtain and shares hard to calculate. This is further reinforced by the fact that some people do not want to be counted in such cybersecurity workshops for confidentiality purposes.

With these insights in mind, we will start SPARTA second year by refining KPIs and maybe re-estimating our targets and their evaluation methods.

4.1.5 Lessons learnt and recommendations

A significant challenge of the Governance and Management activities is to reconcile the constraints of H2020 project management with the agility necessary to perform policy experiments. The position of the Executive Board, at the intersection of both activities, has shown to be key in this balancing act. It has already demonstrated modest but impactful adaptations to some processes:

- The adaptation of the reporting workload at Executive Board meetings. The initial process implemented a full administrative report from all Activity and Program leaders, which “crowded out” technical exchanges and synchronization. In order to make room for these discussions, a new experiment has been launched at M6, with full reporting happening on a quarterly basis, making it possible to focus the remaining monthly EB on core issues.
- The modification of the deliverable quality process. The first wave of deliverables at M6 was based on a classic 21-day internal review period, which in some cases generated a heavy

workload from both editors and reviewers, e.g. due to the information-gathering complexity over the SPARTA pilot network. In order to meet the wave of M12 deliverables, a 21-day pre-review period was implemented at M9, based on the tables of content of the deliverables.

A second challenge lies in the complexity of dealing with internal communications at the scale of SPARTA. The initial approach took a bottom-up approach, encouraging Program, Activity, task leaders and performers to leverage the SPARTA mailing-lists for discussions and collaborations. This had an immediate effect of flooding the discussion channels with solicitations of varying levels of interest for every partner, leading to a disengagement of the medium. The impact was particularly felt on transversal activities, which was diagnosed at M8, and confirmed during the face-to-face meetings during the September SPARTA Meetings in Rome. Interestingly, these meetings also confirmed the overwhelming opinion that such transversalities were a tremendous source of creativity, as witnessed by many in-person discussions. A first round of adaptation has been to experiment with *Stackfield*, a shared online project management and team chat platform[12], the experimentation is still ongoing. A second round of adaptation might be necessary to push top-down actions on transversal activities.

4.2 Transversal Activities

4.2.1.1 WP9 – Cybersecurity training and awareness

The work in WP9 is organized into four tasks, as described in the project proposal: T9.1 Cybersecurity Skills Framework Model Development, T9.2 Academic Programs in Cybersecurity, T9.3 Professional Training in Cybersecurity and T9.4 Raising Awareness in Cybersecurity.

Three out of total four tasks were started in 2019 and each task has a Task Leader and responsible organisation assigned. The Task Leaders form the WP9 Steering Committee (SC), a.k.a. the Training and Awareness Taskforce, that has been established during the kick-off meeting in Genova on April 2nd, 2019.

The SC is the main management body of the WP9 and is involved mainly in work planning and quality assurance. The work inside tasks is managed independently by Task Leaders, who are responsible for the quality of results and coordination with other bodies. The Task Leaders also maintain the external relations with key partners, namely ENISA, ECSO, and national agencies. Currently, the interval of SC meetings is set to 1 month. On the SPARTA level, the WP9 is represented in the Executive Board and Strategic Board by the WP9 Lead.

Internally, the WP9 closely cooperates mainly with WP8 on the topic of cyber ranges and their federations and with WP12 concerning the Go Cyber with SPARTA campaign in outermost regions.

Externally, the WP9 involved key institutions for consultations during the creation of a skills framework and the analysis of existing training programs. With key institutions (EC, ENISA, ECSO, and other pilots), the cooperation is continuous and managed by the WP9 Lead. The topic of cyber ranges and their federation is handled with special care and in cooperation with other pilots, so that the selection, testing, deployment and evaluation of cyber range tools is synchronized and WP9 minimizes overlapping activities.

