D7.4

Dissemination strategy and activities, engagement and business opportunities – P2

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Abstract

This deliverable describes the dissemination strategy put in place in the HEIR project, to facilitate the execution of the dissemination activities and maximize their impact. It provides tailored actions for several types of public, scientific, healthcare, cybersecurity and general public. It provides additional strategic information in engaging the CERT/ISAC community, which is a fast-growing set of bodies in Europe, and how to address other EU projects. It then provides ongoing and upcoming dissemination activities of particular importance for the progress of the project.

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Executive Summary

This deliverable describes the dissemination strategy put in place in the HEIR project, to facilitate the execution of the dissemination activities and maximize their impact.

It provides tailored actions for communication and dissemination towards several types of scientific, healthcare, cybersecurity communities and the general public. Scientific dissemination takes the form of publications and workshops and is well known to the scientific community. We have specific actions for the healthcare community, which is less engaged in ICT and cybersecurity aspects. We also have specific actions towards the cybersecurity community, which is less knowledgeable about the medical sector. Finally, we have a significant dissemination effort towards the general public, to raise awareness of these issues.

It provides additional strategic information on engaging the CERT/ISAC community, which is a fast-growing set of bodies in Europe, and ways to address related EU projects. This aims at supporting this community with new methods and tools to better understand and fight cyber attacks.

It then provides ongoing and upcoming dissemination activities of particular importance for the progress of the project. In particular, we intend to speed up industry-oriented dissemination, as events are reopening in Europe.

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1. Introduction

This reports the structuration of activities in task 7.2, "Communication strategy triggering awareness and new business opportunities", and task 7.4, "Exploitation and standardization activities and links to CERTS and CSIRTS".

The proposed communication and dissemination strategy aims at developing actions that will help HEIR reach the following program goals and KPIs presented in the description of action.

Table 1: HEIR Impact and KPIs

HEIR Impact	Current implementation	KPI	Target
HEIR aims to contribute the development of the solid CSIRT Network with its technological tools and modules that can be used to raise levels of the overall security and resilience in health sector across the EU.	Establishment of links to CSIRTS and CERTS and feedback gathering on the architecture	iKPI1: Number of health sector related entities/ stakeholders	>20
HEIR will advance state of the art in the fields of (i) cyber threats identification, monitoring and protection, (ii)data exchange and protection; and machine learning – facilitated threat detection, mitigation and real-time response; (iii) a multiple-level visualisation and awareness raising mechanism	Scientific publications	iKPI4: Number of publications in the specific fields	> 5
Via HEIR Observatory module the project will construct a solid, automated information sharing network among all involved actors in the health sector.	Establishment of links to CSIRTS and CERTS and feedback gathering on the RAMA score	See iKPI1	
HEIR will focus on raising cybersecurity awareness to executives and employees in healthcare sector, defining the duties, responsibilities and communication procedures and protocols of all the members ensuring at the same time alignment with current directives and legislations; thus, significantly advancing Security Governance in health sector	Involvement of healthcare partners and EAB members	iKPI9: Number of executive members of healthcare institutions engaged to security governance practices through HEIR platform	>5

In order to successfully engage the community, the HEIR project has developed a communication strategy, that has been reported in deliverable D7.3. We are providing here results of this dissemination strategy during the second period.

2. Final Overview of HEIR Dissemination and Communication Strategy

HEIR's Dissemination and Communication strategy, as initially outlined in D7.3, has played a pivotal role in ensuring the comprehensive and effective dissemination of the project's outcomes to pertinent audiences. These encompass the research and academic community, industry stakeholders, and collaborative efforts with other EU-funded initiatives.

Throughout the project's duration, the dissemination and communication strategy has been consistently updated and adjusted to optimize outreach to targeted audiences. This encompassed enhancing HEIR's presence on social media platforms, fortifying the website with updated content, and participating actively in a multitude of events.

Figure 1: HEIR's Dissemination and Communication Strategy

To delve into specifics, the latter stages of the project encompassed the completion of phases 2 and 3. In the former phase, HEIR partners were actively engaged in a multitude of events, showcasing the project's outcomes, orchestrating a comprehensive strategy for submitting papers to esteemed academic conferences and journals, and consistently updating the project's website with pertinent content. Transitioning into the project's final year, HEIR intensified its dissemination endeavors. This entailed organizing and participating in multiple events to spotlight its achievements, submitting papers to renowned platforms, conducting a culminating year event featuring collaboration with other EU-funded projects, partnering with the Horizon Result Booster initiative, and crafting and presenting its ultimate business model.

Moreover, distinct audience segments were identified, categorized into three main clusters: the scientific community, the industrial sphere, and other entities such as the European Commission, policy-making bodies, and standardization organizations. Each cluster was approached with bespoke communication strategies tailored to facilitate the effective distribution of the project's outcomes.

Concluding, HEIR Dissemination and Communication Strategy has exemplified a dynamic and adaptive strategy that has effectively facilitated the extensive and efficient dissemination of the project's outcomes to pertinent audiences. Its flexibility and responsiveness to the project's evolution have enabled the plan to capitalize on engagement opportunities and enhance awareness at every stage of the project's timeline.

3. Report on Activities

In this subsection, we will report all the work done and the liaisons achieved in this second period. In the following, we will describe what we have achieved so far in each of the categories of targeted liaisons.

3.1 Website

HEIR's project website has been a pivotal tool for disseminating our results. During the second period of the project, HEIR's website underwent several updates. Firstly, in terms of content, the HEIR consortium continuously updated the website with the latest, public deliverables (see Figure 2).

Deliverables

The following table presents the list of HEIR deliverables. The full texts of public deliverables will become available as the project progresses..

Deliverable No.	Deliverable name	Type	Dissemination level
D1.1	HEIR innovations for healthcare systems	Report	Public
D1.2	Positioning of HEIR	Report	Confidential
D1.3	System Architecture definition	Report	Public
D2.1	The HEIR facilitators package: MVP	Demonstrator	Public
D2.2	The HEIR facilitators package: 1st complete version	Demonstrator	Public
D2.3	The HEIR facilitators package: Final complete version	Demonstrator	Public
D3.1	The HEIR 1st layer of services package for the MVP	Demonstrator	Public
D3.2	The HEIR 1st layer of services package: 1st complete version	Demonstrator	Public
D3.3	The HEIR 1st layer of services package: Final version	Demonstrator	Public
D4.1	The HEIR 2nd layer of services package for the MVP	Demonstrator	Public
D4.2	The HEIR 2nd layer of services package: 1st complete version	Demonstrator	Public
D4.3	The HEIR 2nd layer of services package: Final version	Demonstrator	Public

Figure 2: Website – Deliverables

Following, two new sections were introduced. The first, called 'Blog' (see Figure 3), includes several blogs written by the HEIR consortium enabling interested parties to understand more about the project. More specifically, during the second period of the project, ten (10) blog posts were written. Seven (7) of them introduced the public to the different technologies implemented/used within HEIR, and how these can be utilized to strengthen cybersecurity in healthcare environments, whereas the rest of them described how these technologies were applied to our pilots.

