Grant Agreement number: **825618**

Project acronym: **NGI_TRUST**

Project title: **Partnership for innovative technological solutions to ensure privacy and enhance trust for the human-centric Internet**

Type of action: Research and Innovation Actions (RIA)

NGI Trust Impact Evaluation Report

Abstract: This report presents the main findings of the Impact Evaluation of NGI Trust project as well as lessons learned from the project, concluding remarks and recommendations that serve as a basis for future research and innovation actions.

This report is part of a project that has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 825618

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1 Introduction

Given the immense penetration of the Internet in our daily lives, and thanks to the pervasive usage of mobile devices and related apps, users tend to be online much more than in the past. This new environment offers almost unlimited opportunities to stay connected with peers and to share all kinds of information via apps and social media. This combined with the number of 'things' that are connected to the Internet, which themselves produce data and information, has led to an explosion in Internet usage and developments.

On the one hand, this has empowered users to access and share more information than ever before. On the other hand, the Internet has become a critical infrastructure that is under constant warning: threats to the core operation of the network, threats to information security, threats to user privacy, and more generally threats to the openness of the Internet and the way information is controlled. Many experts have been warning about the need to ensure that users' privacy is protected and that the Internet remains open and free for all, but that at the same time regulation is needed to align the digital world with core societal values.

The **NGI Trust project** aimed to boost privacy-enhancing and security technologies to make user and device interaction with the Internet and its services more secure without compromising user-friendliness and privacy. In addition, the privacy-enhancing and security technology solutions looked to consider user needs, market and business needs, legal and societal needs alongside the development of these solutions.

The project had four overall objectives:

- Reinforce, structure, and develop the community of researchers, innovators and technology developers in the field of privacy- and trust-enhancing technologies
- Build on the state of the art in privacy- and trust-enhancing technologies by focusing support for third-party personal data, attributes and information
- Improve user trust and acceptance of emerging technologies by focusing on applications and solutions that develop a more open, robust and dependable Internet and strengthen Internet governance
- Foster the exploitation and commercialisation of the results of selected third-party projects through a tailored process of coaching and mentoring

To achieve these objectives, the NGI Trust used a cascade funding mechanism to support third-party projects, engaging with different players (academic research groups, high-tech start-ups and SMEs, etc.) working at various technology readiness levels (TRL) to explore topics that are critical to the next-generation Internet. Furthermore, projects were supported with dedicated technical coaching sessions, led by experts in the fields of privacy- and trust-enhancing technologies, and business mentoring sessions aimed at improving their qualitative level of knowledge and to make the best use of intellectual property rights (IPR), as well as planning the exploitation and market orientation of their technological solutions.

The NGI Trust project explored security, privacy and surveillance aspects from different perspectives: at protocol level (i.e. seeking R&I ideas in this area that may lead to new business opportunities), as well as by exploring technical and political

limitations that cause conflicts (i.e. privacy versus security, authentication versus anonymity, etc.). Given that Europe, at present, has the most advanced privacy laws and regulations in the world, NGI Trust investigated how to use this aspect as a competitive advantage in software and hardware production, in data management services, etc.

This report presents the main findings of the Impact Evaluation of NGI Trust project including outputs, outcomes and lessons learned. It also includes concluding remarks and recommendations that serve as a basis for future research and innovation actions under Horizon Europe.

2 Impact Evaluation of NGI Trust

Between May and October 2021, NGI Trust commissioned VVA to prepare an impact evaluation of the 57 third-party funded projects, drawing lessons from the implementation process and the results achieved to date (spring 2021), or foreseeable within the coming 18 months (end 2022).

The aim was to assess the technical, economic and societal impact of the portfolio of third-party projects with respect to the aims and targets set out by the NGI Trust project. The following specific issues and questions were targeted:

1. To what extent has the portfolio of selected projects met the objectives of the NGI Trust project and thereby contribute to the European Commission's overall Next Generation Internet initiative goals?

2. To what extent are the funded projects, individually or based on a collective contribution to specific topics, likely to lead to an impact in terms of improving privacy- and trust-enhancing solutions for European Internet users?

3. What lessons can be drawn for future NGI policy priorities and Horizon Europe funding and support measures (RIAs, CSAs, etc.), in the field of privacy- and trust-enhancing technologies?

To perform this exercise, VVA developed an analytical framework (Table 1) to guide the overall impact evaluation, following the general evaluation principles of evidence-based research and triangulation of sources, in line with international best practices, such as: the Better Regulation Guidelines of the European Commission, United Nations Evaluation guidelines and OECD guidelines. A detailed answer to each evaluation criteria and question are annexed to this report.

Table 1: Evaluation criteria and questions

Evaluation criteria	Evaluation questions
Relevance	• To what extent is NGI Trust fulfilling a relevant role in the Commission's initiative *Next Generation Internet*?
	• To what extent is NGI Trust fulfilling a relevant role vis-à-vis its beneficiaries?
Coherence	• To what extent are the projects selected in NGI Trust coherent with the overall Commission's initiative *Next Generation Internet*?
Effectiveness	• To what extent has NGI Trust's funding calls produced positive direct/indirect/spill-over effects among its beneficiaries? For example, scientific outputs and results, effects on collaboration among stakeholders, wider societal effects.
	• To what extent can the projects selected in NGI Trust contribute to a more "resilient, trustworthy and sustainable Internet of human value"?
Efficiency	• To what extent has the NGI Trust's rationale for funding and funding procedures resulted in an efficient system?

Source: VVA

2.1 Summary of key findings

NGI Trust is considered to have **filled an important funding gap** for researchers and innovators: the majority of beneficiaries stated that they applied for two main reasons: 1) the simple application process/low bureaucratic overhead, and 2) the lack of funding at the national level in the field of trust and privacy technologies.

The NGI Trust's **portfolio of projects was considered highly relevant to the Commission's Next Generation Internet initiative.** More specifically, the grouping of priorities into 12 thematic areas helped to align the funded projects with the aims of NGI. In terms of the call documents, having a criterion 'relevance to the NGI initiative' was considered helpful for the future, in order to orientate the projects more strongly and make the connection to the relevant Commission priorities more explicit for evaluation purposes.

The projects were well supported by ancillary activities, such as webinars involving other NGI initiatives (e.g. Tetra), which gave an overview of the Commission priorities for NGI. These aimed to increase relevance by decreasing the disconnect between how the projects collaborate with each other, further enhancing the move towards a 'European brand of innovations' in this area by supporting the development of informal communities of practice. This, in turn, contributed to the fulfilment of the resilience, trust and inclusion pillars of the overall NGI initiative.

Figure 1: Summary of 12 NGI Trust Thematic Areas

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BEYOND PASSWORDS BETTER PRIVACY SAFER BROWSING USER CONTROL IMPACT OF AI HUMAN-CENTRIC INTERNET

STRONGER TOOLS EFFECTIVE IDENTITY PERSONAL DATA MANAGEMENT DATA ETHICS SECURING THE INTERNET OF THINGS ADVANCING IDENTITY

The **projects selected by NGI Trust were found to be coherent with the Commission's NGI initiative**, although there is room for adjustments. The communication efforts of NGI Trust for the second and third call resulted in a larger percentage of awardees from different geographical backgrounds compared to the first call, reflecting increased coherence with the NGI goals of inclusion and community-building.

To increase internal coherence within different activities in NGI Trust, more targeted and specific communication efforts could result in better implementation of future stakeholder, research and business engagement strategies. In terms of the coherence of the award criteria with the overall aims of the Commission's NGI initiative, the element of novelty/innovation could have been separated to directly consider wider innovation indicators from the applicant organisation (e.g. high-growth in revenue or staff, R&D spending).

As a consequence, while the quality of the projects was high across the portfolio, the commercialisation element, which runs through NGI Trust and also the broader NGI initiative, could have been more strongly represented in the selection of projects. NGI Trust selected projects that work well not only with its own focus but also show coherence with the whole NGI portfolio. While the projects funded by NGI Trust overlap technically with other initiatives, the delivery methods for funding are sufficiently distinct, so that each initiative finds its niche.

The **projects selected in NGI Trust contributed to a more "resilient, trustworthy and sustainable internet of human value"**. NGI Trust third-party projects could effectively contribute to the emergence of a Next Generation Internet worldwide and not geographically constrained to Europe. The results of the projects were found to be dynamic and firmly in the hands of the community, which means useful research can be duplicated and reused to effectively sustain the objectives of NGI Trust beyond the direct funding beneficiaries. Indeed, beneficiaries expressed their satisfaction about having obtained sufficient funding to pursue research that is open source. They felt that this allowed them to contribute more effectively to the objectives of a Next Generation Internet by putting important technology and frameworks in the hands of the many.

Indeed, a paramount objective of **NGI is to contribute to Open-Source Software (OSS)** and create a community of stakeholders in the field of privacy- and trust-enabling technologies. In line with this, the majority of beneficiaries considered their solution partly Open-Source or fully Open Source. In this way, the results of the projects were viewed as dynamic, democratic (in the hands of the community) and, if well duplicated and reused, likely to sustain the objectives of NGI Trust beyond the funded recipients. As a result, through the diffusion of OSS, NGI Trust was felt to have an induced effect in fostering the development of additional products and services.

NGI Trust contributed to **creating a community of stakeholders** in the field of privacy- and trust-enabling technologies, and to promoting know-how sharing and collaboration. The findings of the projects were focused on applications in a variety of industries and contexts, which is testimony to the broad dissemination and potential exploitation of the results of NGI Trust. However, the effectiveness of NGI Trust could be limited if many of the projects cannot find a sustainable business model to generate revenues, especially when there is no intellectual property involved.

NGI Trust fulfilled a relevant role in supporting beneficiaries who, individually or based on their collective contribution to specific topics, are likely to generate an impact on privacy- and trust- enhancing solutions for European Internet users. NGI Trust was regarded by participants as a **tailor-made initiative for niche Internet researchers and innovators.** Generally, NGI Trust participants believed that the objectives of NGI Trust were in line with the development needs of Internet innovators. Although there was a strong heterogeneity in the technologies developed by the third-party projects, there was also an emphasis on privacy-enabling technologies such as software engineering, standards, protocols, interoperability, cryptography, algorithms, proofs and decentralised solutions including blockchain and distributed ledger technologies. At the same time, the report found that a few verticals dominate, namely the public sector, telecommunications, education, financial services, healthcare, and media and entertainment.

In addition to the technical and thematic impacts of the projects, NGI Trust's funding calls produced a number of positive direct and spill-over effects. For example, the NGI Trust platform allowed the beneficiaries to present their technology to a broader network of innovators, leading researchers and technology experts. The initiative has increased the capacities of nearly all beneficiaries to **participate in larger collaborative projects and build new partnerships.** Furthermore, before joining NGI Trust, most participants were approaching their projects from a technical perspective. Thanks to participating in this initiative, beneficiaries had the opportunity to learn more about the commercialisation aspects, such as improving their knowledge of different business models, co-designing products and gathering expertise on how to best design a privacy-oriented product, as well as gaining better insight into the innovation process related to their specific sector.

Another immediate direct impact was that the **majority of projects showed significant progress along the innovation funnel.** The survey results showed that

only 15.6% of the projects had remained at the same Technology Readiness Level (TRL) stage at the end of the grant period, while 42.2% reached TRL 5-6, and 28.9% reached TRL 7-8. In addition, six projects were funded twice by NGI Trust, and the impact of the projects was greatly enhanced by such follow-on funding. NGI Trust enhanced most projects' capacity to use the outputs of their projects to attract other sources of funding. For instance, after participating in NGI Trust, the project CUBBIT closed a €7 million funding round to continue its development.

Most beneficiaries shared the idea that **NGI Trust is an effective funding mechanism in supporting the development of a human-centric internet.** In terms of lessons learned for future NGI policy priorities, Horizon Europe funding and support measures (RIAs, CSAs, etc.), beneficiaries commented that the future emphasis should be on supporting the development of clear commercial plans in the thematic area of "better privacy and personal data management" and "Impact of AI and IoT" as most projects in these two thematic areas lacked this.

Overall, the funded projects contributed to advancing specific topics, and some showed strong promise towards commercialisation and concrete impacts in terms of improving privacy- and trust-enhancing solutions for European Internet users. In terms of lessons learned for future NGI policy priorities, some beneficiaries commented that the issues of standardisation, decentralisation, and interoperability should be investigated further. In addition, considering that most solutions see the public sector as their main destination market, further growth could come from **enhancing cooperation with public institutions**. Different forms of public procurement for innovation, in which the public sector uses its purchasing power to act as an early adopter of innovative solutions which are not yet available on a large-scale commercial basis, could be explored.

2.2 Evaluation of Relevance of NGI Trust

- **Q1: To what extent does NGI Trust fulfil a relevant role in the Commission's initiative Next Generation Internet?**

This question relates specifically to how the objectives of the NGI Trust as an EU intervention correspond to wider EU policy goals and priorities. The overall mission of the Commission's Next Generation Internet (NGI) initiative, launched in 2016, is to re-imagine and re-engineer the internet for the third millennium and beyond. The key focus of the policy is to support an internet designed for humans as an interoperable platform ecosystem that embodies the values that Europe holds dear: openness, inclusivity, transparency, privacy, cooperation, and protection of data.

The overall aims of the NGI Initiative, as stated in the September 2020 publication 'NGI Forward' are to support the creation of 'a more democratic, resilient, sustainable, trustworthy, and inclusive internet by 2030.' This is to be achieved by focusing on five pillars, each of which include a set of objectives. These can be found in Table 2 below and were drafted by the NGI Forward project. NGI Forward is the strategy and policy arm of the NGI initiative, led by an international consortium of seven partners.