4.2.1.1.1 Current State and Results

In 2019, the main objective of WP9 was to design the cybersecurity skills framework that will map the skills necessary for cybersecurity job roles. The skills framework was created on time and is described in the Deliverable 9.1. The framework will be used for next activities, mainly the design of training curricula, that will be the main outcome in 2020. Besides the framework, a deep analysis of existing academic programs in cybersecurity was performed. The results are available to SPARTA members in the form of a web tool. The tool is also available to external partners (e.g., to ENISA for its Education Map). The progress and outcomes of respective tasks are detailed below:

[12] Encrypted project management software and team chat, https://www.stackfield.com, 2020

- Task 9.1: the activities of this task were performed and finished according to the plan. The main outcome of this task is the D9.1 report that includes the specification of the skills framework mapping the cybersecurity skills to the roles. The deliverable was finished on time and approved by the reviewers. D9.1 will be submitted according to plan in M12.
- Task 9.2: the activities of this task were performed and finished according to the plan. The main outcome of this task is the analysis of the existing study programs worldwide and the software tool visualizing the results. The results will be included in the D9.2 report that is due in M18.
- Task 9.3: the activities of this task were performed and finished according to the plan. The main outcome is the mapping of existing professional training programmes and design recommendations by various institutions. Furthermore, the cooperation with key institutions dealing with education and training on the EU level, such as ECSO and ENISA, was started and strengthened. The results will be included in the D9.2 report that is due in M18.
- Task 9.4: this task starts in M12, so preparatory activities were carried out during the M01 - M11 period.

4.2.1.1.2 Lessons Learnt

With 14 institutions directly involved and strong relations to another SPARTA WPs, WP9 needs to be managed more like a project, than a classical WP only. Thus, relatively strong independence and responsibility is given to task leaders, who are all represented in the main management body, the Steering Committee.

After the first year, the SC meeting period is set to 1 month, which may change in different periods (more frequent meetings are expected during the deliverable submission time in mid 2020).

Furthermore, a task management tool is required to trace activities and deadlines, currently Stackfield is used for this purpose.

Overall, the WP9 adheres to the DoA and there are no major deviations expected.

4.2.1.2 WP10 – Sustainable exploitation and IPR

The goal of the work package WP10 “Sustainable exploitation” is to gather all participants around the final objective of creating a sustainable exploitation plan for the outcomes of the research programs.

The following principles had to be enforced:

- Ensure a strong legal security for all assets needed for exploitation of SPARTA's project results or promoted solutions (platforms, software, other types of infrastructures, and data-based content).
- Set up a common exploitation strategy by providing necessary document and resources in order to harmonize results exploitation.
- Ensure the sustainability of all software developments within the SPARTA project by providing legal support and information on exploitation of results both for internal and external consortium needs.

Four deliverables were produced during the first year:

- Assessment of Pre-Existing Resources (APER) on M06
- Data Management Plan (DMP) on M06
- Identification and Documentation of Produced Resources (IDPR) on M12
- Exploitation Plan on M12

These are foundational documents, supporting a simple but critical process: the proper management of resources throughout the different phases of the research programs. The first documents were submitted to the programs, in order to be able to build a consortium wide report, while the others did not need that much interactions, as they would be supporting documents for further use.

From a practical standpoint, SMILE attempted to establish communication with the other WP10 members, starting with the opportunity of the kick-off meeting in Saclay in February 2019, in order to build collectively the roadmap that would allow to deliver the expected content.

Most of the communication attempts were unsuccessful and left without answer, with the notable exception of the LEONARDO representatives. This situation led SMILE to work directly on the deliverables, given the very short timeframe.

One of the most significant challenges with the APER and DMP is that they are usual documents for researchers involved in EU funded projects. They are handled at the program level, but there is not much habit of generating such documents for a group of different research programs. The constraint is also that they are perceived as rather formal compliance exercises, and not seen as true enablers for exploitation purposes.

Once the documentation phase is over, we would very much like to explore the opportunity to experiment on ways to transform the APER, DMP, and IDPR formats so that they become more appreciated tools for the choice of exploitation strategies. We believe that the completion of deliverables D10.5 and D10.6 could offer such an opportunity.

4.2.1.3 WP11 – Certification organization and support

The main objective of the WP11 "Certification organization and support" is to align SPARTA certification support activities with the different European and national cybersecurity certification initiatives. More specifically work was conducted on the following topics:

- Mapping international/European cybersecurity certification initiatives (Task 11.1);
- Liaising with European and national cybersecurity authorities (Task 11.2);
- Supporting European and national cybersecurity authorities with evaluation facilities (Task 11.3);
- Providing recommendations for software development process cybersecurity compliance (Task 11.4).