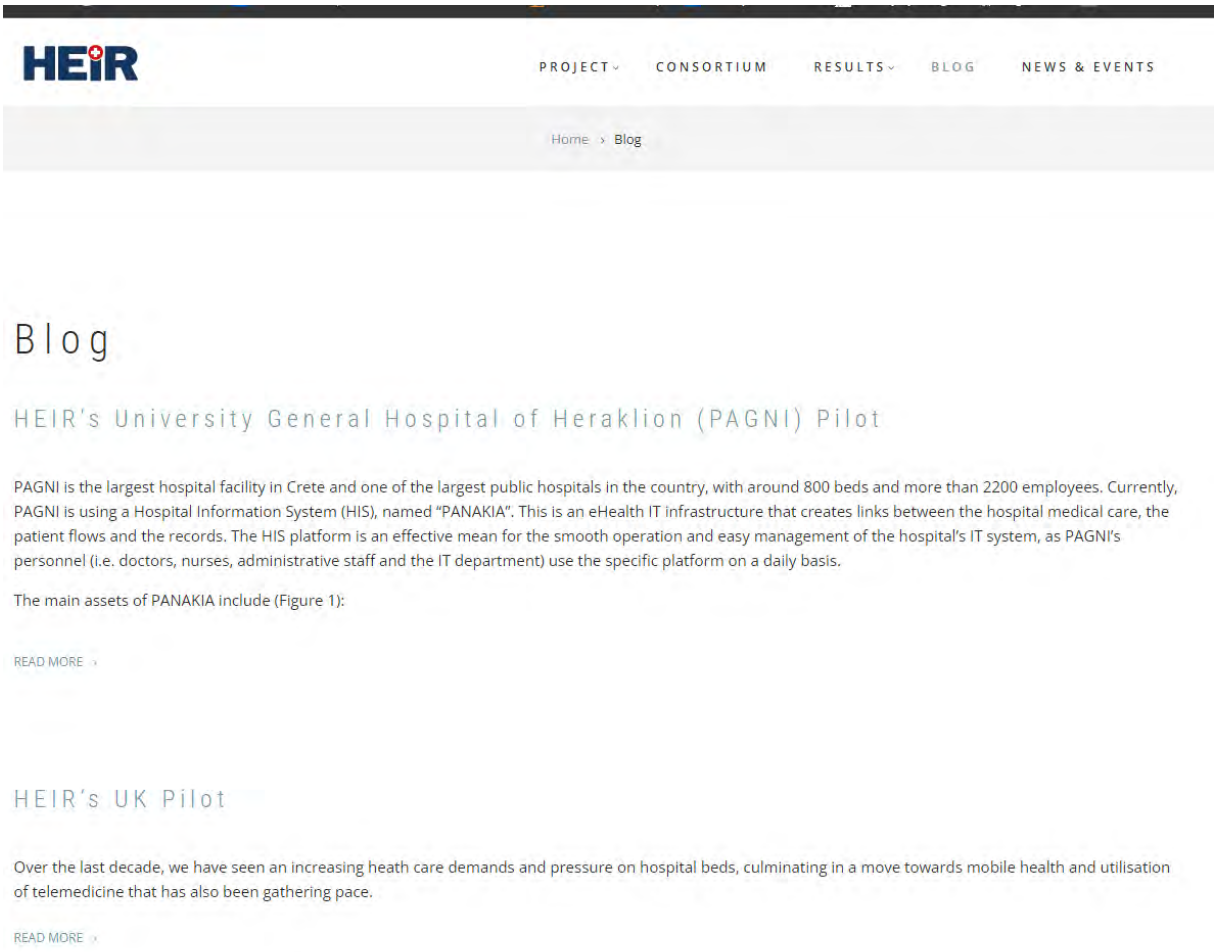


Figure 3: Website -- Blog

The second section called "News & Events" (see Figure 4) includes the latest updates from the HEIR project, such as Newsletters, and events that HEIR organized or participated in.

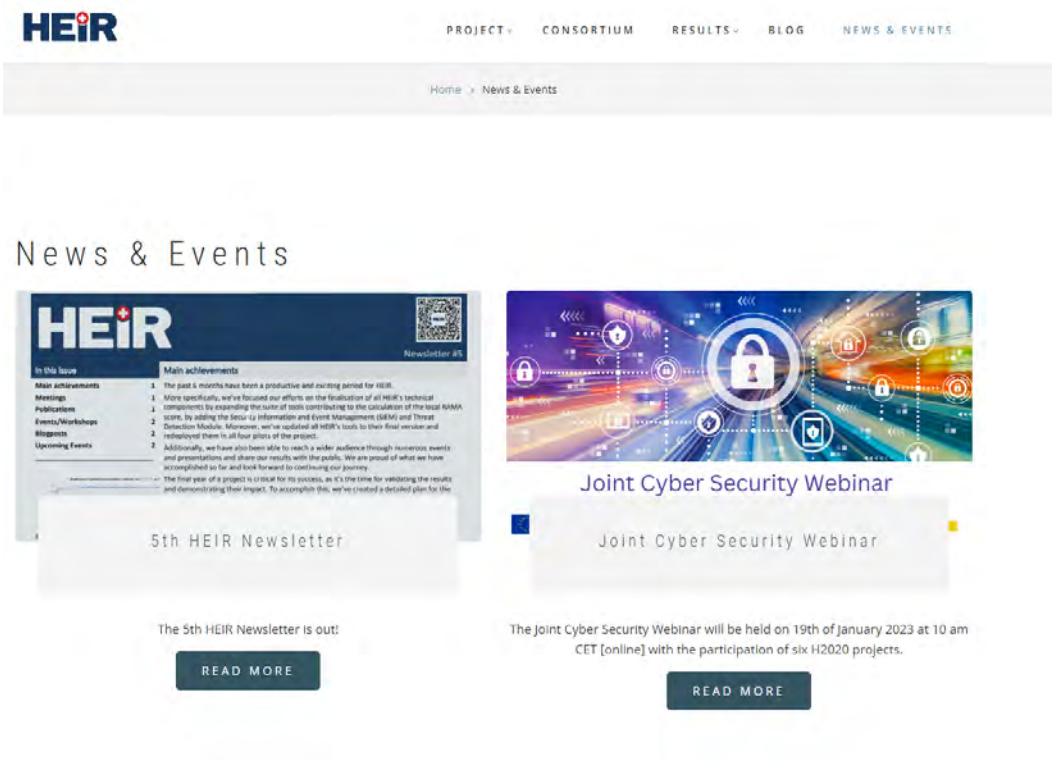


Figure 4: Website -- News & Events

In general, HEIR's website averaged more than 5212 site access per year, 193 visitors per month, ~20 downloads per month.

3.2 Social media dissemination – Twitter

HEIR has demonstrated remarkable activity across multiple social media platforms, particularly Twitter and LinkedIn, showcasing their commitment to engaging with a diverse audience effectively. To facilitate seamless connectivity, HEIR set up an official Twitter account, accessible via https://twitter.com/h2020_heir, which serves as a prominent link on the project's official website.

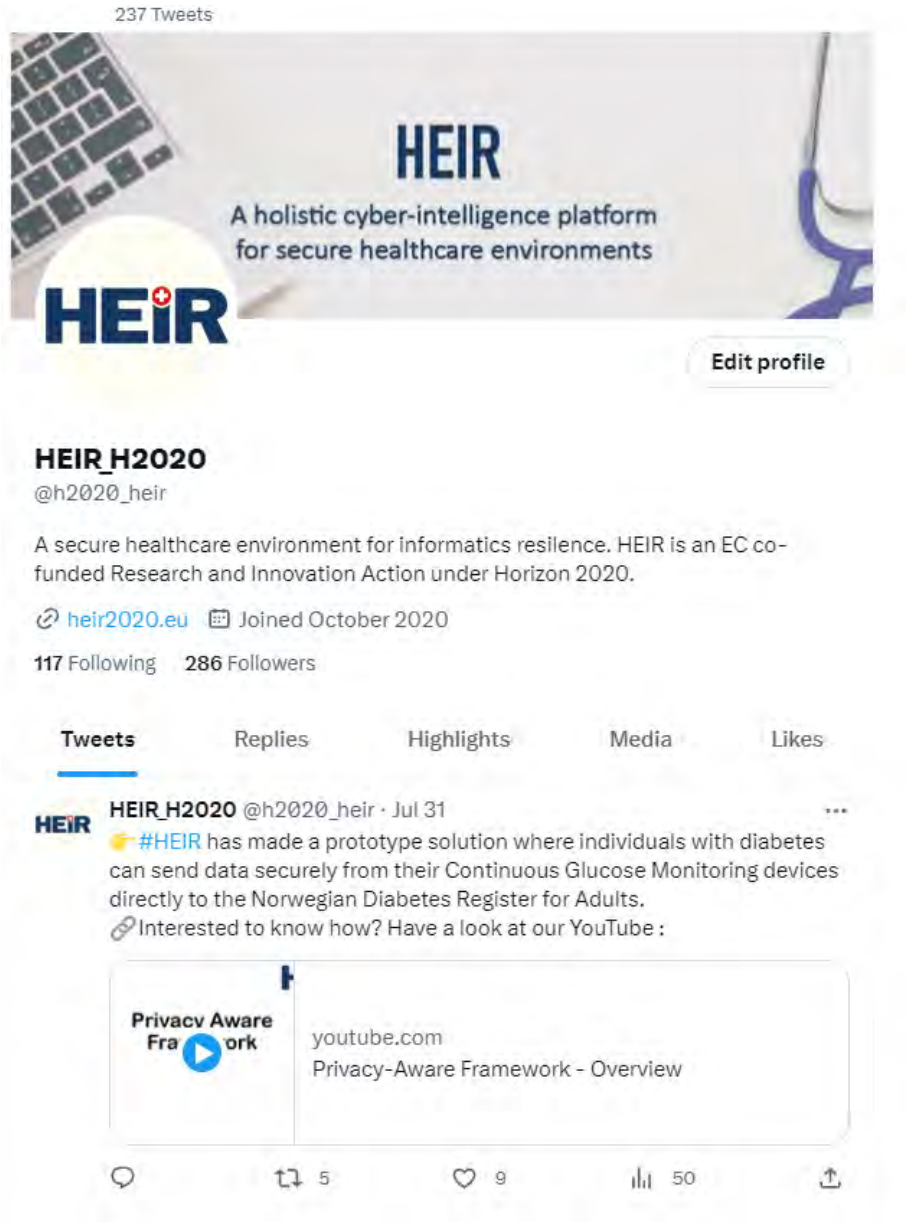


Figure 5: HEIR's Twitter

Notably, during the second phase of the project, the HEIR consortium intensified its social media presence, achieving an average of 10 posts on Twitter per month, attracting an average of 8 new followers per month, and generating an impressive average of 586 impressions per tweet. These initiatives exemplify HEIR's proactive approach to enhancing visibility and interaction, establishing meaningful connections with their target audience during this pivotal stage of the project.