Table 2: Objectives from NGI Forward 2020 publication[1]

Democracy	• A single market for ethical data use and technology worth 1 trillion Euros by 2030.
	• Data wallet for Europeans by 2025.
	• Commons-driven decentralised data spaces for personal data
	• Strengthening interoperability and data portability rules.
	• Digital deliberation tools
Resilience	• Systems that can withstand environmental, economic and cyber shocks
	• open-source technology and open standards first across all layers of European governance
	• Reviving the multi-stakeholder model and protecting global digital rights.
	• Protecting critical infrastructures
	• Retraining programme, building skills within organisations and among the general public
Sustainability	• Fully circular and carbon-neutral economy for digital technology by 2030
	• Circular economy for digital devices by 2030
	• Extending data minimisation practices to include sustainability measures
	• Europe at centre for market for trustworthy technology worth 1 trillion Euros by 2030.
	• technologies that can meaningfully help address the climate crisis
Trust	• Establish a globally recognised "Made in Europe" brand for trustworthy and privacy enhancing technology
	• Launch an auditing body that scrutinises the security, trustworthiness and privacy-awareness of hardware, software and digital services
	• Creation of a dedicated News Innovation fund.
	• Bring more development of devices and solutions back to Europe.
	• New modes for citizens to give meaningful consent to being tracked or subjected to data driven decision-making
Inclusion	• By 2030, all Europeans can meaningfully shape the internet.
	• All have affordable, high-speed internet access by 2030 and skills to use it
	• Making the internet governance and technology development layers more inclusive and diverse.
	• Promote equal representation of minority languages and accessibility of services
	• Address socio-economic dynamics which may results in marginalised groups being less likely to participate in the NGI

Source: NGI Forward working paper: A VISION FOR THE FUTURE INTERNET

The stated mission of NGI Trust is well aligned with the Trust, Resilience and Democracy pillars of the overall NGI Initiative. This is illustrated through NGI Trust's specific aims, as described in the introductory section. The aims emphasise

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[1] https://www.ngi.eu/wp-content/uploads/sites/48/2020/10/Vision-for-the-future-internet-long-version-final-1.pdf

reliability, openness, commercial products, among other elements also found in the overall goals of the NGI initiative.

These priorities are grouped, via the funded projects, into 12 thematic areas: beyond passwords', 'better privacy', 'safer browsing', 'user control', 'impact of AI', 'human centric internet', 'stronger tools', 'effective identity', 'personal data management', 'data ethics', 'securing the internet of things' and 'advancing identity'. This grouping is helpful to further orientate the projects to the aims of NGI, however there are a number of overlaps and projects which do not fit neatly into the groupings. It may be useful therefore to reduce the number of areas to keep them relevant and meaningful.

The governance of NGI Trust includes an international advisory board of nine people, plus a Programme Officer from DG Connect. The presence of the DG Connect Programme Officer ensures alignment with the overall objectives of the Commission in this area. The composition of the consortium was seen as a major strength of NGI Trust by the Commission, especially as it included organisation which had not received European funds before. In that sense the NGI priorities of openness and inclusivity are also reflected in the consortium for the project.

In terms of how the call documents were structured, several measures ensured the relevance of NGI Trust activities to the NGI initiative. In the first call, NGI Trust provided examples of areas of concerns, which proposals may address. A selection of these can be found in Figure 2 below.

Figure 2: Examples of areas of concern

Area of Concern	Current State	Shortcoming	Ideal state
Users have Consent spread across multiple service providers	Inconsistent breadth and depth, siloed by solution/service provider	Lacks portability & interoperability	Consistent ontology, portable, interoperable machine readable and human readable receipts
Identity and fine-grained access for IoT and non-Web resources	Fine-grained access control is largely limited to web-based applications, requiring human interaction and strong compute intensive crypto.	With IoT a category of devices and services become part of the Internet that often lack capabilities in terms of compute power, battery life and interface possibilities to use the current state-of-the-art in access control.	Rich set of fit-for-purpose tools for fine-grained access control for IoT and non-web services.

Source: NGI Trust call document: Guidance for applicants - call 1.

These examples are aligned with the aims of NGI Trust and NGI initiative. The call text was adapted slightly in the second round, orientating the projects to the aims of NGI Trust and the NGI initiative via a section with an overview of NGI Trust aims, an overview of specific types of projects NGI Trust was looking for in that round, as well as an indicative list of possible areas of concern/opportunities and specific topics. For the third call, the list of topics was supported with additional information aligned with the aims of NGI Trust and it was part-merged with the list of proposed projects used in the previous call. Each of these topics reflects one of the aims of NGI Trust (i.e. the resilience, trust and democracy pillars of the NGI initiative). These textual adaptions for each call reflect an iterative process focused on attracting a wider variety of applicants with more focused commercial goals than in the first call, which largely attracted type 1 (lower TRL) applications.

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In terms of the selection criteria for project funding, these remained the same across the three calls:[2]

- Novelty/innovation (40% weighting)
- Expertise and excellence of the proposed team (30% weighting)
- Project planning and value for money (30% weighting)

Even though these criteria are very aligned and supported by guidance to applicants, it could be useful to consider introducing a specific criterion on 'relevance to the NGI initiative' in the future. This could help orientate projects more strongly and make the connection to Commission priorities more explicit for evaluation purposes.

In addition to awarding funding to third party projects, NGI Trust is also responsible for providing coaching, optional mentoring (including business plan and IPR advice) and dissemination of the results of the third-party projects. The relevance of the coaching and mentoring was ensured through presentations and liaising closely with the NGI Trust advisory board. Additional activity included results webinars, which enabled the funded projects to network with each other and present their outputs. It also provided an overview of the relevance of the different projects. The webinars were introduced fairly recently, after the consortium began to see a disconnect in how the projects collaborate with each other. The webinars aim to enhance the move towards a European brand of innovations in this area by supporting the development of informal communities of practice. This contributes to the fulfilment of the resilience, trust and inclusion pillars of the overall NGI initiative.

Regarding the budget and planning, a number of actions were taken to keep NGI Trust relevant to the Commission priorities during the life of the project. For example, as the Covid-19 pandemic emerged "all coaches contacted their projects in order to assess the potential impact. Projects that planned pilots involving the public, as well as workshops and focus groups were affected the most. Where necessary, coaches recommended a project extension (within the existing budgets) which were then agreed between the projects and the coordinator."[3] This mitigation activity ensured that the projects remained relevant to the aims of NGI Trust and the Commission priorities, despite changes in activities.

Furthermore, during the project the NGI Trust consortium proposed amendments to the budget to increase relevance. This included e.g. a re-allocation of the external coaching budget: "The planned amount for subcontracting for coaching (38,250 euro) will also be reduced as the coaching is being done almost entirely in-house (aside from the limited involvement of one or two members of the AB to support)."[4] This enabled an increased number of projects to be funded and therefore makes NGI more relevant to the aims of the Commission.[5] When cross-analysing the NGI Trust aims and priorities with those of NGI generally, NGI Trust is therefore strongly aligned to the resilience, trust, and democracy pillars of the initiative.

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[2] https://wiki.geant.org/display/NGITrust/
[3] NGI Trust Interim Report
[4] ibid
[5] Please note that the effectiveness of in-house coaches is evaluated in other criteria (question 4 and 5) as it is more relevant to the effectiveness of NGI Trust.

- **Q2: To what extent does NGI Trust fulfil a relevant role vis-à-vis its beneficiaries?**

This question investigates the beneficiaries' motivations behind the application process and to what extents NGI Trust funds meet the needs of the beneficiaries.

Potential beneficiaries were reached by the NGI Trust consortium through Work Package 2 which aimed to ensure that the project call information was distributed as widely as possible within the community of research and innovation players and to select promising projects in line with the goals of NGI Trust and the NGI Initiative.

In support of this, NGI Trust collaborated with the NGI4ALL project communication team to feed information to the NGI.eu website including material for a blog. Two consortium members, EFIS and GÉANT, also participated in NGI communications groups coordinated by NGI4ALL.

Overall, communications with potential applicants were done via pre-existing contacts of the NGI consortium. This was supported by targeted work by each of the project partners via online and social media channels. These efforts were supported by a comprehensive stakeholder, research and business engagement strategy. The strategy was focused on:

- Identifying stakeholders
- Creating and analysing stakeholders' profiles
- Planning the engagement
- Engaging stakeholders
- Measuring effectiveness

The consortium made efforts to build new links with key multipliers such as the network of digital innovation hubs, European Technology Platforms (ETPs) and public-private partnerships working in the NGI field. The strategy in particular targeted SMEs and those from Central, Eastern and Baltic European countries. For example, a mapping exercise of organisations from Central and Eastern Europe, resulted in targeted emails sent to a mailing list encompassing a wide variety of stakeholders for the 2nd and 3rd Open Calls.[6]

These efforts resulted in a larger percentage of awardees from these categories compared to the first call, reflecting increased coherence with the NGI goals of inclusion and community-building. In the first call, 48% of awardees were SMEs, this dropped to 43% in the second call before rising to 61% in the third call. With regards to the representation of Central, Eastern and Baltic European countries among awardees, of the 13 countries in the first call, 1 was from these geographical areas (8% of awardees). Of the 14 countries in the second call, 2 were from these geographical areas (18% of awardees). Of the 16 in the third call, 2 were from these geographical areas (12% of awardees). Despite these efforts to branch out to a wider community, the interviews revealed that there was still a heavy reliance on personal contacts within the NGI consortium in order to reach potential applicants.

According to the online survey (

Figure 3), the motivations for applying to NGI Trust calls vary across participants and projects. The most common motivation shared by 67.3% of the project representatives is linked to **the amount of funding which turned out to be well-**

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[6] NGI Trust interim report

suited to the beneficiaries needs. Other relevant motivations include: application was driven an interest in ambitious, exploratory, and high-risk work (61.2%), conduct unique and original research (57.1%) and a desire to further develop existing research towards commercialisation (38.8%).

Furthermore, the interviews showed that **the lack of project funding especially at the national level** means that NGI-Trust responds to the needs of innovators operating in the field of trust and privacy technology and it is regarded by most interviewees as a flexible and tailored-made initiative for niche internet researchers and innovators. This is compounded by the flexibility of use of funds and the opportunity for both developing new fields of enquiry and to receive support provided by experienced coaches. Across the board, each project's motivation for applying for funding featured two elements**: the simple application process and the low bureaucratic overhead**.

Figure 3: Responses to the survey question: "Motivations for applying to NGI Trust calls (multiple choice)"
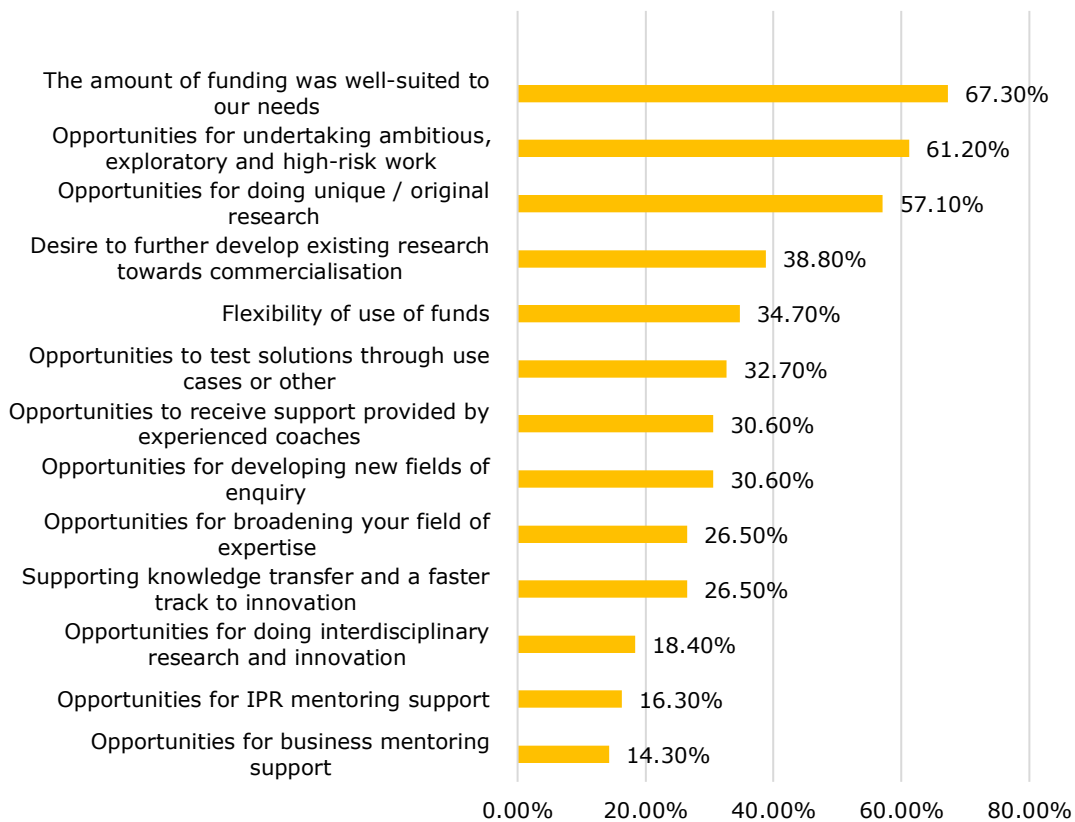
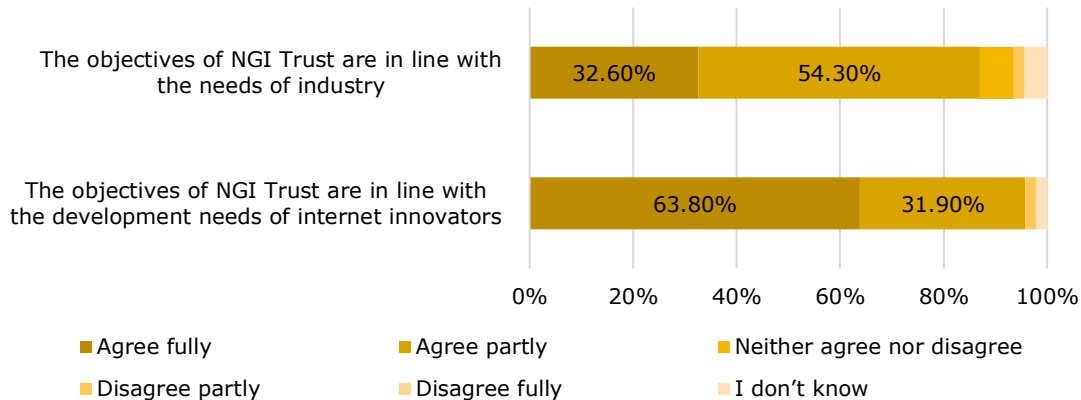*Source: VVA elaboration of the online survey results – sample: 46(min)-47(max) responses*

Almost all NGI Trust survey respondents believe that **the objectives of NGI Trust are in line with the development needs of internet innovators**, with 63.8% fully supporting this point of view and none fully disagreeing. At the same time, 32.6% of the survey respondents perceive the objectives of NGI Trust as being completely in line with the needs of industry, while 54.3% of them do to some extent.