During the first year of the SPARTA project the planned work focused on the mapping international/European cybersecurity certification initiatives with results being described in deliverable D11.1.

The work package is managed based on monthly audio conferences where all participants of WP11 are invited to attend. This audio conference is mainly used for task leaders to report on progress of their tasks. Task leaders are free to organise task specific audio conferences.

Physical SPARTA meetings are an opportunity to organise specific WP11 sessions. The work package interacts with the four SPARTA research programs to help them understand more about cybersecurity certification and how it could be useful for them to take certification into account for their research.

Collaboration with the CAPE research programs, on continuous cybersecurity assessment, has clarified how cybersecurity assessment tools can be used for incremental cybersecurity certification. This collaboration has been facilitated by the fact that some WP11 partners are also involved in the CAPE research program.

The main achievement of the first year is the production of deliverable D11.1, on the mapping of international and national cybersecurity certification initiatives. The main aim of this deliverable is to understand the cybersecurity certification context in Europe and to identify which standards could be relevant for the SPARTA research programs. The deliverable presents the new European regulation, the European Cybersecurity Act, with a description and analysis of the cybersecurity certification framework and its current priorities. This report also describes several national initiatives dedicated to the cybersecurity of SME's and argues that SME cybersecurity certification could benefit from harmonization across Europe, in the context of the European cybersecurity certification framework.

Initial work in Task 11.2, Task 11.3, and Task 11.4 has started focusing on how the SPARTA network should interact with national cybersecurity authorities, how cybersecurity certification evaluation

facilities should adapt to the new context defined by the EU cybersecurity act, and analysing how cybersecurity certification of development processes can be an alternative approach to product certification for improving cybersecurity product quality.

The evolution of the EU cybersecurity act will provide the context that will drive the work of the next year in WP11. One of the big challenges from the communication point of view will be promoting cybersecurity certification and encouraging organisations to investigate the benefits of certification. This message can be made convincing by demonstrating that lightweight and incremental cybersecurity certification is possible and that it can be integrated in current development processes.

4.2.1.4 WP12 – Dissemination and communication

Regarding the governance setup for WP12, the Communication and Dissemination team conducted weekly brainstorm meetings, to assess and validate dissemination and communication actions, constantly re-think new approaches, and gather new ideas.

Therefore, WP12 follows an agile methodology, enabling a responsive action in volatile environments, to promptly address new challenges and coordinate with other activities and programs needs in a timely fashion.

WP12 deployed a set of guidelines to direct partners in the procedures for communication and dissemination activities related to SPARTA. The team uses a room in the *Stackfield* platform to facilitate interactions and coordinate activities with other WPs.

4.2.1.5 The First ELSA Audit

In December 2019, the first ELSA Audit engagement was performed. The audit implementation, execution, results, and recommendation are reported in deliverable D2.2.

The first ELSA Audit aimed to improve ELSA awareness, build ELSA capabilities, as well as to collect feedback on audit process itself, thus ensuring high and continually evolving ELSA standards.

The ELSA control objectives that were selected for the first ELSA Audit are presented in the following table.

Audit Coverage		**Controls**
Topic	**Sub-topic**	**Assertion / question**
Fundamental rights	Solidarity and Subsidiarity	The SPARTA project provides a working environment that fosters solidarity between SPARTA participants coming from different Member States.
Fundamental rights	Solidarity and Subsidiarity	The SPARTA project provides a working environment that fosters solidarity between SPARTA beneficiary organizations.
Fundamental rights	Solidarity and Subsidiarity	The SPARTA beneficiary organizations share equally, or at least reciprocally, in the benefits, burdens, and risks of collaboration in the project.
Fundamental rights	Solidarity and Subsidiarity	The SPARTA project provides a working environment that fosters team orientation, mutual respect, and openness for different views and approaches.
Fundamental rights	Freedom and Privacy	The SPARTA project provides a working environment that fosters compliance with privacy-related laws and regulations, as well as foster privacy-related ethical standards.
Fundamental rights	Freedom and Privacy	The SPARTA project provides a working environment that does not unduly restrict the professional autonomy of SPARTA participants.
Fundamental rights	Policies, Standards, Procedures, and Guidelines	The SPARTA project provides the necessary and sufficient policies, standards, procedures, and guidelines, related to fundamental human rights issues.
Privacy - PII	GDPR requirements	In the scope of the WP that I lead, GDPR legal requirements are well understood by the WP participants.