3.3 Social media dissemination – LinkedIn

HEIR has also been highly active on LinkedIn, utilizing the platform to foster meaningful engagement with a diverse professional audience. The consortium established an official LinkedIn group, accessible at https://www.linkedin.com/company/heir-h2020-project/, to facilitate seamless interaction and networking opportunities.

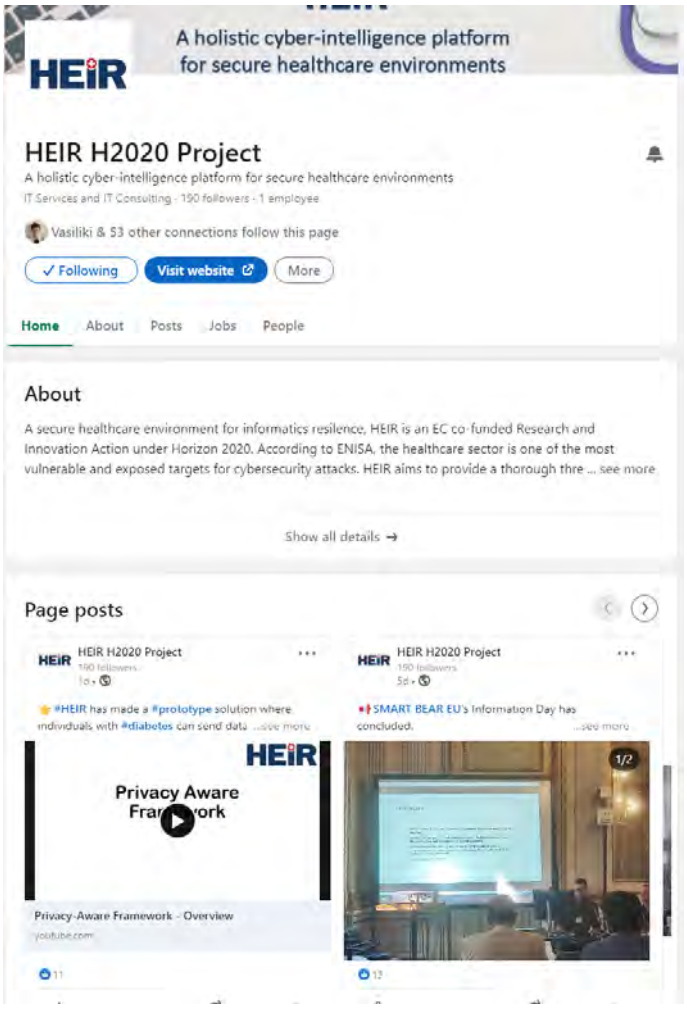


Figure 6: HEIR's LinkedIn

Throughout the project's progression, HEIR has consistently maintained an impactful presence on LinkedIn, contributing valuable content and updates to the group. More specifically, HEIR averaged 10 posts and discussions per month. Subsequently, the group's content has garnered substantial engagement, with an average of 61 views per month. HEIR's strategic utilization of LinkedIn serves as a testament to its dedication to establishing strong connections with industry experts, researchers, and stakeholders, amplifying the project's reach and impact within the broader professional sphere.

3.4 Social media dissemination – Youtube

HEIR, during the second part of the project, intensified its efforts to create multiple YouTube videos that would allow everyone to get familiarised with the project and its different offerings. More specifically, thirteen (13) videos were made available through our official YouTube channel (https://www.youtube.com/@HEIRH).

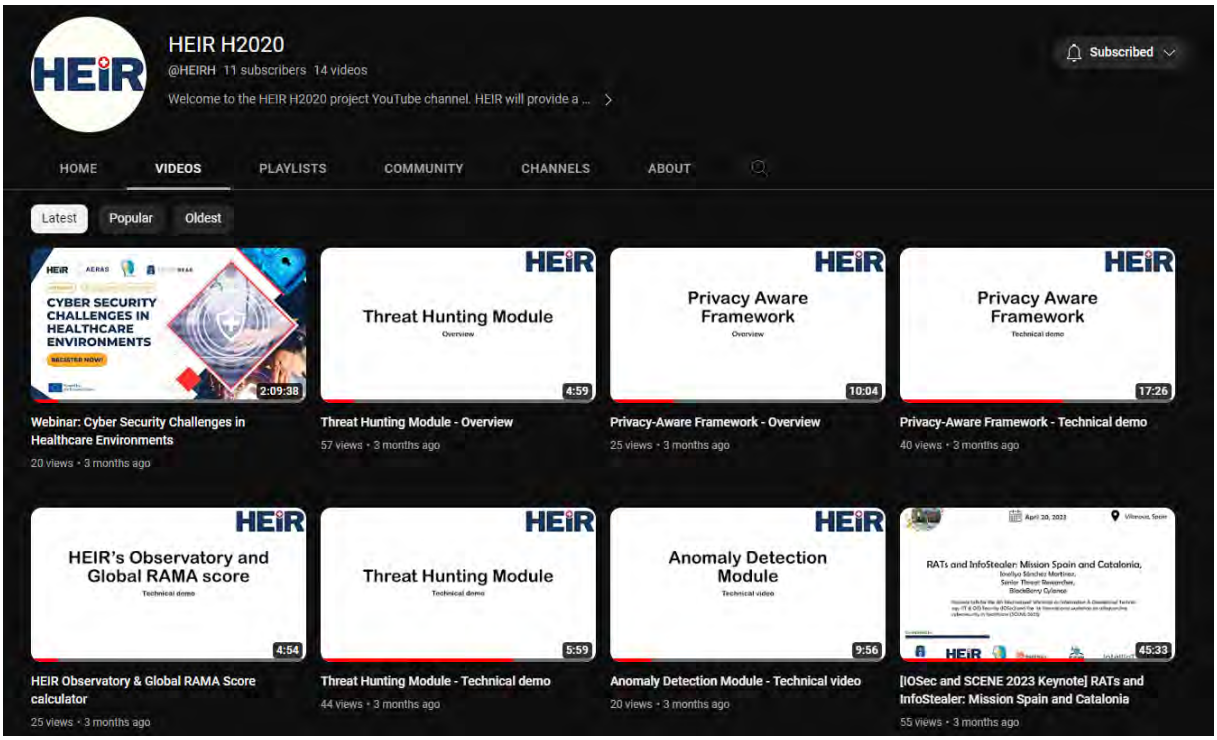


Figure 7: HEIR's YouTube Channel

The videos were categorized into three primary sections. The initial section, titled "Mid-term Review," encompassed the videos showcased by HEIR for illustrative purposes during the project's mid-term review. Following that, the "Demos" section encompassed videos designed to exhibit the various tools and functionalities of the HEIR platform. Each of these videos was created with a text-to-speech functionality and has been translated into the primary languages of our pilots, namely English, Greek, and Norwegian. Lastly, the "Final Review" section contained videos intended for presentation during the project's final review.

3.5 Zenodo

The HEIR project has fully embraced the principles of Open Science by utilizing Zenodo (https://zenodo.org/communities/heir_project?page=1&size=20), an open repository developed under the European OpenAIRE program.

HEIR has actively utilized Zenodo, a widely recognized open-access repository, to share and disseminate its research outputs and project-related materials. By depositing relevant data, publications, and resources on the platform, HEIR ensures that its valuable contributions are accessible to the broader academic and research community.

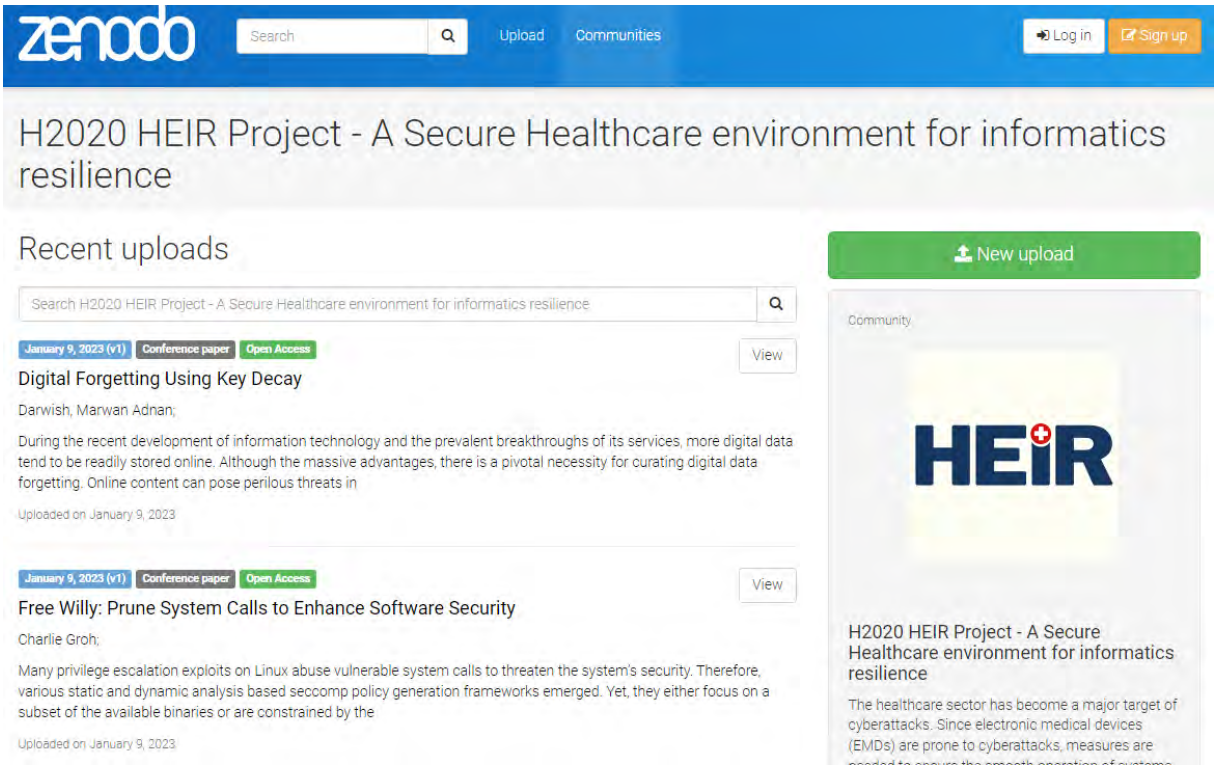


Figure 8: HEIR's Zenodo

The project's presence on Zenodo facilitates seamless access to its research findings, fostering collaboration and knowledge exchange with fellow researchers and stakeholders worldwide.