Despite these positive results, interviewees generally considered the size of the grant to be appropriate for conducting feasibility/exploratory studies or test/pilot projects, but not for commercialization. Indeed, some interviewees commented that the grant could be complemented with the creation of a network of potential

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investors interested in privacy (a topic which is a "*dead angle*" for many investors) as it is complex to find research funds to conduct exploratory research or to bring concrete use cases to the market.
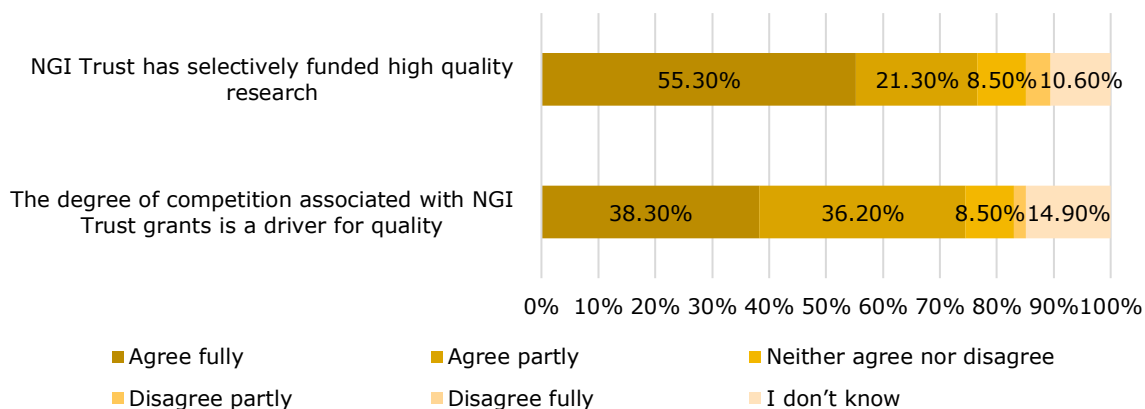
Table 3: Responses to the survey question: "To what extent do you agree with the following statements?"

The objectives of NGI Trust are in line with the needs of industry — 32.60% — 54.30%

The objectives of NGI Trust are in line with the development needs of internet innovators — 63.80% — 31.90%

- Agree fully
- Agree partly
- Neither agree nor disagree
- Disagree partly
- Disagree fully
- I don't know

Source: VVA's elaboration of the online survey results – sample: 46(min)-47(max) responses

Overall, interviewees were of the opinion that NGI Trust has been good at selecting high quality projects and that it has been successful in its objective to "Build on the state of the art in privacy and trust enhancing technologies by funding projects in priority topics". The results from the interviews are confirmed by the survey, where the majority of the respondents agree that "NGI Trust has selectively funded high quality research".

Figure 4: Response to the survey question: "NGI Trust has selectively funded high quality research" / "The degree of competition associated with NGI Trust grants is a driver for quality"

NGI Trust has selectively funded high quality research — 55.30% — 21.30% 8.50% 10.60%

The degree of competition associated with NGI Trust grants is a driver for quality — 38.30% — 36.20% — 8.50% 14.90%

- Agree fully
- Agree partly
- Neither agree nor disagree
- Disagree partly
- Disagree fully
- I don't know

Source: VVA's elaboration of the online survey results – sample: 47 responses

This, in turn, may also have a positive "*signalling impact*" on the beneficiaries, as the selection and participation in NGI Trust can convey "*high quality research*" to the internet privacy and trust enhancing tech ecosystem.

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2.3 Evaluation of Coherence of NGI Trust

- **Q3: To what extent are the projects selected in NGI Trust coherent with the overall Commission's initiative Next Generation Internet?**

In this specific question, the coherence of NGI Trust was assessed in two ways:

- Looking at the portfolio of funded projects (internal coherence);
- In comparison with other NGI initiatives (external coherence).

The aim was to understand how well or not NGI Trust worked and to highlight areas where there are synergies with other programmes or points of tensions.

In terms of project selection, each proposal was reviewed by (at least) 2 evaluators from within the consortium, with the option of a third review in cases where opinions conflict. For the third-round call, all type 3 projects were evaluated by three evaluators.[7] The evaluation criteria for project were the same for each of the three calls. 8 Overall, this was considered a robust method of evaluating applications and, although the scoping interviews revealed a need for calibration of different perspectives, this does not appear to have detracted from the quality of applications or range of topics selected.

In terms of the coherence of the criteria with the overall aims of the NGI Trust project, one of the key objectives of NGI Trust was to "*Foster the exploitation and commercialisation of the results of selected third-party projects through a tailored process of coaching and mentoring*". In order to encourage commercialisation as a result of the funding, the element of novelty/ innovation could have been separated out to directly consider wider innovation indicators from the applicant organisation (e.g., high-growth in revenue or staff, R&D spending). Given the variety of organisations applying, these indicators would obviously need to be carefully chosen.

In order to assess the internal coherence of NGI Trust, Figure 5 looks at the objectives pursued by the portfolio of funded projects to assess whether they were aligned with the overall NGI objectives.

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[7] Interim report

[8] The criteria were novelty/innovation (40% weighting), expertise and excellence of the proposed team (30% weighting), project planning and value for money (30% weighting)https://wiki.geant.org/display/NGITrust/ . Please refer to Q1 Relevance

Figure 5: Survey question: "What problem is your project/ solution attempting to address"?
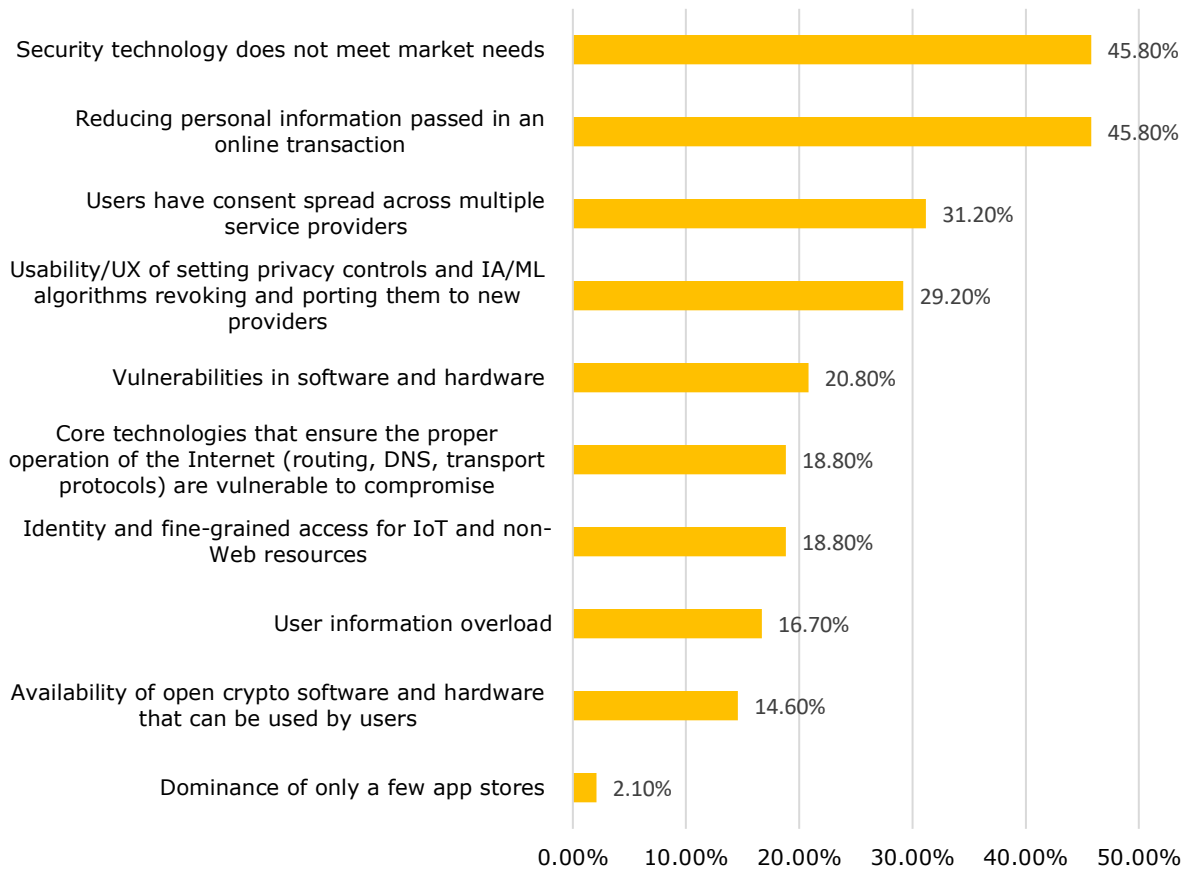
Source: VVA elaboration of the online survey results – sample: 1 (min) – 22 (max)responses

The plurality of the respondents commented that their project contributed to addressing the problem that "Security technology does not meet market needs" (45.8%) and "Reducing personal information passed in an online transaction" (45.8%).

In addition to the options included in the online survey, respondents commented that they have pursued other challenges in their projects including:

- **AI fairness** and using AI to detect rights and duties,
- Detection of **Cybersecurity threats from IoT devices**
- **Distributed intelligence** for IoT applications
- Making digital trust **more human**
- Making **self-sovereign identity** easy to use and understood in a community context
- **Scalability** to manage tens of millions of identities
- The need for **automated privacy protection**, so that users do not have to handle all security and privacy configurations ,
- Anonymization of **personal data**
- **Decentralized technologies new infrastructure paradigm**
- Lack of **data ownership tools**

In line with the priorities listed in NGI Forward's Working paper, "*a vision for the future internet*" [9], the funded projects clearly point towards enhancing "*trust in and on the internet*". From reading an article on social media to making an online payment, the selected projects attempt to identify innovative solutions to tackle trust and privacy issues, such as: more trustworthy models for online interactions (e.g. DISSENS), reliable information (e.g. CASPER), data-sharing (e.g. MW4ALL) and/or identity management (e.g. MYPCH).

The funded projects by NGI Trust clearly contribute towards the EU's objectives for the creation for a market for trustworthy technology by 2030 and making Europe a proactive developer of trusted solutions.

In addition, respondents to the survey were asked whether their projects contributed to developing Open-Source Software or Hardware. 64.7% of the projects contributed to Open-Source Software and 11.8% to both Open-Source Software (OSS) and Open-Source Hardware (OSH).

Figure 6: Responses to the survey question: "Has your project developed or contributed to developing Open-Source Software or Hardware" (single choice)
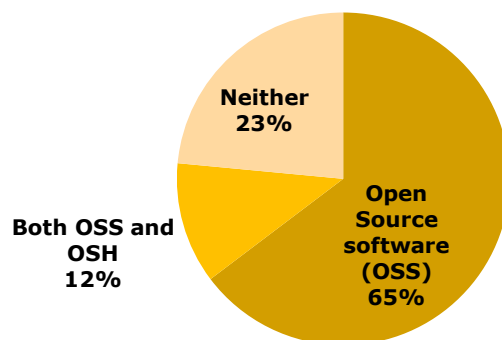
Source: VVA elaboration of the online survey results – sample: 51

These findings are in line with the Open-Source software strategy 2020-2023 of the European Commission and corroborate a recent study10 which states that OSH is lagging behind OSS. As most of the solutions were developed in open-source model, this also suggests that the results of the projects are dynamic, in the hands of a community and that useful research can be duplicated and re-used to effectively sustain the objectives of NGI Trust beyond the funding recipients. Indeed, several interviewees expressed their satisfaction from an academic point of view about having obtained sufficient funding to pursue research that is open source. They felt that this allowed them to contribute more effectively to the objectives of a Next Generation Internet by putting important technology and frameworks in the hands of the many.

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[9]Source: https://research.ngi.eu/wp-content/uploads/2021/02/Vision-for-the-future-internet-long-version-final-1.pdf
[10]Source : https://digital-strategy.ec.europa.eu/en/library/study-about-impact-open-source-software-and-hardware-technological-independence-competitiveness-and

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Based on the results of the online survey, the participants felt they were contributing to the objectives of NGI: out of 47 respondents, 27 (or 57.4%) fully agreed and 17 (or 36.2%) partly agreed that the objectives of NGI Trust are in line with the need to make the internet more human-centric and accessible to different groups in society (see Table 4).