Privacy - PII	GDPR requirements	In the scope of the WP that I lead, technical and organizational measures to ensure data protection were designed and are being implemented for all processing activities.
Privacy - PII	Awareness and engagement	In the scope of the WP that I lead, generic privacy requirements and concerns were formally presented and discussed in a formal venue or procedure (telco, meeting, conference, workshop, or other effective communication means).
Privacy - PII	Legal capabilities and competency	I understand the legal concepts of "personal data", "consent", "data breach", "profiling", and I am able to apply these concepts in the scope of the WP that I lead.
Privacy - PII	Legal capabilities and competency	I understand the legal concepts of "pseudonymisation", "encryption", and I am able to apply these concepts in the scope of the WP that I lead.
Privacy - PII	Legal capabilities and competency	I understand the legal concept of "high risk data processing operations" and I am able to apply this concept to assess risk to rights and freedoms of the natural person, in the scope of the WP that I lead.
Privacy - PII	Policies, Standards, Procedures, and Guidelines	The SPARTA project provides the necessary and sufficient policies, standards, procedures, and guidelines, related to privacy issues.
Ethics requirements	"Dual-use" ethics category	In the scope of the WP that I lead, the issues of SPARTA dual-use items (i.e. for both civil and military purposes) were formally presented and discussed, namely according to the requirements of deliverable D14.1.
Ethics requirements	"Humans" ethics category	In the scope of the WP that I lead, the issues of human participation in SPARTA research activities (identification, recruitment, and consent) were formally presented and discussed, namely according to the requirements of deliverable D14.2.
Ethics requirements	Policies, Standards, Procedures, and Guidelines	The SPARTA project provides the necessary and sufficient policies, standards, procedures, and guidelines, related to ethical issues.
Gender and diversity	Intercultural enablers	In the scope of the WP that I lead, I have not encountered significant difficulties and roadblocks related to intercultural communication, understanding, and appreciation.
Gender and diversity	Negative discrimination	In the scope of the WP that I lead, I have not encountered significant difficulties and roadblocks related to women's attraction, participation, or retention in the workplace.
Gender and diversity	Negative discrimination	In the scope of the WP that I lead, I have not encountered significant gender stereotypes and unconscious bias, that may impact negatively organizational performance.
Gender and diversity	Policies, Standards, Procedures, and Guidelines	The SPARTA project provides the necessary and sufficient policies, standards, procedures, and guidelines, related to gender and diversity issues.
Responsible research and innovation	Goal achievement	Overall, the SPARTA project fosters responsible research and innovation.
Responsible research and innovation	Roles and empowerment	In the scope of the WP tasks that I lead, I am responsible for fostering responsible research and innovation.
Responsible research and innovation	Roles and empowerment	In the scope of the WP tasks that I lead, I feel motivated and empowered to foster responsible research and innovation.
Responsible research and innovation	Policies, Standards,	The SPARTA project provides the necessary and sufficient policies, standards, procedures, and guidelines, related to responsible research and innovation.

	Procedures, and Guidelines	

Table 2: ELSA control objectives, for the first ELSA Audit engagement

The relevance of these control objectives for assessing the ELSA component of governance should be clear:

- The ELSA Audit explicitly addresses fundamental rights, privacy, ethics requirements, gender and diversity, and responsible research and innovation.
- There is an emphasis on fundamental governance components:
  - Principles, policies, and frameworks;
  - Culture, ethics, and behaviour.
- All topics under control include a statement on policies, and the scope of control objectives related to policies encompasses several levels:
  - Policies (requirements fostering the desired culture and behaviour);
  - Standards (policies applied to specific situations);
  - Procedures (how-to descriptions);
  - Guidelines (recommendations).

Also, the SPARTA working environment is explicitly referred in the control objectives, thus ensuring that ELSA excellence is embedded in SPARTA and in the daily lives of SPARTA participants, towards establishing ethical, legal, and societal aspects into the DNA of the SPARTA Project, as well as the future CCN.

4.2.2 Synergies between Programs and Activities

This section described several synergies that were developed between work package WP12 and other work packages.