3.6 Promotional Material

From the HEIR project's initial phase of dissemination and communication planning, a consistent visual identity was established across all dissemination materials. These initial materials encompassed newsletters, flyer, and PowerPoint presentation, adaptable to diverse audiences and utilized to showcase the project at various events.

As the project advanced, these materials underwent updates and expansions to mirror the project's advancements. In the second half of the project, the focus shifted to refreshing existing materials and creating new ones tailored for upcoming events. This involved generating a new iteration of the roll-up banner and materials generated by various HEIR partners to promote the project within their networks.

In the third year, the project's promotional materials were further honed and extended to accentuate the project's outcomes. This encompassed producing demo videos, event recordings, and other audiovisual content, disseminated through the project's YouTube channel and other social media platforms. These promotional materials played a pivotal role in successfully arranging and presenting live demo events, spotlighting the HEIR solution in real-world scenarios. The project's promotional materials have not only elevated its visibility but have also served as a valuable tool for communication and engagement, notably contributing to the project's objectives in dissemination and communication. Table 2 offers a rundown of the dissemination materials provided by partners throughout the project's lifetime.

Table 2: Promotional Material

Title	Use
General Presentation	General presentation used by HEIR partners to present the project.
Banner	The initial and updated banner to promote HEIR in events.
Leaflet	The initial and updated leaflet to promote HEIR in events.
Newsletters	Several newsletters included HEIR's updates throughout the project's lifetime.
Information Day presentations	All presentations from the 4 HEIR-related Information Days.

3.7 Events organized by HEIR

Throughout the second part of the HEIR project, the consortium directed its efforts towards effectively disseminating and communicating the project's accomplishments. This objective was accomplished by orchestrating a series of pivotal events that served as vital platforms for sharing the project's trajectory, discoveries, and future aspirations. These events played a pivotal role in connecting with other EU-funded projects, stakeholders, industry stakeholders, and the general public.

Each of these events offered opportunities for the consortium to spotlight the project's milestones, engage with the community, collect valuable input, and cultivate partnerships. These gatherings also offered a platform to practically demonstrate how our research translates into real-world applications, underlining the potential influence of the HEIR project on the cybersecurity landscape. The subsequent subsections will furnish an intricate overview of each event, spotlighting their goals, activities, and outcomes.

3.7.1 Pilots Information and Training Day

HEIR successfully orchestrated a series of four distinct Information and Training Day events, each corresponding to a specific pilot location. While three of these events unfolded physically (one in Athens, one in Heraklion, and one in Croydon), the fourth event was conducted online. The paramount intention behind these gatherings was twofold: firstly, to inform healthcare personnel about the HEIR project's objectives and the potential augmentation it offers to their organization's cybersecurity framework; secondly, to deliver a comprehensive training session designed for healthcare practitioners and IT experts. Further insights into the event's structure are detailed in D7.10.

3.7.2 Workshops

HEIR successfully organised two workshops. The first one, called IOSEC 2022 (see Figure 9), was held in conjunction with the 17th International Conference on Availability, Reliability, and Security (ARES 2022) in Vienna, Austria.

Figure 9: IOSec 2022 Banner

The second workshop, called SCENE 2023 (see Figure 10), was held in conjunction with the International Conference on Design of Reliable Communication Networks (DRCN 2023) in Vilanova, Spain.

Figure 10: SCENE 2023 Banner

3.7.3 Roundtable Discussion on Security and Secure Information Exchange in the Healthcare Sector

HEIR, in collaboration with the ECSCI cluster, the EU-CIP project, and seven more EU, Norwegian and French projects, organised a roundtable discussion on security and secure information exchange in the Healthcare Sector (see Figure 11). The event was held in Oslo, Norway and the discussion covered topics in the areas of cybersecurity in healthcare, secure information exchange in healthcare, funded projects' collaboration activities, and healthcare providers' participation in the NESIOT project.

Figure 11: Roundtable Discussion on Security and Secure Information Exchange in the Healthcare Sector banner

3.7.4 Cyber Security Challenges in Healthcare Environments Webinar

HEIR, in collaboration with the Horizon Results Booster Team, organised the Cyber Security Challenges in Healthcare Environments webinar (see Figure 12). The event was held online with the participation of AERAS, AI4HealthSec and SMART-BEAR EU-funded projects.

Figure 12: Cyber Security Challengers in Healthcare environments banner

3.8 Participation in venues

HEIR participated in the events depicted in Table 3.

Table 3: Participation in events

Name of the Event	Event Organiser	Number of attendees	Location	Participation
FIC 2022	FIC	>150	Lille, France	Physical
Prague Intervention 2022	GALÉN - SYMPOSION s.r.o.	~200	Prague, Czech Republic	Physical
CyberHOT Summer School	Security Research Lab, UoP Microprocessor and Hardware Lab, TUC	>100	Chania, Greece	Physical
IOSEC 2022	TUDelft	>100	Vienna, Austria	Physical
Privacy Symposium Venice	ECCP	>100	Venice, Italy	Physical
Roundtable for Healthcare Security	University of Oslo	<25	Oslo, Norway	Physical

Name of the Event	Event Organiser	Number of attendees	Location	Participation
SCENE 2023	HEIR, AI4HealthSec, Smart Bear	>100	Vilanova, Spain	Physical
CitySCAPE Cybersecurity Webinar	citySCAPE	>150	Online	Online
FIC 2023	FIC	>150	Lille, France	Physical
Diabetesforum 2023	Diabetesforbundet Helsediktoratet Den Norske Legeforening	500	Oslo, Norway	Physical
Cyber Security Challenges in Healthcare Environments	HEIR	>150	Online	Online
SMART BEAR's Info Day	SMART BEAR	>100	Milan, Italy	Physical
MEDINFO2023	Australian Institute of Digital Health	> 3000	Sydney, Australia	Physical
CUH Annual R&D meeting 2022	Croydon University Hospital	> 75	London, UK	Physical
TechShow London	Tech Show London Team	>2000	London, UK	Physical
CUH annual R&D Day 2023	Croydon University Hospital	> 75	London, UK	Physical
Annual digital conference	Digital Government team	> 1000	London, UK	Physical
Cityscape final event	citySCAPE	<50	Athens, Greece	Physical

4. Monitoring & Contribution of Dissemination & Communication Activities

The HEIR project employs a structured system to track the advancement of its dissemination endeavors through key performance indicators (KPIs). These KPIs, established in alignment with the Grand Agreement, span across various dissemination avenues. They serve as indispensable tools for the dissemination manager, project coordinator, and exploitation manager, enabling them to fine-tune strategies and incorporate feedback for project enhancement. Covering a spectrum of metrics including website analytics, event engagements, and publication counts, these KPIs extend beyond mere quantitative enumeration. Their essence lies in evaluating the value of dissemination initiatives, steering them toward the most impactful actions.

In the forthcoming sections, tables will be presented to illustrate the progression achieved in Dissemination and Communication KPIs within HEIR. These tables will outline the advancements across Y1, Y2, and Y3, offering a comprehensive snapshot of accomplishments and ongoing status. The intent is to provide a lucid and succinct depiction of the project's dissemination and communication strides, spotlighting the influence and outreach of these endeavors. This approach ensures the project's evolution remains transparent and quantifiable, facilitating continuous assessment and adaptive strategies as needed.

4.1 Annually or end-of-project tracked dissemination KPIs (dKPIs)

Table 4 presents the results of the dissemination KPIs, for the dKPIs that have been monitored on a yearly basis or for dKPIs that were assessed at the end of the project (2nd half of August 2023).