Table 4: Responses to the survey question: "what extent do you agree with the following statements?"
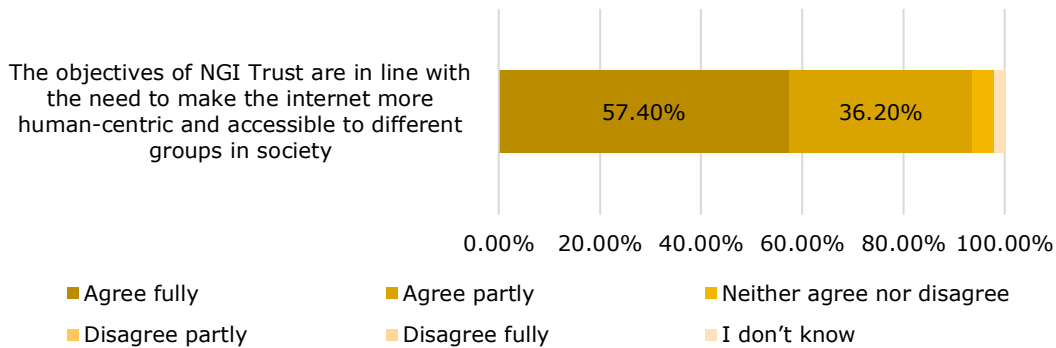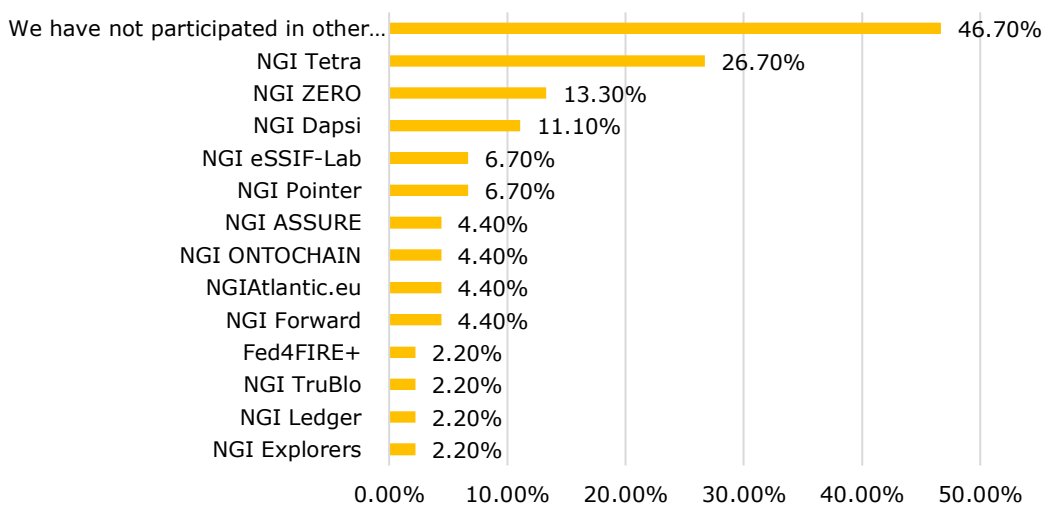

Source: VVA's elaboration of the online survey results – sample: 47 responses

The survey confirms that stakeholders believe NGI Trust has been good at selecting high quality projects. However, it must be said that the commercialisation element, which runs through NGI Trust and also the broader NGI initiative, could have been more strongly represented (please refer to Q5, for further analysis).

One further element to consider when evaluating whether the projects selected were coherent with the overall aims of the NGI initiative is the extent to which the projects showed engagement with other initiatives of NGI, i.e. its external coherence.

Figure 7 shows that a significant proportion (over 25%) of the respondents also participated in NGI Tetra. The reason is that NGI Tetra provided business support to third parties awarded via other NGI open calls, including Trust.

Figure 7: Survey question: 'Have you or your organisation participated in other NGI initiatives?'

Source: VVA's elaboration of the online survey results – sample: 1 (min) – 21(max) responses

By looking into the detail of projects funded under other NGI initiatives, a quick scan of the literature and sources for other NGI initiatives outlines the strongest potential synergies and overlaps with the initiatives in Table 5.

Table 5: Synergies and overlaps[11]

NGI Trust	**Human-centric Internet** through stronger European **ecosystem** of researchers, innovators and technology developers in the field of **privacy and trust enhancing technologies.**
NGI Ledger	Provides mentorship, guidance and direct grants to projects willing to build **human centric solutions** where citizens retain **control over their data.**
NGI-POINTER	Bottom-up projects that are able to build on top of state-of-the-art research, **scalable protocols and tools** to assist in the practical **transition or migration to new or updated technologies**
NGI DAPSI	Develop **human-centric solutions** in the **Data Portability field. T**o make significantly easier for citizens to have any data which is stored with one service provider **transmitted directly to another provider**
NGI Zero	High standards in terms of security, **privacy, accessibility, open-source licensing, documentation, etc.**
ONTOCHAIN	**Blockchain-based** knowledge management solutions that form part of its novel protocol suite and software ecosystem. Applications include **trustworthy web, social media, crowdsensing, service orchestration, and decentralised and unsupervised online social networks**
ESSIF-LAB	Advance the broad **uptake of SSI** as a next generation, open and trusted **digital identity solution** for faster and safer **electronic transactions via the Internet**, as well as in real life.

As can be seen in Table 5, there are a number of thematic overlaps with other NGI initiatives. The key distinguishing element therefore for NGI Trust is the grant scheme (i.e. type I, II and III) compared to the other initiatives.

There are two different approaches to technology among the funded projects. The first one applies to type I and/or II projects which research novel technologies that embed privacy and trust in various layers of the Internet. The second is to build use cases on proven and somewhat mature technologies to prove the feasibility and viability of privacy-based business models. Both approaches are complementary and needed to bring forward a next-generation internet.

Based on the opinions of stakeholders, synergies are to be found with NGI Tetra (via its business support to third parties) and with the NGI Zero project, which provided grants to individual researchers and developers as well as small teams to work on important new ideas and technologies that contribute to the establishment of the Next Generation Internet, in particular, free/libre/open-source software. In that sense, NGI Trust has selected projects that work well not only with its own focus but also show coherence with the focus of the whole NGI portfolio.[12]

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[11] This information was taken largely from https://www.ngi.eu/ngi-projects/
[12] NGI Tetra has been excluded from the list as its horizontal activities are intended to build on the activities across the NGI portfolio.

Overall, the projects funded by NGI Trust do overlap with the themes of other initiatives. Indeed, one of the NGI Trust projects did note that their reasons for not engaging with the optional business mentoring service was that they already had business mentoring services available through the ESSIF-Lab BOC1.13

However, the delivery methods for funding are sufficiently distinct. For example, the focus of ESSIF-LAB could be considered as overlapping with the NGI Trust DECIDE project and the DISSENS project but the focus of NGI ESSIF-LAB on infrastructure and the lab framework suggests that it remains distinct to NGI Trust. Similarly, NGI Ledger's themes are quite broad and do overlap with NGI, however its focus is on specific verticals (Health, Finance, Collaborative Economy, Public Services, Energy) and as such it retains a unique character.

In addition, the results of the survey are quite clear regarding the question of synergies and overlaps. For EU-level synergies, 66% of respondents either disagreed partly or disagreed fully that NGI Trust duplicates other funding. Figure 8 supports this conclusion, perhaps with the slight exception of NGI Zero. In fact, as also highlighted in the case studies, most stakeholders are not aware of similar funding opportunities in the field of trust and privacy technologies at the national level. NGI Trust, therefore, is perceived to fill a gap in funding in this specific technology research domain.

Figure 8: Survey question: "The NGI Trust funding duplicates those of other EU sources"?
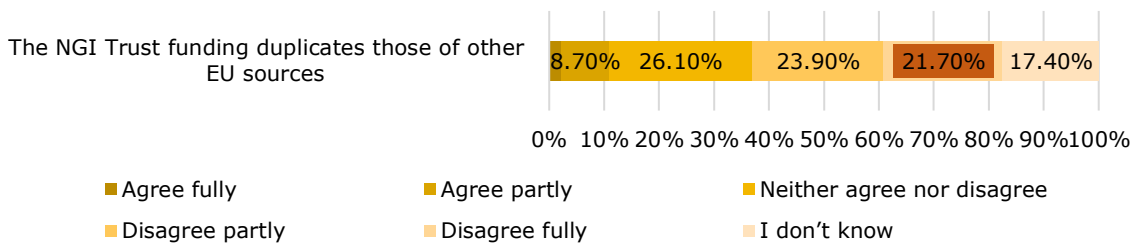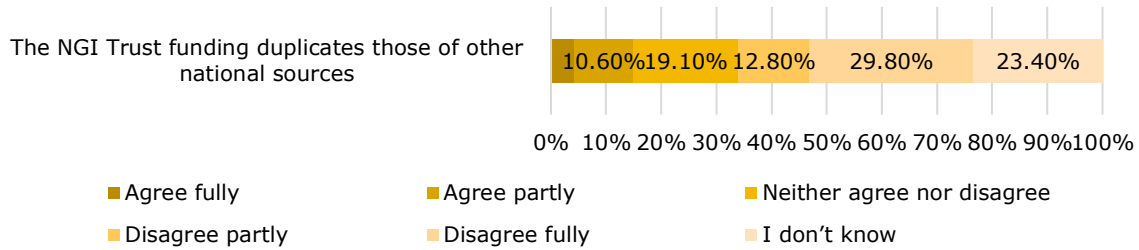

Source: VVA's elaboration of the online survey results – sample: responses

At the national level, Figure 9 shows a similar interpretation, with even fewer respondents seeing overlaps and a larger percentage (23%) unable to offer a view.

Figure 9: Survey question: "The NGI Trust funding duplicates those of other national sources"?

| The NGI Trust funding duplicates those of other national sources | 10.60% | 19.10% | 12.80% | 29.80% | 23.40% |

0% 10% 20% 30% 40% 50% 60% 70% 80% 90%100%

- ■ Agree fully
- ■ Agree partly
- ■ Neither agree nor disagree
- ■ Disagree partly
- ■ Disagree fully
- ■ I don't know

Source: VVA's elaboration of the online survey results – sample: responses

2.4 Evaluation of Effectiveness of NGI Trust

- **Q4: To what extent have NGI Trust's funding calls produced positive direct/indirect/spill-over effects among beneficiaries?**

The immediate direct effect that participation in NGI Trust had on its beneficiaries was the acceleration of their projects. This was assessed by looking at the Technological Readiness Level (TRL) of the proposed solutions at the beginning and at the end of the third-party projects (see

Table 6). Overall, NGI Trust projects have greatly improved the TRL of their proposed solutions throughout the grant period. At the beginning of the projects, 64.6 % of them were at an early-stage R&D level (TRL 5 or lower). The survey results show that only 15.6% of the projects remained in this stage by the end of grant period, while 42.2% reached TRL 5-6, 28.9% TRL 7-8 and 13.3% reached TRL 9.

Table 6: Responses for the survey question: "At which stage of the innovation process was your proposed solution?"

	Early stage R&D (TRL5 or lower)	**Demonstration and piloting (TRL5-6)**	**Operational technology moving towards practical and/or commercial viability (TRL7-8)**	**Tested and internet-scalable solution (TRL9)**
When your project began?	31 (64.6%)	14 (29.2%)	3 (6.3%)	0.0%
When the project finished?	7 (15.6%)	19 (42.2%)	13 (28.9%)	6(13.3%)

Source: VVA elaboration of the online survey results – sample: First question: 48 responses. Second question: 45 responses.

In addition, a small number of projects (six) were funded twice by NGI Trust. These projects mostly started from a more advanced stage of innovation, except one which started as early-stage R&D (TRL 5 or lower). All projects moved to a more advanced stage, with 1 project having achieved a tested and internet-scalable solution (TRL 9).

Table 7: Responses for the survey question: "If you were funded by NGI Trust twice, at which stage of the innovation process was your proposed solution for the second project".

	Early stage R&D (TRL5 or lower)	Demonstration and piloting (TRL5-6)	Operational technology moving towards practical and/or commercial viability (TRL7-8)	Tested and internet-scalable solution (TRL9)
When your project began?	1 (16.6%)	4 (66.6%)	1 (16.6%)	0
When the project finished?	0	1 (16.6%)	4 (66.6%)	1 (16.6%)

Source: VVA elaboration of the online survey results – sample: 6 responses.

All survey participants confirmed that the achievements of their NGI Trust project were well aligned with their initial expectations except for two project which regarded their achievements as "'below expectations" (see

Figure 10). Additionally, eleven survey respondents, representing approximately 30% of total respondents, expressed the opinion that their initial expectations were surpassed in terms of achievements. For instance, DISSENS achieved the publication of a research paper in peer-reviewed journal, that was not initially foreseen as a project output.