4.2.2.1 Interaction with WP1

The interaction between WP12 and WP1 is of utmost importance to align the communication activities with the overall needs of SPARTA governance. This interaction enabled the construction of cohesive communication materials, strategic communication for events, and constant adaptation of the internal and external IT communication infrastructures.

During the first year of the project, communication obstacles were assessed and mitigated, namely:

- The internal communication between partners was facilitated by use of *Stackfield*, a tool that allows easier collaboration among partners, sharing tasks and documents.
- The implementation of a bi-monthly internal newsletter, to promote the communication among partners, ensuring all participants are up to date with the main activities and outcomes of SPARTA.

4.2.2.2 Interaction with WP3 and WP8

The interactions with WP3 – Roadmap Design and WP8 – Clustering, platforms and ecosystems was crucial to producing communication materials for SPARTA events, as well as its dissemination on SPARTA social media accounts.

Synergies for the second year contemplate the monitoring of the WP's activities to timely design communication strategies, that will help leverage the visibility of SPARTA's activities and achievements to the target audiences.

4.2.2.3 Interaction with SPARTA Programs (WP4 to WP7)

Interactions between SPARTA programs within the scope of WP4 to WP7 (T-SHARK, CAPE, HAII-T, and SAFAIR) and WP12 were initiated during the first year of the project. A section dedicated to the four programs within the internal newsletter was produced, to keep track of the program's achievements and progress.

For the second year of SPARTA, major interactions between WP12 and the four Programs (WP4 – WP7) are planned, namely to:

- Communicate the programs' achievements, through social media, events, and the SPARTA website;
- Promote communication between the programs and the other SPARTA activities, through the internal newsletter.

4.2.2.4 Interaction with WP9

Synergies between WP12 and WP9 - Cybersecurity Training and Awareness Program - were developed through the "Go Cyber with SPARTA" campaign, related to task 12.5 – Outermost Regions Engagement. This initiative aims at building awareness of cybersecurity in the outermost regions, including:

- implementation of cybersecurity training workshops;
- awareness campaigns;
- guidelines and curricula (for Universities, as well as other organizations).

4.2.3 Lessons learnt and recommendations

Ethical, legal, and societal aspects are important components of governance. This entails the following implications regarding the relation between governance, assessment, and ELSA in the SPARTA Project:

- Alignment should be sought between the governance, assessment, and ELSA frameworks;
- Alignment should be sought between best practice regarding governance, assessment, and ELSA.

Chapter 5 Summary and Conclusion

The first part of this work discusses key points of the state-of-the-art in research and innovation governance. It establishes the strong correlation to concepts of mission-oriented research and innovation, public procurement and strategic autonomy. It shows how they should interact with the governance of the four pilots and how in particular they should be executed in SPARTA's governance.

Throughout the rest of the document, we discussed the instruments and enablers of SPARTA and their relation to the state-of-the-art. Key priorities are implemented and tested in all three of SPARTA's main instruments: the mission-oriented Roadmap, the ecosystem-building Partnerships and the risk-taking Programs. The different SPARTA Enablers are acting as support for SPARTA Instruments, and are helping them in their execution and implementation of innovative solutions in the scope of SPARTA's mission.

Overall, and from this document, we can see that the governance has been successfully launched. Strongly inspired by the state-of-the-art, the SPARTA pilot implements modern principles, learning from its experimentations, failures and successes. Based on the diversity of its actors and cooperations between them and its Enablers and Instruments, SPARTA adapts and grows to create a research governance in Europe, facing the novel societal grand challenges in the European Union.

In the following two years of its execution SPARTA will continue to foster innovation and research, strengthening its governance, field-testing of its principles, instruments and enablers. The initial organisation and planning of governance, R&D&I, community and exploitation activities has already changed from its learnings. Beyond, SPARTA policy capacities will continue to evolve to create a strong basis for European excellence and autonomy in cybersecurity research and innovation.