Table 4: Annually or end-of-project tracked dKPIs status

Communication Channel	dKPI	Measured By	Threshold	Status (achieved)
HEIR website	**dKPI#2:** # of site access annually	Matomo	>5000	☑ (~5100)
Events - Up to 25 participants (Networking events targeting national and EU policy makers, National, Regional and Local Authorities)	**dKPI#10:** # of events	Manually	>= 5	☑ 24
	dKPI#11: # of audience contacts	Surveys	>= 50% of the participants	☑
	dKPI#12: # of participants interested in ***HEIR*** project	Surveys	>= 40% of the participants	☑
Events - 25-100 participants (public lectures, for relevant end users & general public, info days, workshops, hackathons)	**dKPI#13:** # of events	Manually	>= 10	☑ 17
	dKPI#14: # of audience contacts	Surveys	>= 30% of the participants	☑

Communication Channel	dKPI	Measured By	Threshold	Status (achieved)
	dKPI#15: # of participants interested in ***HEIR*** project	Surveys	>= 20% of the participants	✓
Events - >100 participants (Conferences - *HEIR* relevant)	**dKPI#16:** # of events	Manually	>= 10	✓ (13)
	dKPI#17: # of audience contacts	Surveys	>= 50% of the participants	✓
	dKPI#18: # of participants interested in ***HEIR*** project	Surveys	>= 40% of the participants	✓
Journal & magazine publications	**dKPI#19:** # of international referred journal publications by ***HEIR*** partners	Direct reporting	>=6	◔ (4)
	dKPI#20[1]: # of special issues in international referred journals	Direct reporting	>= 4	✓
	dKPI#21: # of publications in international (printed or online) magazines	Direct reporting	>= 6	✓ (13)
Presentations in international conferences, summer schools, hackathons, workshops	**dKPI#22:** # of conference presentations by ***HEIR*** partners	Direct reporting	>=12	◔ (8)
	dKPI#23: # of international conferences, workshops hackathons organised	Direct reporting	>= 4 events with > 100 attendees	✓ (4)
Promotional material (brochures, newsletters, videos)	**dKPI#24:** # of high-quality printed brochures with the technical approach and activities of ***HEIR***	Direct reporting	> 1000 hard copies in >10 events	✓ (~1500 copies per event)
	dKPI#25: # of high-quality electronic brochures with the technical approach and activities of ***HEIR***	Admin tool	>1000 downloads	✓ (~1005)

[1] HEIR organised the Special issue on Cybersecurity in Healthcare as part of the International Journal of Information Security.

Communication Channel	dKPI	Measured By	Threshold	Status (achieved)
	dKPI#26: Regular newsletters with ***HEIR*** technical activities	Admin tool	9 newsletters	(8)
	dKPI#27: # of stakeholders viewing 5min high-quality videos about ***HEIR*** in YouTube (private channel)	Youtube	> 500 views	(719)

Note: A status indicated by a green checkmark signifies the complete fulfillment of the dKPI, whereas a status marked by an orange half-check indicates partial completion.

4.2 Monthly tracked dKPIs

Table 5 presents the monthly tracked dKPIs per year. It's noticeable that during the first year of the project, a significant portion of the dKPIs either faced non-fulfillment or were only partially accomplished. This outcome can be attributed to several factors, including the project's initial focus on formulating the dissemination strategy and generating corresponding materials, the absence of substantial results to share, and the need for reassessment of certain dKPI thresholds. In response to the latter, a formal request was submitted to the Project Officer (PO) and subsequently approved during the project's midterm review. Subsequent to this revision, the consortium directed more intensified efforts in the second and third years, resulting in higher rates of both full and partial achievement of the dKPIs.

Table 5: Monthly tracked dKPIs status.

Communication Channel	dKPI	Threshold	Y1 Status (achieved)	Y2 Status (achieved)	Y3 Status (achieved)
Website	dKPI#1: # of visitors/countries	>= 100 visitors	(~54)	(130.5)	(207.18)
Website	dKPI#3: # of downloads per month	> 500	(3)	(14)	(20.1)
Twitter	dKPI#4: # of regular push announcements	>10	(1)	(9)	(10)
Twitter	dKPI#5: New followers per month	>= 20	(8)	(10.33)	(11)
Twitter	dKPI#6: # of tweet impressions or profile visits	>= 500	(0)	(255.75)	(831.75)

Communication Channel	dKPI	Threshold	Y1 Status (achieved)	Y2 Status (achieved)	Y3 Status (achieved)
LinkedIn	dKPI#7: Number of regular push announcements	> 10	✗ (1)	✓ (9)	✓ (10)
LinkedIn	dKPI#8: New discussion per month	>= 10	✗ (1)	◔ (9)	✓ (10)
LinkedIn	dKPI#9: View of HEIR profile	>= 60	✗ (25)	✓ (78.41)	✓ (63.33)

Note: A status indicated by a green checkmark signifies the complete fulfillment of the dKPI, a status marked by an orange half-check indicates partial completion, and a status with a red cross signifies that the dKPI was not fulfilled.

5. Report on EU CERTs / CSIRTs – ISACs Liaison Activities

We have identified fifteen CERTs/ CSIRTs established in EU, based on ENISA's Inventory [1] and one (1) ISAC based on ENISA report for ISACs in Europe [2]. We sent out sixteen (16) invitations describing HEIR proposition and our requesting their participation in HEIR's liaison activities. We received back five (5) responses; four (4) of them were positive and one was negative. The remaining invitations were never received any response. Table presents the status of each invitation accompanied with some details on the dates of the communication and some brief explanation where needed.

Table 4: EU CERTs/CSIRTs – ISACs liaison status

Full name	Country	Contacted on	Status(date)
GRNET-CERT	Greece	09/09/2021	Accepted (03/10/2021)
National Authority Against Electronic Attacks (NAAEA) – National CERT	Greece	09/09/2021	No Response
Greek military Cert	Greece	09/09/2021	No Response
CERT POLSKA	Poland	09/09/2021	Accepted (10/09/2021)
CZ.NIC-CSIRT	Czech Republic	09/09/2021	No Response
CERT-EU	European Union	09/09/2021	No Response
Computer Emergency Response Team Austria	Austria	09/09/2021	No Response
CSIRTMalta	Malta	09/09/2021	No Response
National CSIRT-CY	Cyprus	09/09/2021	No Response
National Cyber Security Centre (NCSC – NCKB in Czech)	Czech Republic	09/09/2021	No Response
Computer Security Incident Response Team - Italia	Italy	09/09/2021	No Response
Information Technologies Security Incident Response Institution (CERT.LV)	Latvia	09/09/2021	Declined (13/09/2021)
Norwegian healthcare sector CERT	Norway	09/09/2021	No Response
The Norwegian National Cyber Security Centre	Norway	09/09/2021	No Response
Vysočina Region Regional Authority	Czech Republic	09/09/2021	Accepted (01/11/2021)
Empower European ISACs	European Union	09/09/2021	Accepted (17/09/2021)

The accepted CERTs/CSIRTs have received an invitation to participate in HEIR's info days. At the end of the event, attendees from the CERTs/CSIRTs answered a relevant on-line questionnaire. Three of the CERTs/CSIRTs have completed the questionaries, the results of which can be found in the Annex.

Finally, it was agreed to maintain an open collaboration between HEIR and the CERTs/CSIRTs teams, extending even beyond the lifecycle of the project (after M36). Also, these teams could act as potential future customers/users of the HEIR platform, enhancing their internal training programmes.

6. Report on SMEs / Public Sector Liaison Activities

We identified a number of links that could be exploited throughout the lifespan of HEIR in D7.3. We exploited these liaison links to further promote the technical advances and capabilities developed in HEIR to the SME community and Public Sector, providing a compelling offer for enhancing the security in the healthcare sector.

6.1.1 Report on SMEs liaison activities

To disseminate the acquired knowledge from HEIR to SMEs, we proactively engaged with them. While not all of the reached SMEs operated in the healthcare sector, they could still benefit from adopting the technology developed within HEIR to address internal challenges. With two of them, EthosHub (https://www.ethos-hub.eu/) and dot.syntax (https://www.dotsyntax.gr/), we scheduled individual meetings and informed them about the technological advancements achieved through our project. Further we reached out additional SMEs, some of which we will collaborate on a special issue on cybersecurity for the healthcare domain in the International Journal of Information Security, which we are currently preparing.

6.1.2 Report on Public Sector liaison activities

The HEIR project participated in several liaison activities with public bodies. In particular, HEIR members participated in the 1st ENISA cybersecurity skills conference, which presented the European Cybersecurity Skills Framework (ECSF); a practical tool to support the identification and articulation of tasks, competences, skills and knowledge associated with the roles of European cybersecurity professionals. On the closing remarks of the 1st ENISA conference on skills the Head of Cabinet for European Commission Vice-President stated: "*We now need to make sure that we address what could become our biggest challenge: how to have the right people with the right skills to shield our citizens and our economies from ever more pervasive cyberattacks across all critical sectors*". HEIR technology can assist towards this direction and we shared our insights and lessons learned with the other participants.