Figure 10: Reponses to the survey question: "How would you rate the achievements of your first NGI Trust project compared to the expected outcome?"
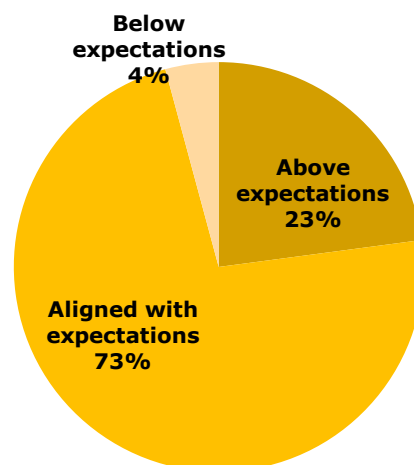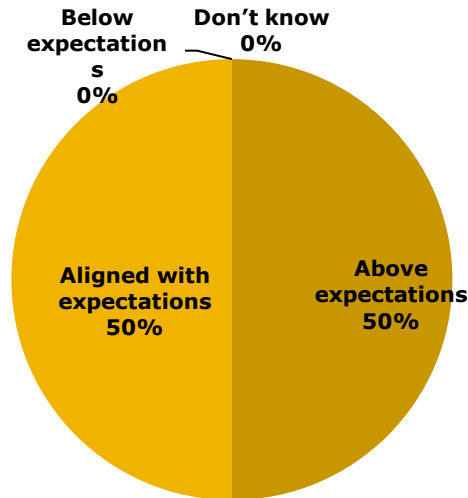

Source: VVA elaboration of the online survey results – sample: 48 responses

This perception of having achieved positive results is even more pronounced for the six projects that were funded twice. Regarding their expectations compared to the expected outcomes, none of the projects rated the achievements as "below expectations" and half of the projects surveyed rated their achievements as "above expectations" or "aligned" with those.

Figure 11: Responses for the survey question: "How would you rate the achievements of your second NGI Trust (if applicable) compared to the expected outcome?"

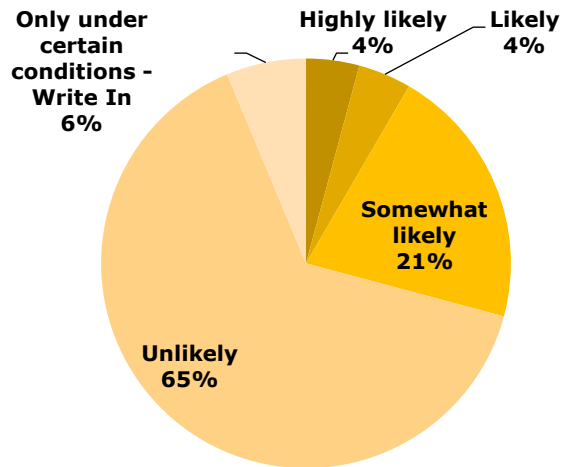*Source: VVA elaboration of the online survey results – sample: 6 responses*

According to the interviews conducted, the positive feedback from the funded projects is partly due to the support of NGI coaches that was greatly appreciated by each project that benefitted from this service.

For those beneficiaries who expressed more negative views, these were mainly attributed to the consequences of the Covid-19 pandemic. For instance, some groups had to reduce the size of their user studies, delaying product uptake, and eliminating the possibility of testing software on persons and in trade fair gatherings which were all cancelled. Nonetheless, according to the interviews conducted, the majority of the projects were not strongly affected by the pandemic as there were online tools to conduct remote work.

Overall, it can be concluded that NGI Trust has been successful in its objective to boost R&D projects in privacy and trust enhancing technologies. The online survey results show that 65% of respondents said that they would not have been able to achieve the same or similar results for their solutions without NGI Trust funding and only 4% think it is highly likely that they would have achieved the same or similar results (see Figure 12).

Figure 12: Responses for the survey question: "Would you have been able to achieve the same or similar results for your solution without the NGI Trust funding?"

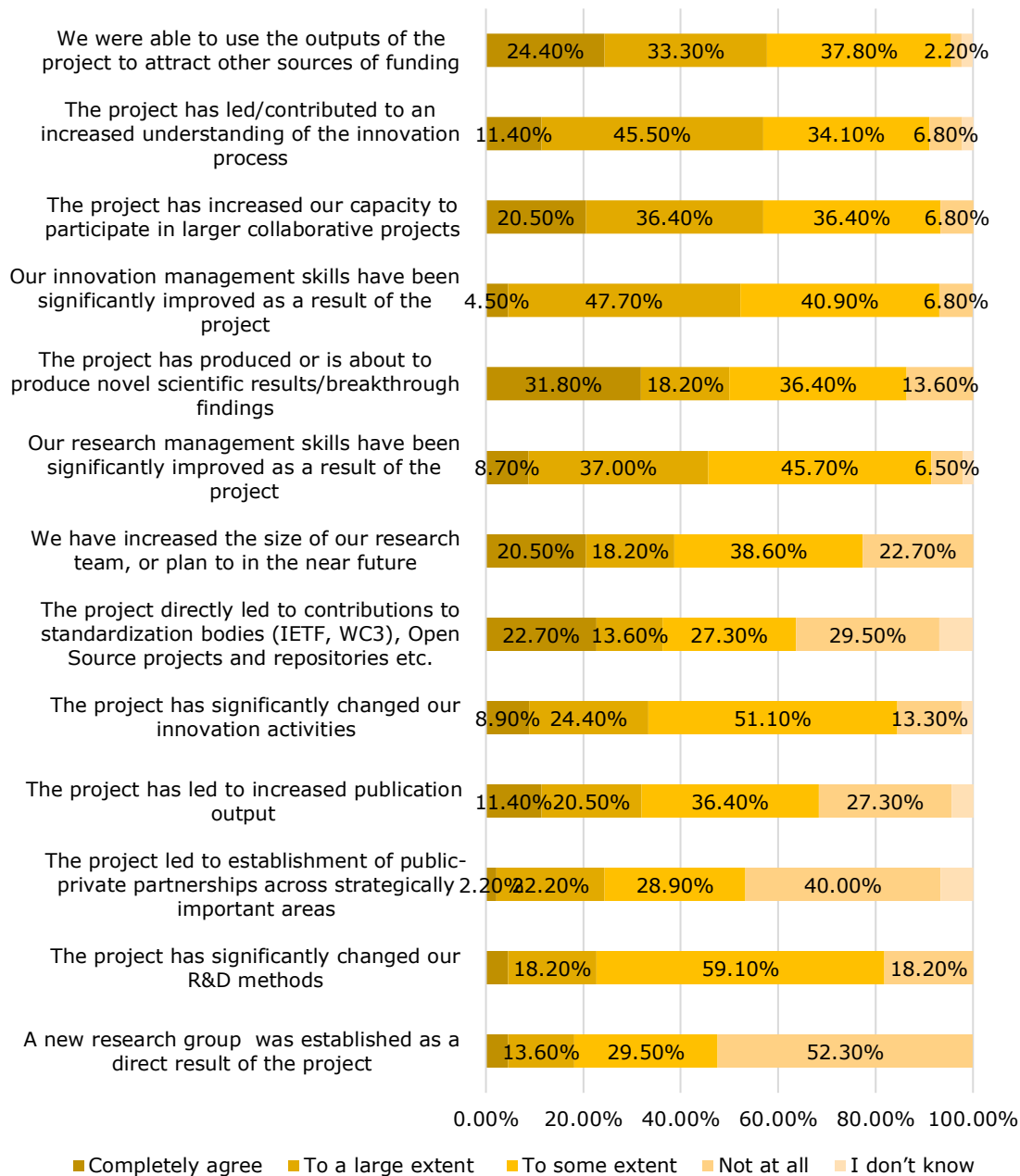*Source: VVA elaboration of the online survey results – sample: 48 responses*

Besides progression of their solution towards commercialisation or deployment, a large number of survey respondents (86.4%) said that they had produced or were about to produce novel scientific results/breakthrough findings (see **Error! Reference source not found.**). Another aspect shared by almost all survey respondents (95.6 %) is that **NGI Trust enhanced their capacity to use the outputs of their projects to attract other sources of funding**. For instance, after participation in NGI Trust, the project CUBBIT closed a €7 million funding round to continue its development, research and conduct the market tests needed to reach an actual system proven in operational environment (TRL9) and to support the growth of B2C and B2B Sync&Share cloud services.

The NGI Trust initiative allowed beneficiaries to **present their technology to a broader network** of innovators, leading researchers and technology experts. 93.3 % of respondents in the survey indicated that it increased their capacity to participate in larger collaborative projects and building new partners.

Moreover, NGI Trust had a positive impact on **improving innovation capacity** and research management competences among the third-party projects and most importantly, NGI Trust significantly improved their internal organisational structure and coordination. According to the interviews conducted, this was done through expanding their knowledge of different business models, codesigning products and gathering expert insights about how to best design a privacy-oriented product and to gain a better knowledge of the innovation process related to their specific sector (as most participants were solely approaching their projects from a technical perspective).

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Figure 13. Reponses to the survey question: "Besides progression of your solution towards commercialisation or deployment, what are the other important outcomes of NGI Trust's funding on your work?"

	Completely agree	To a large extent	To some extent	Not at all	I don't know
We were able to use the outputs of the project to attract other sources of funding	24.40%	33.30%	37.80%	2.20%	
The project has led/contributed to an increased understanding of the innovation process	11.40%	45.50%	34.10%	6.80%	
The project has increased our capacity to participate in larger collaborative projects	20.50%	36.40%	36.40%	6.80%	
Our innovation management skills have been significantly improved as a result of the project	4.50%	47.70%	40.90%	6.80%	
The project has produced or is about to produce novel scientific results/breakthrough findings	31.80%	18.20%	36.40%	13.60%	
Our research management skills have been significantly improved as a result of the project	8.70%	37.00%	45.70%	6.50%	
We have increased the size of our research team, or plan to in the near future	20.50%	18.20%	38.60%	22.70%	
The project directly led to contributions to standardization bodies (IETF, WC3), Open Source projects and repositories etc.	22.70%	13.60%	27.30%	29.50%	
The project has significantly changed our innovation activities	8.90%	24.40%	51.10%	13.30%	
The project has led to increased publication output	11.40%	20.50%	36.40%	27.30%	
The project led to establishment of public-private partnerships across strategically important areas	2.20%	22.20%	28.90%	40.00%	
The project has significantly changed our R&D methods	18.20%	59.10%	18.20%		
A new research group was established as a direct result of the project	13.60%	29.50%	52.30%		

Source: VVA elaboration of the online survey results – sample: 44 (min)-46(max) responses.

According to the survey, participation in NGI Trust failed to some extent to create "new research groups as a direct result of their work" and to "establish public-private partnerships across strategically important areas": respectively 52.3% and 40% of respondents declared that NGI Trust had not contributed to this outcome at all.

Beyond the grant period (Figure 14), 75.6% of the survey respondents stated to have a defined business strategy for further development of project results and 73.3% confirmed to have a detailed research strategy for further development of their

solution. Also, most respondents confirmed their intent to participate in other EU NGI initiatives (82.2%).

Figure 14. Responses for the survey question: "Beyond the grant period…".
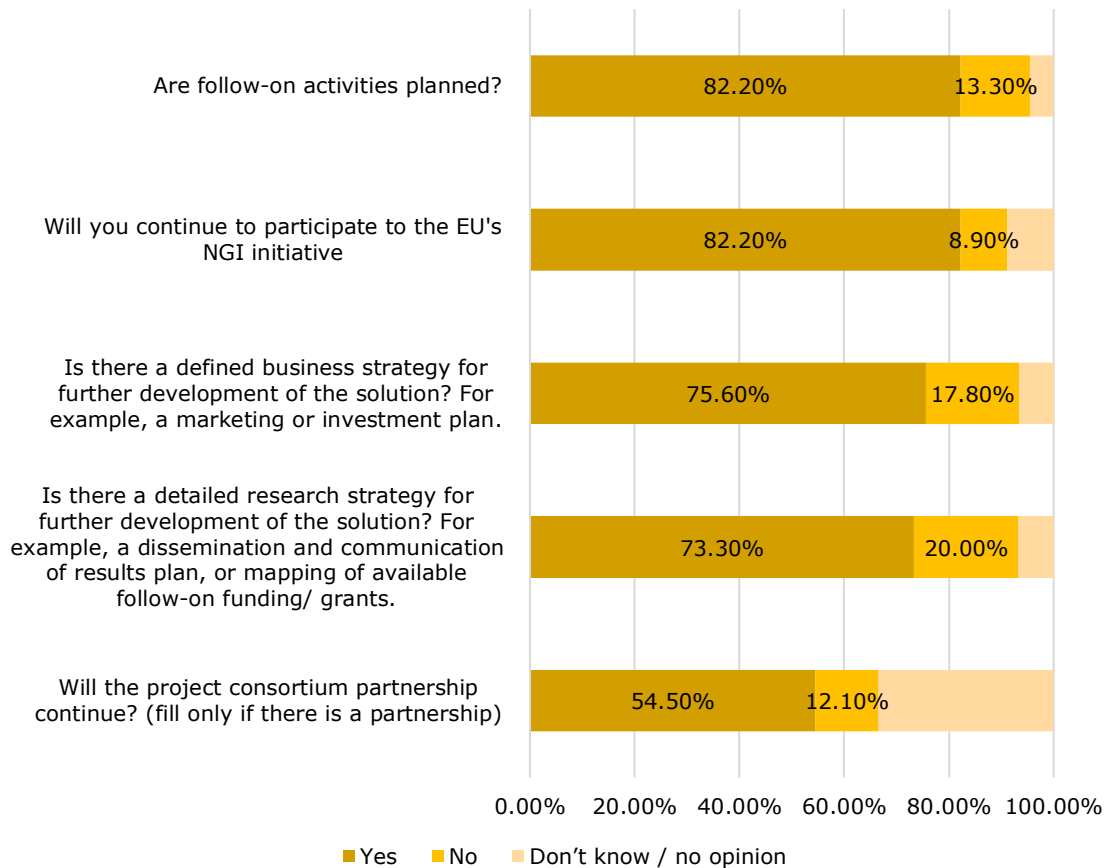
Source: VVA's elaboration of the online survey results –sample: 33(min)-45(max) responses

As highlighted in Table 6, there is more uncertainty about whether the project consortium partnerships will continue beyond the grant period or not. According to the interviews, this uncertainty mostly holds true for partnerships involving public and private organisations, due to the different missions/objectives that the two pursue. For example, in the project DISSENS, the Fraunhofer institute has integrated the knowledge it acquired into its consulting services and is planning to exploit DISSENS in this way, whereas the project partner TALER is looking to commercialise the output of its project.