Chapter 6 List of Abbreviations

Abbreviation	Translation
AB	Advisory Board
ACM	Association for Computing Machinery
AI	Artificial intelligence
CCN	Cybersecurity Competence Network
CISA	Certified Information Systems Auditor
CISM	Certified Information Security Manager
CRISC	Certified in Risk and Information Systems Control
EB	Executive Board
EC	European Commission
ECSO	European Cyber Security Organisation
ELSA	Internal ethical, legal and societal aspects
ENISA	European Union Agency for Network and Information Security
GA	General Assembly
GDPR	General Data Protection Regulation
ICT	Information and Communications Technologies
IEEE	Institute of Electrical and Electronics Engineers
JRC	Joint Research Centre
KPI	Key Performance Indicator
RIA	Research and Innovation action
RRI	Responsible Research and Innovation
SD	Strategic Direction
SPARTA	Strategic Programs for Advanced Research and Technology in Europe
SVN	Subversion Document Repository
WP	Work Package

Chapter 7 Glossary

Term	Definition	Reference
Internal Auditing	Internal auditing is an independent, objective assurance and consulting activity designed to add value and improve an organization's operations. It helps an organization accomplish its objectives by bringing a systematic, disciplined approach to evaluate and improve the effectiveness of risk management, control, and governance processes.	IAA
SPARTA	Acronym for “Strategic Programs for Advanced Research and Technology in Europe”, a European Commission Horizon 2020 programme, project number 830892, as per call H2020-SU-ICT-2018-2020, Work programme H2020 SU-ICT-03-2018: Establishing and operating a pilot for a Cybersecurity Competence Network to develop and implement a common Cybersecurity Research & Innovation Roadmap.	SPARTA
Governance Activity	Set of tools, processes, and expertise that are developed and experimented in Workpackage 1.	
ELSA Activity	Set of tools, processes, and expertise that are developed and experimented in Workpackage 2.	
Roadmap Activity	Set of tools, processes, and expertise that are developed and experimented in Workpackage 3.	
Partnership Activity	Set of tools, processes, and expertise that are developed and experimented in Workpackage 8.	
Training Activity	Set of tools, processes, and expertise that are developed and experimented in Workpackage 9.	
Exploitation Activity	Set of tools, processes, and expertise that are developed and experimented in Workpackage 10.	
Certification Activity	Set of tools, processes, and expertise that are developed and experimented in Workpackage 11.	
Dissemination Activity	Set of tools, processes, and expertise that are developed and experimented in Workpackage 12.	
Management Activity	Set of tools, processes, and expertise that are developed and experimented in Workpackage 13.	
T-SHARK Program	Set of tools, processes, and expertise that are developed and experimented in Workpackage 4.	

CAPE Program	Set of tools, processes, and expertise that are developed and experimented in Workpackage 5.	
HAII-T Program	Set of tools, processes, and expertise that are developed and experimented in Workpackage 6.	
SAFAIR Program	Set of tools, processes, and expertise that are developed and experimented in Workpackage 7.	