HEIR also supported the CyberHOT Summer School, which took place in Crete in September 2021 under the auspices of the 5th NMIOTC Cyber Security Conference in the Maritime Domain. The CyberHOT training program, was based upon NATO Red Teaming knowledge and expertise, and enabled the participants to implement various red-teaming methodologies and tools. Utilizing the dedicated labs by HacktheBox, a wide range of penetration testing scenarios was showcased. The aim was to raise the skills of the workforce to meet current and future cyber incidents and challenges. HEIR sponsored this event with content and trainers since the topic was in the main interests of the project objectives in terms of creating and enhancing people's skills for resolving addressing and tackling future cyber security challenges.

7. Report on EU Projects

The list of joint activities with other EU projects is presented in Table 6, along with a description of the activity carried out during the second period.

Table 6: Affiliated EU projects joint activities

Name	Type	Involved Partner	Description of the joint activity
Joint webinar between CityScape, HEIR, PUZZLE, SENTINEL, TRAPEZE, SECANT	Joint dissemination webinar	IMT, STS, FORTH	All projects presented their activities and results. The webinar then became a round-table for discussion between the projects, and to answer questions from the audience.
Horizon Booster cluster	Exploitation	All partners	In addition to the individual Horizon Booster Results application, the HEIR project created a cluster with three other projects, to better organize exploitation.
Participation in citySCAPE's final event	Dissemination	STS, FORTH	HEIR participated in the final event of citySCAPE where we discussed HEIR's exploitation plan
SCENE 2023	Workshop	STS, IMT	HEIR, in collaboration with AI4HealthSec, ASCAPE, and SMART-BEAR organized the 1st International Workshop on Safeguarding cybersecurity in healthcare (https://drcn2023.upc.edu/SCENE2023.html)
Special issue on Cybersecurity in Healthcare	Joint Special Issue	IMT, STS	HEIR, in collaboration with IntellIoT and AI4HealthSec, organized the Special issue on Cybersecurity in Healthcare (https://www.springer.com/journal/10207/updates/25237774)
IOSec 2022	Workshop	STS, FORTH	In a co-organization with AI4HealthSec and Sentinel H2020 projects, an international workshop on Information & Operational Technology (IT & OT) Security Systems will take place in Vienna, Austria on the 23rd – 26th of August 2022. This workshop will be held in conjunction with the 17th International Conference on Availability, Reliability, and Security (ARES 2022). In this regard, we call for relevant conference papers with a deadline of the 10th of May 2022.
Roundtable discussion on Security and Secure Information Exchange in the Healthcare Sector.	Dissemination event	Multiple HEIR partners	During the roundtable discussion, we presented HEIR's achievements.

8. Report on impact KPIs (iKPI)

The Description of Action defines a number of impact KPIs to measure the project's impact in the European ecosystem. We are reporting herein the evaluation of the fulfilment of these impact KPIs at the end of the project.

Table 7: Impact KPIs

Name	Target	Achieved	Description of the achievements
iKPI1: Number of health sector related entities/ stakeholders	>20	19 ☑	We reached through the following entities and organizations to stakeholders of the health sector: EAB (3), Sentinel (1), Secant (2), AI4Healthsec (2), Inteliot (3), Smart-bear (8).
iKPI2: Number of cyber threats and attacks identified and prevented for the health sector	>10	20 ☑	D1.3 identified 12 security objectives and requirements for mitigation for the Threat Hunting and 8 objectives for the Privacy Aware Framework. These objectives are extremely broad and cover classes of threats rather than specific threats. The demonstration scenarios recorded partially demonstrate the threat scenarios prevented.
iKPI3: Number of tools and services included in the holistic HEIR system	>20	19 ☑	19 technological components have been newly developed or integrated in the HEIR architecture and deployed in the use cases. We do not include in this count "standard" middleware such as message brokers (Kafka) or databases (ElasticSearch).
iKPI4: Number of publications in the specific fields	>5	14 ☑	8 publications in international peer-reviewed conferences; publications (under review) in international peer-reviewed journals; 2 publications in general media (one to come in sept. 2023)
iKPI5: Number of challenges and requirements on cyber-threats mitigation identified in the health sector	>20	20 ☑	D1.3 identified 12 security objectives and requirements for mitigation for the threat hunting and 8 objectives for the privacy aware platform. These objectives are extremely broad and cover classes of threats rather than specific threats. The demonstration scenarios recorded partially demonstrate the threat scenarios prevented.
iKPI6: Number of models/standards HEIR will contribute to	>6	7 ☑	D7.8 introduces in section 4 a list of 7 standards to which the HEIR platform has started to contribute or can contribute in the future.

Name	Target	Achieved	Description of the achievements
iKPI7: (%) improved resilience for complicated systems in health sector	20%	Qualitatively evaluated as achieved 	We evaluate qualitatively this KPI using the feedback from pilot partners and EAB. Utilizing the HEIR platform, PAGNI increased the robustness of HIS systems. The inclusion of the Team3 device in the CUH pilot demonstrated the feasibility of anomaly detection on healthcare sensing systems. The deployment of the Privacy-Aware Framework opened new avenues for exchanging and processing healthcare data between NSE and Noklus. The integration of Threat Hunting was positively evaluated by C.S and S.A, both hospital CISOs. N.P. considered that the Privacy-Aware Framework is a step forward for GDPR compliance
iKPI8: (%) reported cybersecurity incident investigations resolved within an organisationally defined timeframe	80%	Qualitatively evaluated as partially achieved 	This iKPI has been qualitatively evaluated by the HEIR pilot partners. PAGNI reported that HEIR's installation on 5 out of 5 workstations makes the IT team aware of the need for software updates, which enhances security overall. There is a positive impact but very difficult to evaluate. Also, it is very hard to compute a baseline.
iKPI9: Number of executive members of healthcare institutions engaged to security governance practices through HEIR platform	>5	6 	Several hospital executives participated in the info days, particularly in Greece, thanks to our local partners. In addition to executives, other important stakeholders participated, such as IT directors and Data Protection Officers (not included in count reported).
iKPI10: (%) Increase of healthcare sector's market share as benefit of the HEIR's advanced cybersecurity services	>10%	Exploitation in progress 	This iKPI is not formally evaluated as the project's results have not been integrated in specific product offerings at this time. However, several commercial actions have been launched by HEIR partners, on the basis of the project's results. Please refer to deliverable D7.9 (exploitation) for additional details.
iKPI11: Number of cyber-security technology providers engaged to HEIR	>10		During the project, we leveraged tools developed by external technology providers (either open source or commercial), but did not engage them.
iKPI12: (%) Detection time reduction in advanced cyber threats	10%	Qualitatively evaluated. 	This iKPI has not been fully evaluated as the project's pilot sites were not exposed to external threats (to avoid creating risk on the pilots). However, this iKPI has been qualitatively evaluated by the HEIR pilot partners. During information days, 6 out of 12 IT experts stated that the Anomaly Detection Module is better in comparison to their existing solution (Increase 50%) (deliverable D6.3, section 3.1). This does not however measure time reduction.

Name	Target	Achieved	Description of the achievements
iKPI13: (%) increased accuracy of security monitoring in health sector	35%	Qualitatively evaluated as partially satisfied 	This iKPI has been qualitatively evaluated by the HEIR pilot partners. Based on D6.3 (section 2.2), PAGNI reported improvement in comparison to the initial cybersecurity solution, the rest (3 pilots) mentioned that there can be no comparison. Based on D6.3, section 3.1, Question 6, 22 out of 29 IT experts considered that the HEIR solution will enhance their performance.
iKPI14: Increase in level of trust among entities in health sector	>50%	Qualitatively evaluated as partially satisfied 	This iKPI has been qualitatively evaluated by the HEIR pilot partners. The value reported represents the consensus estimate. Based on D6.3, section 3.1, Question 6, 22 out of 29 IT experts considered that the HEIR solution will enhance their performance.
iKPI15: Number of legislation issues related to HEIR identified and reported through the project's duration	>5	8 	STELAR has identified and evaluated 8 different legal norms which are relevant to the HEIR project. They have been reported on D7.5 and D7.6. These are the GDPR, Regulation (EU) 2018/1807, the E-privacy Directive 2009/136/EC, the NIS(2) directives, the eIDAS regulation, The European Convention on Human Rights (ECHR) and The European Charter of Fundamental Rights (CFREU).
iKPI16: Number of innovative technologies advanced within HEIR	>5	17 	The project developed and integrated the following components: Local RAMA, Global RAMA, HEIR Client, HEIR Agents, HCC, HET, HNM, TDM, SIEM, VA, 1st Layer GUI, FVT, Observatory, ML-based Anomaly Detection, Privacy Aware Framework, Blockchain. Other technical components were leveraged (communication middleware such as Kafka, database such as ElasticSearch), but these though absolutely necessary are not considered innovative.
iKPI17: Number of industries engaged within HEIR duration to exploit innovative technologies	>3	7 	The auditing mechanism developed by WEL is incorporated in its PaaS product. This will be used as an extra security feature that is especially important for large accounts belonging to **energy**, **insurance** and **human resources** sectors. AEGIS has developed contacts in the **healthcare** and **insurance industry**. ITML has developed contacts in the **Public sector** and in the **manufacturing** and **energy** industries.