- **Q5: To what extent can the projects selected in NGI Trust contribute to a more "*resilient, trustworthy and sustainable internet of human value*"?**

Overall, the participants fulfilled the working plans they committed to and the feedback provided by the final and coaching reports seem to indicate that participants delivered on the technical part of their projects. From Q4, it is possible to conclude that NGI Trust was effective in fostering technological improvements, in terms of TRLs passed by the projects and most of the beneficiaries have a plan to develop their solutions further beyond the grant period.

However, the effectiveness of NGI Trust is limited if the projects cannot find a sustainable model to generate future revenue, which in turn depends on the targeted markets and the business model adopted.

In terms of markets, out of 47 respondents, 22 or 45.8% answered that their project bridged the gap between security technology and market needs in that technology. 22 respondents replied that their solution would reduce the amount of personal information passed on in an online transaction. The second thematic area that emerges from the survey results of question 8 is the notion of consent management and privacy settings. 15 respondents or 31.3% answered that their solution addressed the issue that "Users have consent spread across multiple service providers" and 14 devoted their efforts to introducing "Usability/UX of setting privacy controls and IA/ML algorithms revoking and porting them to new providers". The rest of the options had less than 10 answers. Furthermore, 13 respondents, or 27.1% of the total responded that their project did not tackle any of the listed problems.

Figure 15 shows that most respondents found that their project's geographical applicability was global (83.7%; hence 41 respondents) which suggests that the reach of NGI Trust third party projects is not geographically constrained to Europe.

Figure 15: Responses to the survey question: "What is the geographical applicability of your solution?" (Multiple choice)
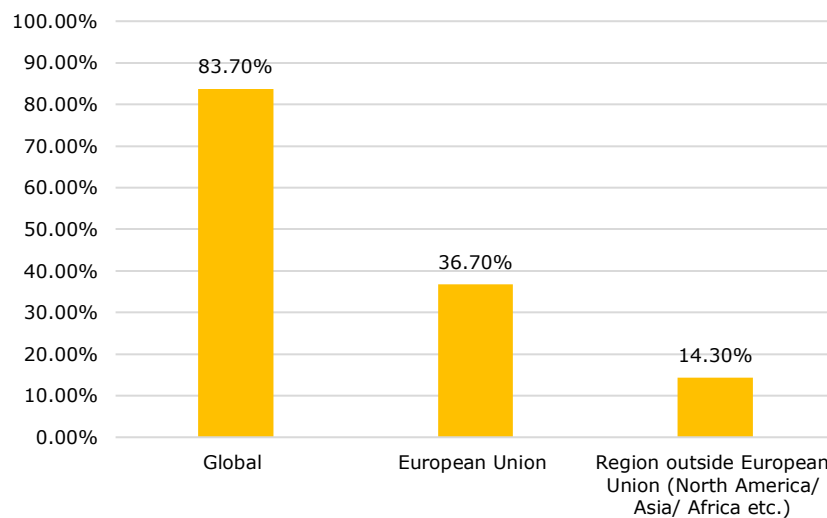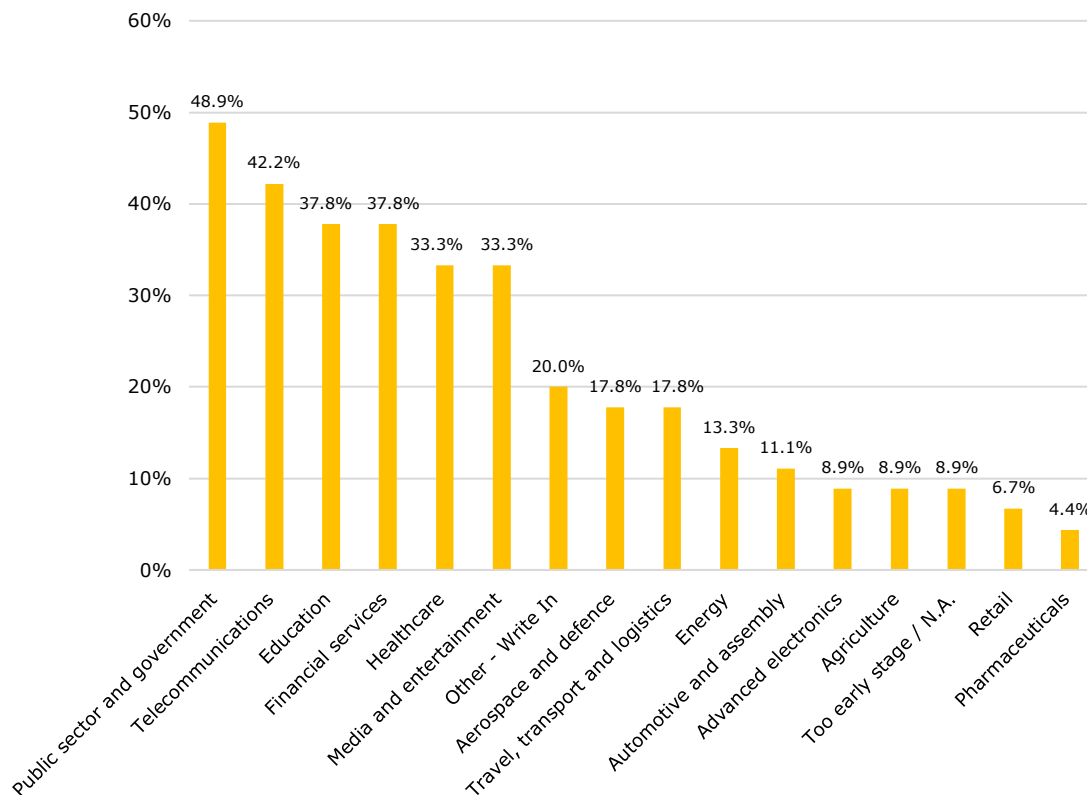

Source: VVA elaboration of the online survey results – sample: 47

In terms of vertical applications, the survey concludes that the projects are relevant to a variety of industries. Figure 16 asked respondents in which industries they would expect their technology to have a likely application. Every industry that was suggested in this question was represented but a few industries dominate with more than 30% of the respondents finding that their solution could be applicable there. These are: public sector (48.9% or 22 respondents), telecommunications (42.2% or 19 respondents), education and financial services (both 37.8% or 17 respondents), healthcare and media & entertainment (both 33.3% or 15 respondents).

Figure 16: Responses to the survey question: "In which industry (-ies) would you expect to have a likely application of your innovation/technology?" (Multiple choice possible)

Source: VVA's elaboration of the online survey results – sample: 47

The remaining industries – namely aerospace & defence, agriculture, automotive & assembly, energy, pharmaceuticals, retail, travel, transport & logistics - were under-represented to some extent with less than 10 respondents finding their innovation applicable to the field. Furthermore, 9 respondents or 20% of the sample for this question found that their technology addressed another industry such as construction, law, IT services or even that their technology was horizontal (IoT; cloud; cybersecurity; private blockchain) and indirectly applicable to a broad range of sectors.

Overall, the answers of the survey seem to indicate that NGI Trust funded projects tackle global problems concentrated in three domains:

• Bridging the gap between security technology and market needs in that technology;
• Reducing the amount of personal information passed on in an online transaction; and
• Consent management and privacy settings addressing the issue of "Users have consent spread across multiple service providers"

In terms of vertical applications, most of the solution see the public sector as the primary target, followed by telecommunications, education and financial services.

In order to further investigate the sustainability of the funded projects, the assessment explored the business model that project participants intend to adopt.

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As the internet relies on several layers of both software and hardware infrastructure, it is paramount for NGI Trust to address not only a variety of industries but also different technologies to bring trust and privacy by design to every corner of the Internet infrastructure. Figure 16 asks respondents to which categories of technology their solution belongs, allowing for multiple selections. There is a strong heterogeneity in the technologies developed by the third-party projects and an emphasis on privacy-enabling technologies such as software engineering, standards, protocols, interoperability, cryptography, algorithms, and proofs (29 respondents or 63% of the sample) and decentralised solutions including blockchain and distributed ledger technologies (19 respondents or 41.3% of the sample).
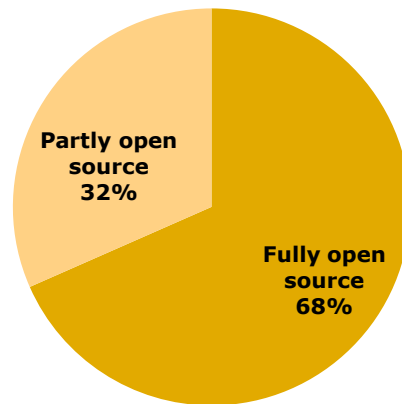
Figure 17: Responses to the survey question: "Which of the categories below best describe the concrete applications that your solution may have in the industry?" (Multiple choice)
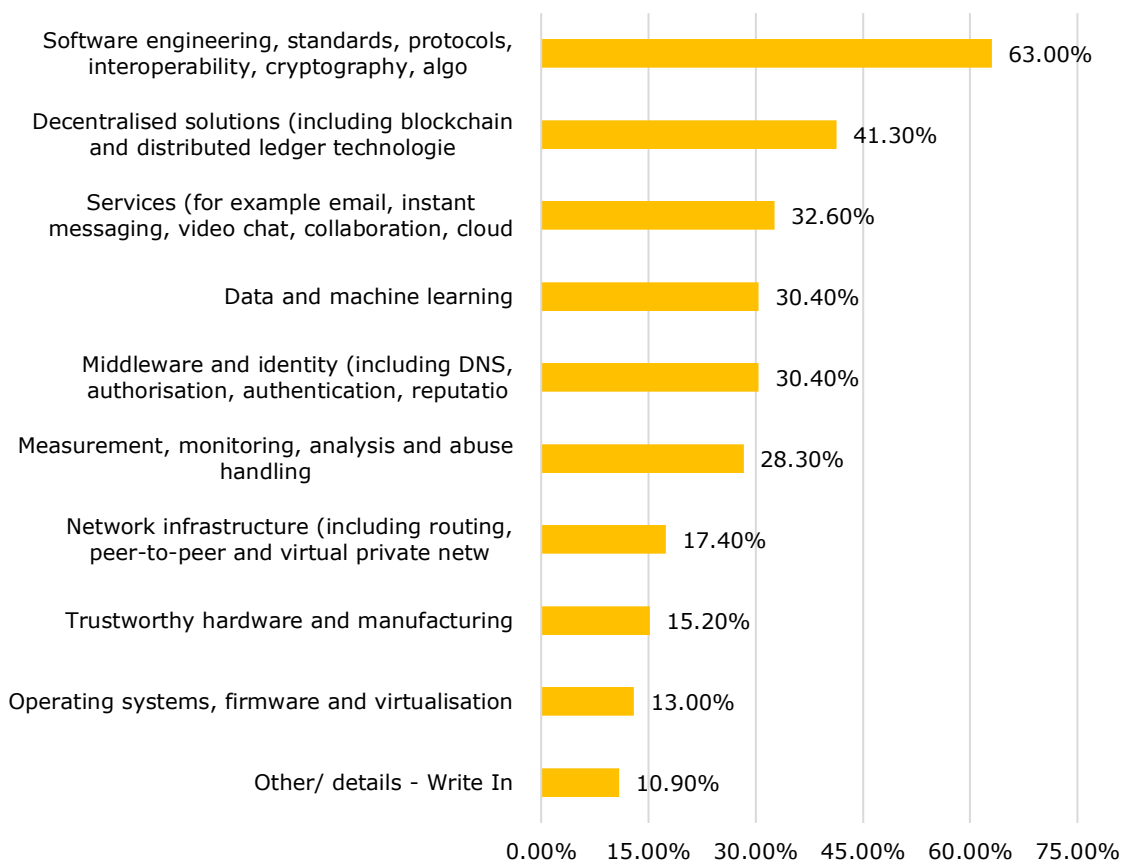
Source: VVA's elaboration of the online survey results – sample: 47

In terms of intellectual property exploitation, Figure 18 shows that 38 respondents replied that their solution was at least partly Open-Source and 26 respondents (or 68.4%) answered that their solution was fully open source.

Figure 18: Responses to the survey question: "To what extent is your solution open source?" (single choice)

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Source: VVA's elaboration of the online survey results – sample: 38

The reason for this result can be twofold:

- It is paramount for NGI to contribute to OSS to create a community of stakeholders in the field of Privacy and Trust Enabling (PET) technologies and to promote know-how sharing and collaboration. According to the European Commission, the diffusion of OSS has a positive and statistically significant effect on the creation of additional ICT start-ups.
- Findings from the case studies highlight that most of the participants see their solutions embedded in an existing product/service rather than a stand-alone solution. OSS allows developers and researchers external to the project to use and extend features of the solution to develop practical use-cases. This result combined with the fact that the majority of the projects did not yet reach a commercially viable solution (TRL < 9) made beneficiaries opt for OSS.

Figure 19 verifies how the projects intends to generate revenues and by which means. The most frequent answer with 29 respondents was to provide the solution or application in a Software as a Service model with some nuances. Indeed, out the 29 respondents opting for a SaaS model, 14 choose to implement a paid subscription model while 15 favour a freemium service with some features available for free or on a pay-per-use model. The second most favoured model with 18 respondents is to provide professional services such as consulting or training on top of the OSS or OSH. However, several respondents are counting on more uncertain sources of revenues that might not allow them to remain viable over the longer term such as crowdfunding (7 respondents) or donations (10 respondents). 11 respondents also answered that they would use other ways of generating revenues to sustain their Open-Source project but they did not substantiate this in more detail.