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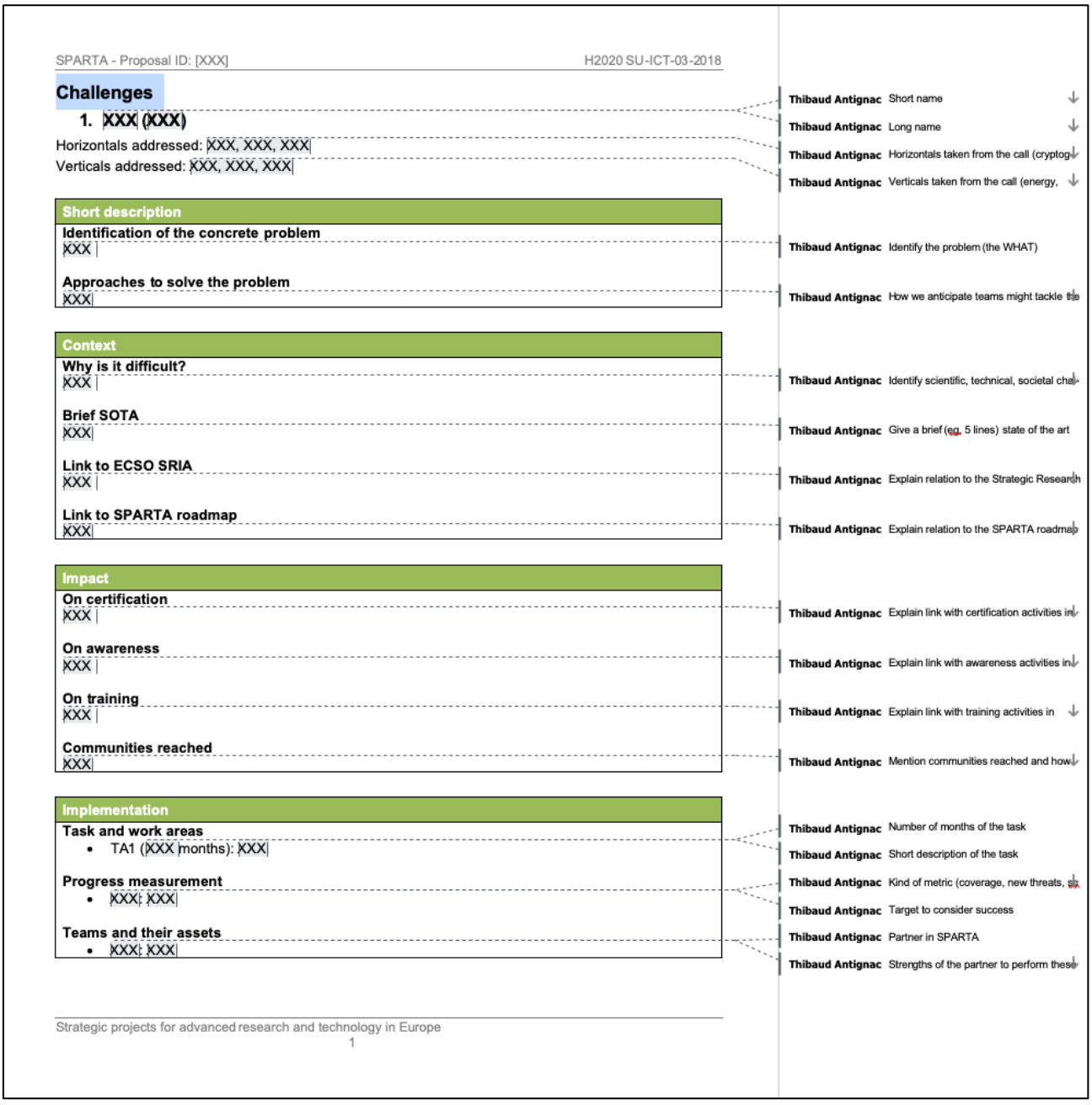
[12] D2.6 General guidelines for responsible cybersecurity research and innovation, *due for publication in January 2022*, SPARTA Project – Strategic programs for advanced research and technology in Europe, European Commission

Annex: SPARTA challenge form



SPARTA - Proposal ID: [XXX] H2020 SU-ICT-03-2018

Challenges

1. **XXX (XXX)**

Horizontals addressed: XXX, XXX, XXX
Verticals addressed: XXX, XXX, XXX

Short description

Identification of the concrete problem
XXX

Approaches to solve the problem
XXX

Context

Why is it difficult?
XXX

Brief SOTA
XXX

Link to ECSO SRIA
XXX

Link to SPARTA roadmap
XXX

Impact

On certification
XXX

On awareness
XXX

On training
XXX

Communities reached
XXX

Implementation

Task and work areas
- TA1 (XXX months): XXX

Progress measurement
- XXX: XXX

Teams and their assets
- XXX: XXX

Strategic projects for advanced research and technology in Europe
1

Thibaud Antignac Short name
Thibaud Antignac Long name
Thibaud Antignac Horizontals taken from the call (cryptog
Thibaud Antignac Verticals taken from the call (energy,
Thibaud Antignac Identify the problem (the WHAT)
Thibaud Antignac How we anticipate teams might tackle the
Thibaud Antignac Identify scientific, technical, societal cha
Thibaud Antignac Give a brief (eg. 5 lines) state of the art
Thibaud Antignac Explain relation to the Strategic Research
Thibaud Antignac Explain relation to the SPARTA roadmap
Thibaud Antignac Explain link with certification activities in
Thibaud Antignac Explain link with awareness activities in
Thibaud Antignac Explain link with training activities in
Thibaud Antignac Mention communities reached and how
Thibaud Antignac Number of months of the task
Thibaud Antignac Short description of the task
Thibaud Antignac Kind of metric (coverage, new threats, sp
Thibaud Antignac Target to consider success
Thibaud Antignac Partner in SPARTA
Thibaud Antignac Strengths of the partner to perform these