Name	Target	Achieved	Description of the achievements
iKPI18: Number of innovative products and services of the HEIR pilot partners directly enhanced by the HEIR platform	>3	8 	The HEIR pilot partners are not commercial entities. We are reporting data from the commercial HEIR partners. 4 HEIR partners reported a total engagement of 8 new products and services. **STS (3):** STS's integration of the components developed within HEIR is planned for either Q1 or Q2 of 2024. **WEL (1):** The auditing mechanism is scheduled to be incorporated in the WEL's commercial PaaS (D7.9) **Aegis (3):** FVT, Observatory, HEIR Visualisations ITML (1): The technologies created for the HEIR SIEM are scheduled to be integrated into the Security Infusion, an ITML commercial project, during the 1st half of 2024.
iKPI19: Number of SMEs providing security-related services reached and engaged within project's duration	>10		We did have exchanges with SMEs active in the cybersecurity domain during the cluster work of the Horizon Results Booster (HRB) service that the HEIR project coordinated. We can report that these SMEs were reached, but engagement was limited to the joint HRB work. We also reached a few SMEs that are in direct privileged contact with HEIR partners.
iKPI20: Expected increase of market share for SMEs exploiting HEIR	>10%	Qualitatively evaluated as satisfied 	**WEL:** Based on our forecast the developed auditing mechanism will account for additional **5** large size accounts within the next year and 25 in total within a 3-year period. **AEGIS:** Initial Market share estimation: 2/1000, Final market share estimation: 3/1000, Increase= +50%. **ITML:** The initial market share prior to the HEIR project was appraised at 0.1%. However, the market share anticipated for the year 2024 is expected to attain 0.2%, indicating a growth rate of 50%.
iKPI21: Number of start-ups and spin-offs boosted exploiting HEIR security services	>4		IMT reports one engagement with a startup created by an Alumni that is addressing cybersecurity for the healthcare sector.

Name	Target	Achieved	Description of the achievements
iKPI22: Increase in market share for the four pilot partners exploiting HEIR platform	>15%	Qualitatively evaluated at a higher level ☑	The pilot partners engaged in HEIR are not commercial entities and are not selling the HEIR platform. We are reporting here exploitation by the HEIR commercial partners. **WEL:** Based on our forecast the developed auditing mechanism will account for additional **5** large size accounts within the next year and 25 in total within a 3-year period. **AEGIS:** Initial Market share estimation: 2/1000, Final market share estimation: 3/1000, Increase= +50%. **ITML:** The initial market share prior to the HEIR project was appraised at 0.2%. However, the market share anticipated for the year 2024 is expected to attain 0.3%, indicating a growth rate of 50%.
iKPI23: Increase in sales for the pilot partners exploiting HEIR platform	>10%	Qualitatively evaluated at a higher level ☑	The pilot partners engaged in HEIR are not commercial entities and are not selling the HEIR platform. We are reporting here exploitation by the HEIR commercial partners. WEL: Based on our forecast the developed auditing mechanism will account for > 15% increase to our sales revenues, as this will attract additional premium customers (large-size accounts). AEGIS: The Prior HEIR clients is evaluated at 3, after HEIR clients is evaluated at 4, nncrease of 25% ITML: Preceding the initiation of the HEIR project, ITML's client base stood at 4. However, the post-HEIR project projection anticipates an expansion of the clientele to 6, signifying a 50% increase in ITML's sales.

From the table, we can draw the following conclusions:

- Several iKPIs are qualitatively evaluated by corroborating evidence provided as explanations in the table.
- All technical iKPIs (related to technological development) have been fully achieved or are close to being achieved. This indicates that the project's technical work was of high quality and met expectations.
- Three impact KPIs failed, iKPI11 (engagement of cybersecurity technology providers) and iKPI19 (SME engagement) and iKPI21 (creation of startups). The two first iKPIs are related to tools, and we had a significant and sufficient set of tools at our disposal. We participated in a few industry conferences and events, but did not create the engagement as a follow-up. iKPI21 is a high-risk KPI and due to its very nature is extremely hard to achieve.
- We evaluate five iKPIs, related to exploitation and impact, as partially satisfied. Exploitation is in progress and is described in detail in deliverable D7.8 (confidential).

9. Publications

Within the scope of HEIR, several noteworthy scientific publications have been produced. We present a compilation of these publications below:

1. Peng Xu, Claudia Eckert, and Apostolis Zarras. Detecting and Categorizing Android Malware with Graph Neural Networks. In *Proceedings of the 36th ACM/SIGAPP Symposium on Applied Computing (SAC)*, 2021.
2. Peng Xu, Youyi Zhang, Claudia Eckert, and Apostolis Zarras. HawkEye: Cross-Platform Malware Detection with Representation Learning on Graphs. In *Proceedings of the 30th International Conference on Artificial Neural Networks (ICANN)*, 2021.
3. Peng Xu, Claudia Eckert, and Apostolis Zarras. Falcon: Malware Detection and Categorization with Network Traffic Images. In *Proceedings of the 30th International Conference on Artificial Neural Networks (ICANN)*, 2021.
4. Mohammad Reza Norouzian, Peng Xu, Claudia Eckert, and Apostolis Zarras. Hybroid: Toward Android Malware Detection and Categorization with Program Code and Network Traffic. In *Proceedings of the 24th Information Security Conference (ISC)*, 2021.
5. Misha Glazunov and Apostolis Zarras. Do Bayesian Variational Autoencoders Know What They Don't Know? In *Proceedings of the 38th Conference on Uncertainty in Artificial Intelligence (UAI)*, 2022.
6. Marwan Darwish and Apostolis Zarras. Digital Forgetting Using Key Decay. In *Proceedings of the 38th ACM/SIGAPP Symposium on Applied Computing (SAC)*, 2023.
7. Charlie Groh, Sergej Proskurin, and Apostolis Zarras. Free Willy: Prune System Calls to Enhance Software Security. In *Proceedings of the 38th ACM/SIGAPP Symposium on Applied Computing (SAC)*, 2023.
8. Misha Glazunov and Apostolis Zarras. Vacant Holes for Unsupervised Detection of the Outliers in Compact Latent Representation. In *Proceedings of the 39th Conference on Uncertainty in Artificial Intelligence (UAI)*, 2023.

In addition to the already published works, several others are currently under review:

1. RAMA: A Risk Assessment Methodology for Healthcare. Submitted to Special issue on Cybersecurity in Healthcare, *International Journal of Information Security (IJIS)*.
2. Integrated knowledge graph to support automatic correlation in the vulnerability analysis process. Submitted to *ACM Digital Threats: Research and Practice (DTRAP)*.
3. Securing Software via System Call Pruning. Submitted to *Journal of Supercomputing*.
4. Cybersecurity and privacy issues when patients in Europe transfer health data from their diabetes devices to health services. Submitted to *Journal of Diabetes Science and Technology*.

Finally, we made some other types of publications:

1. Linking healthcare registries to improve medical research. In *medium.com*.
2. Creating a Privacy-aware framework for Fine-grained Data Access. In *ERCIM News*.

10. Conclusion

Deliverable D7.4 documents the dissemination activities and engagements during the second period of the HEIR project.

We maintained a similar strategy as the one deployed during the first period. It is worth noting that the impact of Covid was very high during the first year of the project. In this period, we have been able to lead many successful physical activities, very often doubled by an online presence. This resulted in increasing activity, as shown by the statistics of our online presence. It is also useful to note that we produced and published several videos showcasing HEIR-developed technologies, and that this material was successfully used during the info days and training (see deliverable D7.10 for more details on the trainings).

This deliverable includes an evaluation of the Key Performance Indicators (KPI) of the project. Following the revision of dissemination KPIs requested at the first review, the project met 22 of its 27 dissemination KPIs and partially achieved 4. We only failed one dissemination KPI, the website downloads. A partial explanation for this is the use of a Youtube channel to disseminate the videos, which reduces the need for the website.

We also evaluated the impact KPIs. Out of the 23 impact KPIs described in the Description of Action, we have been able to satisfy fully 15 and partially an additional 5. 3 impact KPIs remain unsatisfied, related to engagement with cybersecurity companies and SMEs outside the project, and with startup creation. As a whole, the project has achieved its expected impact within the healthcare sector, and is likely to impact other sectors as well during the exploitation phase.

During the execution of the project, we can report that cybersecurity is of increasing importance for the healthcare sector. We recorded and analyzed several cybersecurity compromises in hospitals, generally as a result of ransomware infection. This analysis demonstrated that hospitals are a target (along with other public administrations) and that such cyberattacks have extreme impact, disabling all if not all care capabilities for weeks. Return to normal operations only occurs after months of hard work, and very expensive restauration efforts. We therefore hope that through its dissemination and training activities, HEIR has helped pilot partners and the healthcare community as a whole recognize the severity of the cybersecurity threat, and that it is offering useful tools to fight cybercrime.