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Figure 19: Responses to the survey question: "If your solution/application is open source, what type of business/sustainability model(s) will you use?" (Multiple choice)
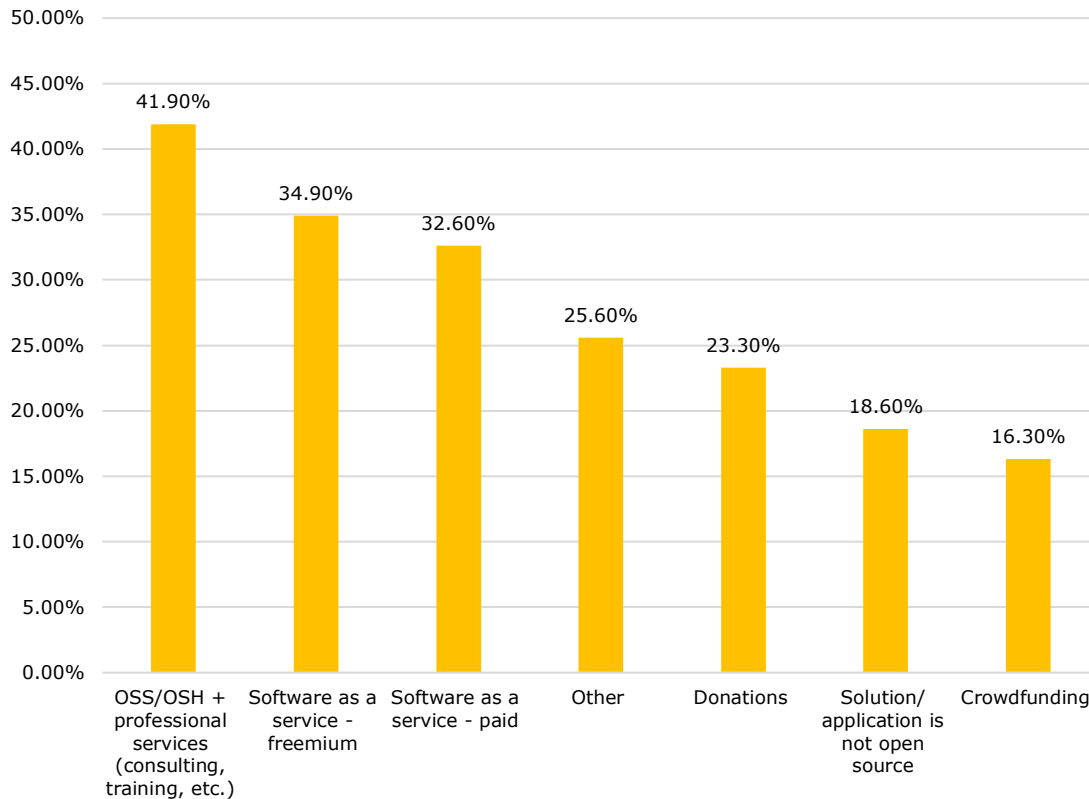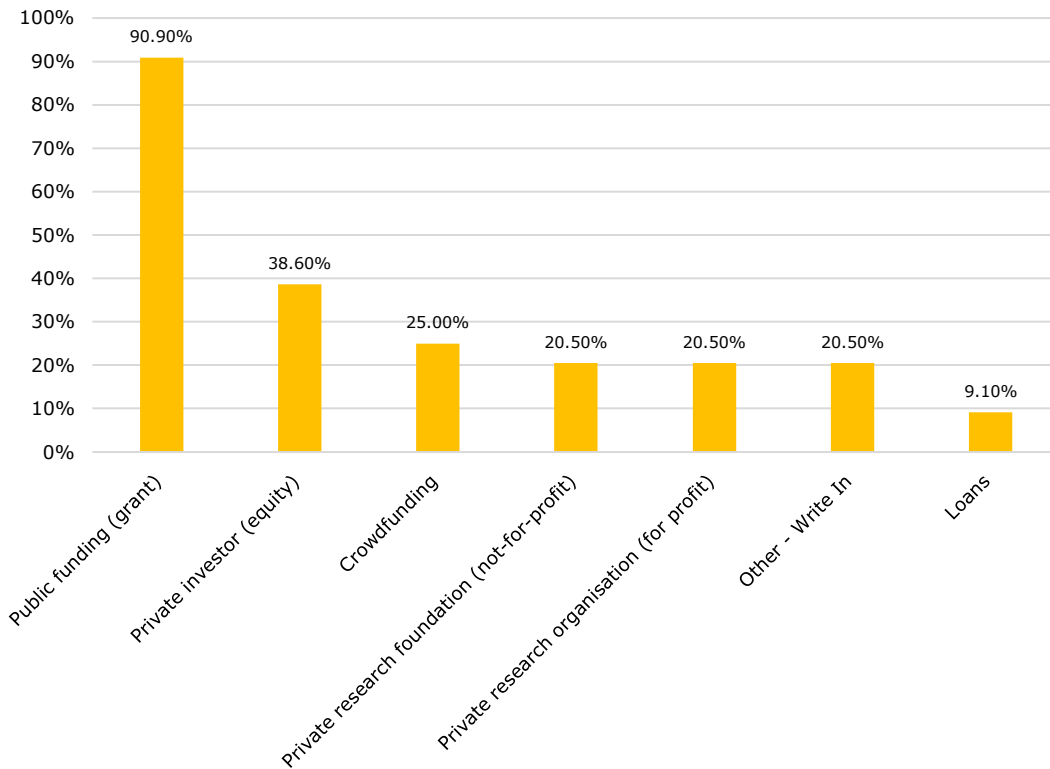

Source: VVA's elaboration of the online survey results – sample: 47

For the immediate future, the projects are developing ways to financially support their solution after the grant has ended (Figure 20). The most popular route after the grant is to apply for public funding (90.9% of survey respondents and also confirmed in interviews). 38.6% of survey respondents plan to secure equity financing and are in the process of raising capital to guarantee their sustainability. Other expected options include crowdfunding and seeking funding from private research foundations and organisations.

Furthermore, the case studies founds that some projects envisage self-funding through other revenue sources, e.g. subscriptions, supporter share funding (co-operative member finance), company's internal financing, freemium offering, and consulting.

Figure 20: Responses for the survey question: "How do you plan to support your solution financially after the grant has ended? (multiple choices possible)"

Source: VVA's elaboration of the online survey results –sample: 4(min)-40(max) responses

This need for further grants should be read jointly with the fact that most of the projects did not reach a commercially viable product/service (TRL<9), and they need additional research work before becoming "investment-ready" to secure financing from the financial market.

Considering that most of the solutions developed see the public sector as their main client, it was commented that further stimuli could come from the cooperation with public institutions. Different forms of public procurement for innovation, in which the public sector uses its purchasing power to act as an early adopter of innovative solutions which are not yet available on large scale commercial basis, could be explored.

One participant also suggested a fourth stage beyond commercialization to help NGI Trust funded projects cooperate among themselves and create interoperability between their technologies in order to create an ecosystem that might more effectively bring forward a Next Generation Internet. The worry that some participants voiced is that channelling funding to isolated and individual projects could be inefficient as a share of them could never go beyond the MVP stage and reach the market.

For future funding opportunities, some beneficiaries commented that the following issues should be investigated further: standardization, decentralisation, and interoperability.
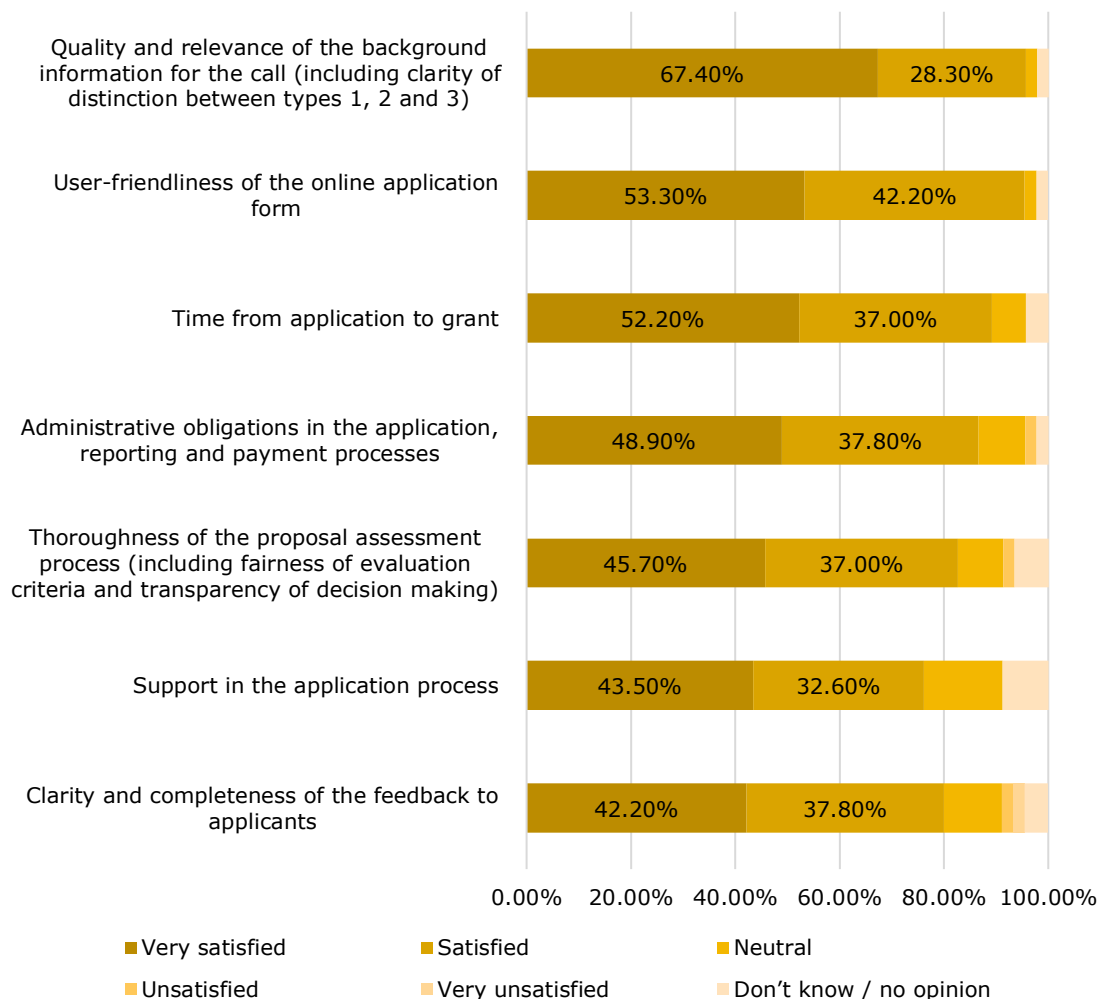
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2.5 Evaluation of Efficiency of NGI Trust

- **Q6: To what extent does the NGI Trust's rationale for funding and funding procedures result in an efficient system?**

This evaluation question informs about the grant process and the coaching sessions and whether they have efficiently addressed the expectations of the beneficiaries as well as respected the specifications of the European Commission.

The results are largely based on the online survey, where respondents were asked to provide their **satisfaction level**. The funding instruments are efficiently tailored to the needs of the third-party projects and relevant for them. Indeed, out of 46 respondents, no one was left dissatisfied with the quality and relevance of the background information for the call (including clarity of distinction between types 1, 2 and 3) while 13 were satisfied and 31 very satisfied. Indeed, according to the survey, only 12% of respondents decided to change the type of funding they were applying for during the application process.

Figure 21: Responses to the survey question 26 – "What is your level of satisfaction on the following aspects?"

Source: VVA's elaboration of the online survey results – sample: 46 (min) – 47 (max) responses

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The online platform provided by the NGI Trust consortium also was successful in facilitating cooperation between the stakeholders of the project and the consortium and 53.3% of the survey participants found it very satisfying. However, some respondents suggested using more dynamic tools and "start-up friendly" collaboration platforms such as Slack, Discord or Rocket.Chat to bolster the interactions between consortium and project teams and among projects. The Consortium should also envisage the creation of a dedicated online platform for the submission of the proposals and project outcomes such as the final report instead of managing it through email.

Concerning the application process, most participants were very satisfied with it. 43.5% were very satisfied with the support provided by NGI Trust (resp. 32.6% were satisfied); 45.7% were very satisfied with the thoroughness of the assessment process, including fairness of evaluation criteria and transparency of decision making (resp. 37% were satisfied) and 52.2% found the feedback provided clear and complete (resp. 37% were satisfied with the feedback). There is thus ample evidence of the efficiency of the application and funding process.

Furthermore, from an administrative standpoint, more than half of the participants were very satisfied with the time lapse between the application and the grant (52.2% or 24 respondents) and 48.9% or 22 respondents were very satisfied with the level of administrative obligations (resp. 37.8%, or 17 respondents were satisfied). Indeed, many participants congratulated on the good balance that the consortium was able to strike between the size of the grant and the paperwork required to access it. Based on feedback from the case studies and final reports, almost every participant found that the deliverables were straightforward and that they did not create disproportionate overheads.

Concerning stakeholder views about the **funding process**, based on feedback provided in the Final Reports and case studies, participants were globally very satisfied with the timely disbursements made by the NGI Trust consortium and the payment schedules that were offered in the funding process. It was clear, easy and well-suited for launching new ideas and products. The methodology of cascading funds was validated by the beneficiaries and the execution from the consortium regarded as robust.

Concerning the coaching sessions (Figure 22) the survey suggests that they were all useful, both mandatory technical coaching and optional business and/or IP coaching. Based on the findings from the case studies, a reason for the lower grades on the usefulness of the mandatory coaching sessions (1 grade of 1/5, 4 grades of 2/5 and 8 grades of 3/5) could arise from the difficulty to find experts with the technical competencies for some of the niche technologies that the projects were involved with.

Figure 22: Responses to the survey question: "How would you rate the usefulness of the mandatory technical coaching sessions?" (5=very useful/ 1= not useful at all)
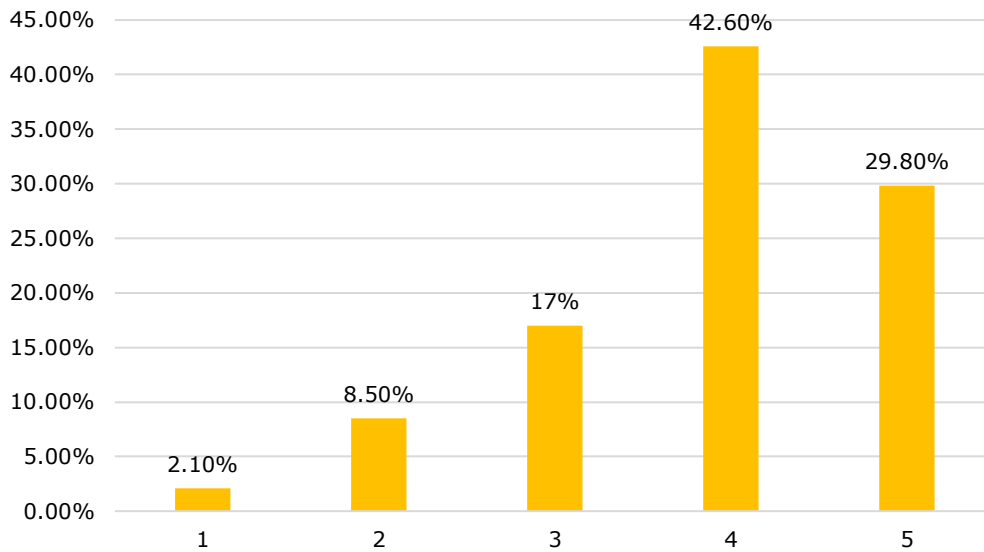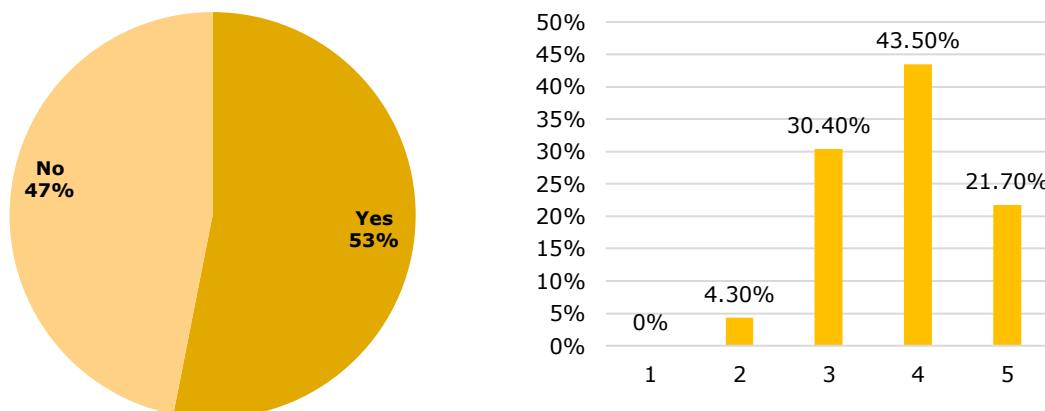

Source: VVA's elaboration of the online survey results – sample: 46 (min) – 47 (max) responses

Approximately half of the projects participated in the **optional mentoring sessions** (53% for the optional business mentoring - Figure 23 - and 49% in the optional Intellectual Property Mentoring –

Figure 24) and based on the case studies, participants only signed up for the optional coaching that had value to them.

The conclusion drawn from the case studies is that Intellectual Property mentoring was proportionately attended more by type I and II projects while business mentoring was privileged by type III projects.

Figure 23: Responses to the survey questions: "Did you take advantage of the optional business mentoring service offered by the NGI Trust consortium?" (left) & "How would you rate the usefulness of the business mentoring sessions?" (right) (5=very useful/ 1= not useful at all)

Source: VVA elaboration of the online survey results – sample: 49

Figure 24: Responses to the survey questions: "Did you take advantage of the optional Intellectual Property mentoring offered by the NGI Trust consortium?" (left) and "How would you rate the usefulness of the Intellectual Property mentoring sessions?" (right) (5=very useful/1= not useful at all)
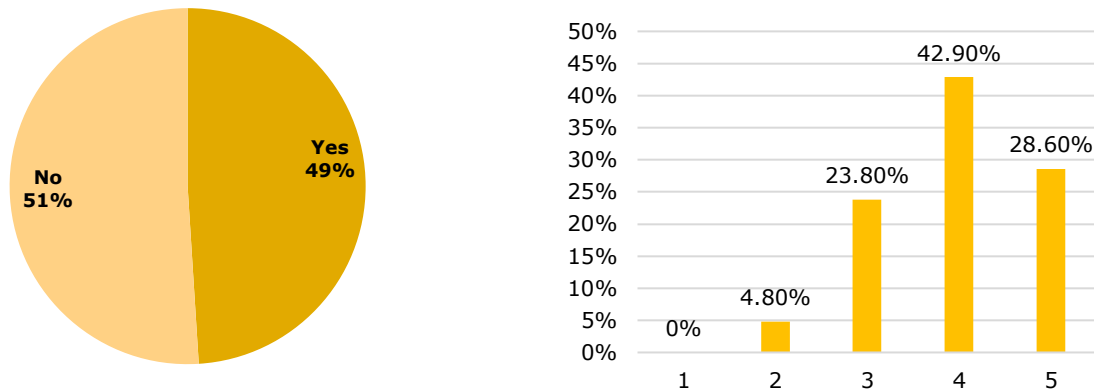
Source: VVA elaboration of the online survey results – sample: 46 (min) – 47 (max) responses

The feedback from the survey suggests that making the mentoring participation voluntary was an efficient formula as optional mentoring sessions were found to be very useful by the partners. For the optional mentoring, potential explanations for lower grades could be that the heterogeneity of participants in terms of maturity on intellectual property or business development forced the coaches to take a high-level perspective without being able to address specific issues that mattered to the projects. A suggestion made by one participant to improve the mentoring would be for participants to identify the knowledge gaps that relate to their projects before the selection of coaches - this would then allow NGI Trust to select the most appropriate advisors.

Other participants interviewed in the case studies explained that the time lapses between mentoring sessions were too long to have a proper sparring partner to help the project grow and they would have liked closer monitoring while some respondents also regretted the remote format imposed by the pandemic. A few project participants also mentioned in the case studies that despite the lack of capacity of coaches to help them on the technical aspects, they were able to challenge them in other areas such as project management and technical task coordination which they found very useful.

The results suggest that, while the societal, topical, and technical elements of the projects were overall covered with the broader aims of NGI[14], effectiveness with commercial element may be improved. The mentoring guidelines noted how "*All NGI Trust coaches are highly experienced and know how to engage best with the third-party projects assigned to them.*" A number of case study projects revealed that the potential downside of this flexibility was that the purpose of the mentoring sessions was not always clearly explained early on in the project. In most cases the mentoring overall found an equilibrium as the project progressed. Most

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[14] See, for example, the brochure for NGI which states 'With an investment plan for the next 10 years, the NGI initiative will shape the development of an Internet that is trustworthy, open, and that contributes to a more sustainable and inclusive society. It will also be an essential driver for the long-term competitiveness of the European economy. Accessed via: https://www.ngi.eu/wp-content/uploads/sites/48/2019/09/NGI-for-an-Internet-of-Humans-1.pdf

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importantly, the lessons learned from the mentoring must be fully integrated into an updated set of mentoring guidelines. These mentoring guidelines should not only outline what coaches can offer but also how this offer can be effectively communicated to third party projects. In this way, it can be explained more clearly what third party projects can expect from their coaches. This will increase the coherence of the activity with the other aims of the NGI Initiative, beyond technical and topical support.

The case studies also allowed to identify **potential levers to increase the efficiency of the NGI Trust scheme**. For instance, the case study participants suggested that even more flexibility could be introduced. For instance, instead of the cascading calls, further funding could be granted based on achievements by the projects. This would also avoid locking exploratory projects into rigid work packages and allow participants to explore new directions and opportunities arising from their findings, especially in such an exploratory field as Privacy and Trust enhancing technologies. Despite these suggestions, participants signalled that the NGI consortium was able to accommodate quite well modifications to the initial plans if they were backed up by sound evidence and argumentation which mitigated the inherent rigidities of cascade funding.

3 Lessons Learned

This section presents main lessons learned from the NGI Trust project implementation, which should serve as basis for improvement in future calls.

3.1 Communication and Dissemination

- Ensure that projects budget a small amount for dissemination activities and are aware of any obligations regarding communications.
- Include participation in **marketing activities** in third-party project agreements.
- Grow the use of **NGI4ALL as the central communications** activity and minimise individual communication work within the NGI family.
- Focus project communication efforts on grant promotion and take on a strong role as a funder, not a promotional channel.
- Reconsider the **lack of a gender diversity target for NGI projects**, particularly for projects representing elements of identity.
- Provide guidance to third-party projects regarding logo image styles and formats, especially when these are to be included in official NGI documentation.

3.2 Project Coaching and Mentoring

- Coaching themes with a particular strong impact on the projects (based on the survey):
  - Future Exploitation, Marketing and Commercialisation
  - User Experience and stakeholder analysis
  - Project Management skills
- Early-stage projects from less experienced innovators would have appreciated a higher number of / more extensive coaching sessions.
- The coaching and mentoring activities are a core support to help third-party projects develop top-quality solutions to accelerate their technological and business maturity. This need should be given priority in follow-up NGI projects.
- **Mentoring should be customised:** There is no business/IPR mentoring recipe that can satisfy all projects: they need to cover different topics, they are at different commercialization stages, they have different original and final objectives (e.g. researchers vs. entrepreneurs / technology licensing vs commercialisation of products and services)
- The use of best practices and strategies (incl. extra EU examples) was useful for mentoring activities.
- There was a need to focus on open-source themes for projects with IP strategies.
- All business organisations participating in NGI Trust should receive **business mentoring**.
- The COVID-19 outbreak showed that projects must **adapt their commercialisation objectives and strategies** to unforeseen circumstances.

- Clear advice on resubmission for follow-up NGI Trust funding and financial requirements was key, allowing projects to continue their innovation process.

- Workshops **involving multiple stakeholders** is key, particularly private and private sector interested in adopting solutions developed by the projects. More of this kind of events should take place.

- Interaction with NGI community should be strengthened to **stimulate further collaboration** about subgrantees of different NGI projects (Trust, Forward, Dapsi, etc.).

- Projects were looking for opportunities to connect with other projects in a similar area (e.g. IoT) across the entire NGI family of projects.

4 What's Next? Future Opportunities

NGI Trust had a number of significant impacts on its beneficiaries, both on an individual level and as a portfolio of projects. The immediate direct impact is that the majority of projects showed significant progress along the innovation funnel. Most of the beneficiaries felt that they were developing important technology and frameworks to be accessible to everybody, by developing partly and fully open-source solutions.

At the end of the NGI Trust project, some verticals were seen to be in dominant position (public sector, telecommunications, education, financial services, healthcare, and media and entertainment). NGI Trust enhanced most projects' capacity to use the outputs of their projects to attract other sources of funding. It was observed that further growth could come from enhancing cooperation with public institutions: different forms of public procurement for innovation, in which the public sector uses its purchasing power to act as an early adopter of innovative solutions which are not yet available on a large-scale commercial basis. Furthermore, some identified areas or applications for future research include:

- Artificial intelligence, including affective technology (combining psychology, behavioural sciences) and modelling AI; machine learning.
- Security of transactions, including appropriate development and efficient design/regulation for e-cash or securing the supply chain.
- Cybersecurity; encryption, potential of law-enforcement agencies to do surveillance, potential application of quantum technologies.
- Decentralisation, digital identity, data portability, data altruism: focus on individuals, how do users/data subjects understand it.
- Smart environments (home, car, etc.).

NGI Trust mobilised third-party stakeholders in Europe and stimulated like-minded partnerships, which helped to bridge growth funding gaps observed in the privacy- and trust-enhancing technology sector. A key result of NGI Trust project has been its capacity to develop informal communities of practice, due to a set of ancillary activities (webinars, mentoring, initiatives of other NGI projects, etc.). NGI Trust underlined the importance of ethics, reliability and credibility within

a 'trust circle' at the centre of a sustainable and appreciable next-generation Internet solutions made in Europe.

NGI Trust not only produced some excellent results but also raised some interesting challenges demanding further research and innovation. By using a similar third-party support funding model with light administration (low red tape) to attract a similar high calibre of talented applicants in future projects that NGI Trust attracted, a new suite of objectives can emerge to tackle the challenges encountered. More work is needed in the domain of decentralised architectures to make people's data-sets more securely portable between networks and easier to use for the mass market. Decentralised identity implementations are typically deployed through digital wallets in end user devices, where API standardisation, conformance and assurance remains formative, giving rise to potential security and data protection threats. Open-source software and hardware in this domain needs to be made more resilient to counter these threats.