11. References

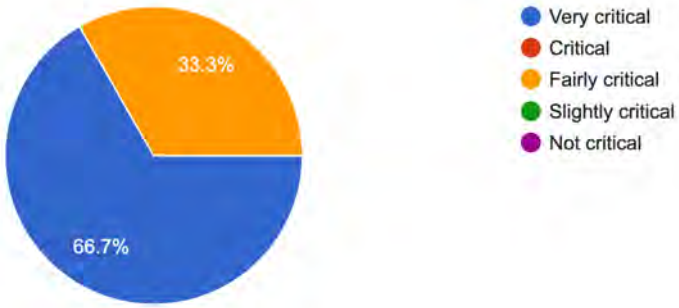
[1] ENISA CSIRT Inventory – "CSIRTs by Country - Interactive Map", https://www.enisa.europa.eu/topics/csirts-in-europe/csirt-inventory/certs-by-country-interactive-map
[2] ENISA - Information Sharing and Analysis Center (ISACs) - Cooperative models https://www.enisa.europa.eu/publications/information-sharing-and-analysis-center-isacs-cooperative-models
[3] PRAXI Network, https://praxinetwork.gr/en/

12. Annexes

12.1 CERTs/CSIRTs Questionnaire Responses

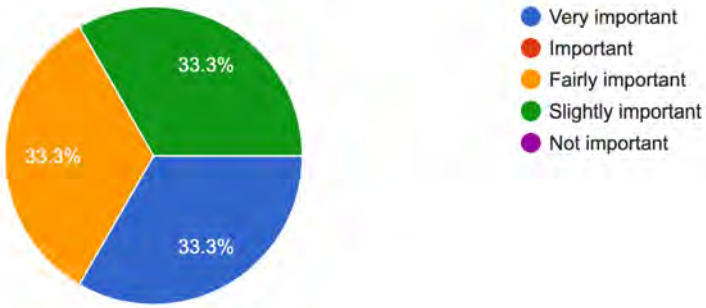
How critical is it for CERT/CSIRT to have access to aggregated data/info regarding the current cybersecurity status of hospitals across Europe?

3 responses



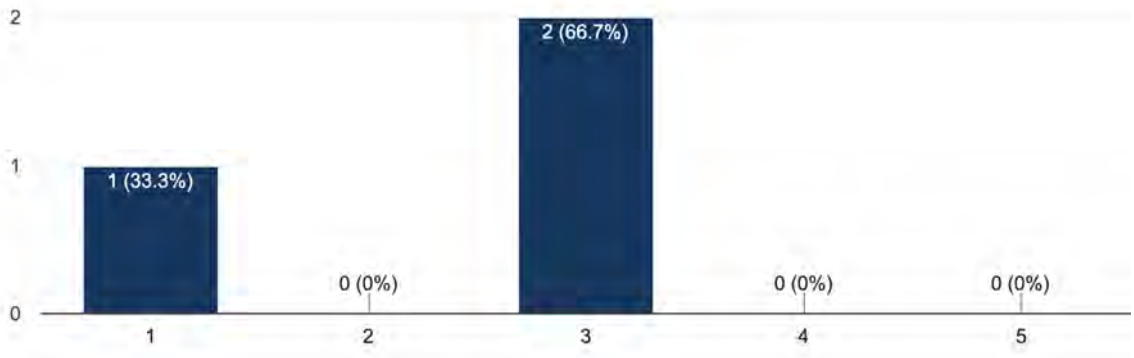
It is also important for you to have access to the analytical security data of individual organizations?

3 responses



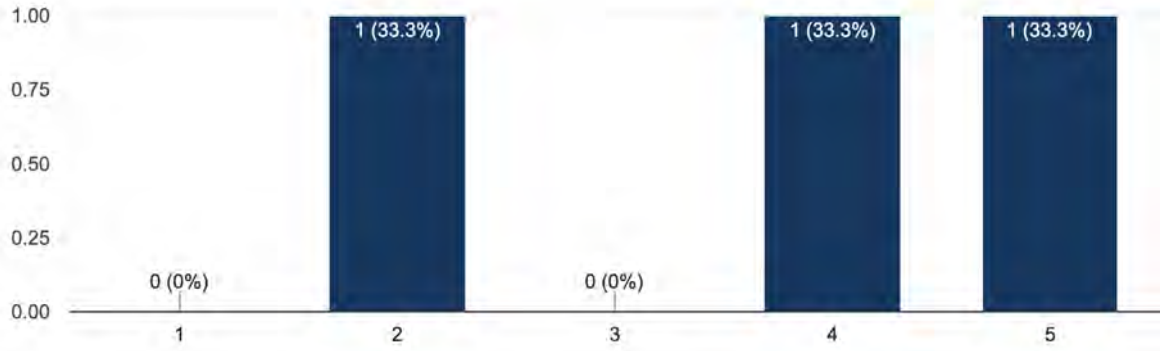
Does a benchmark metric (such as the HEIR global benchmark against which the RAMA scores of medical infrastructures are compared) provide enou...or the cybersecurity status of the Health domain?

3 responses



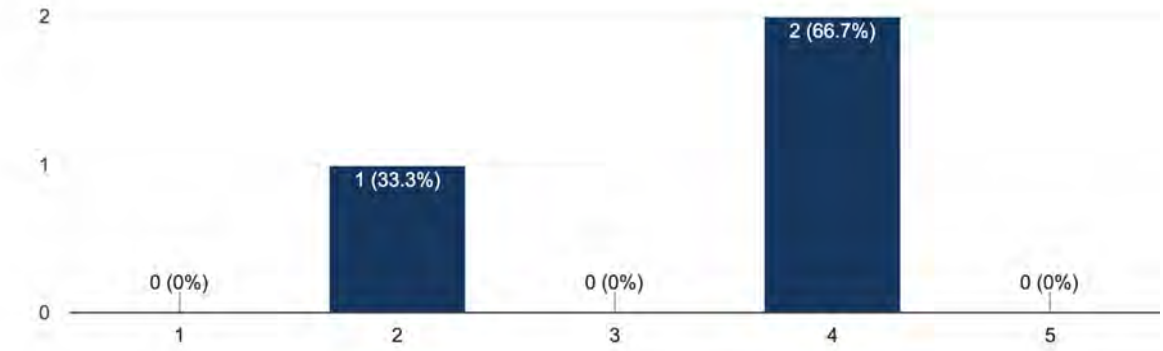
The HEIR Network Module (HNM) has the role to monitor the network traffic.

3 responses



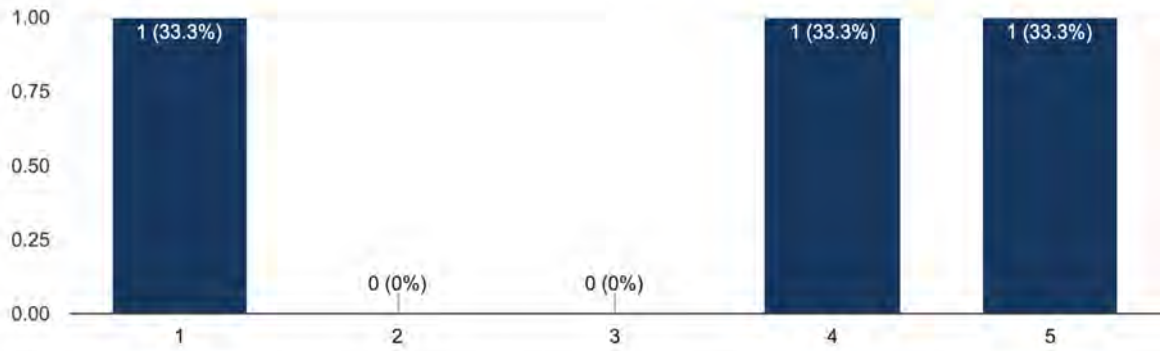
The HEIR Exploit Tester (HET) has the role to assess the attack surfaces for the operating system configuration.

3 responses



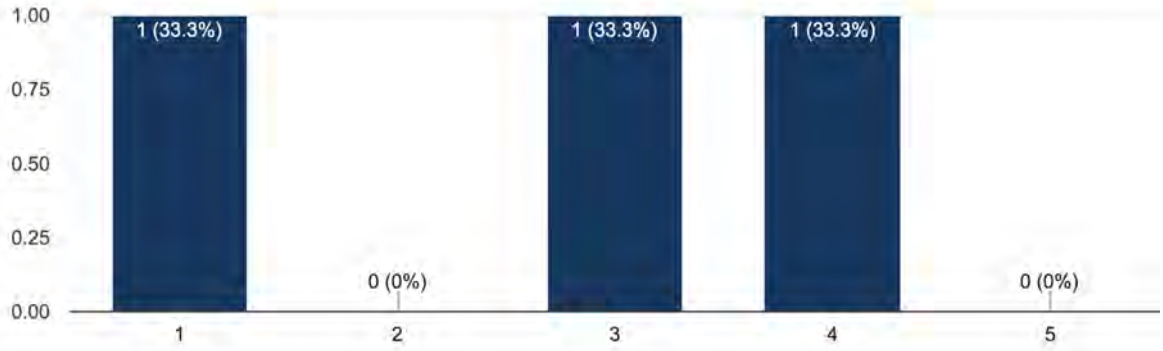
The HEIR Cryptographic Checker (HCC) has the role to alert regarding the usage of outdated security protocols that are used inside the HEIR en...iders for the HEIR system inside the environments.

3 responses



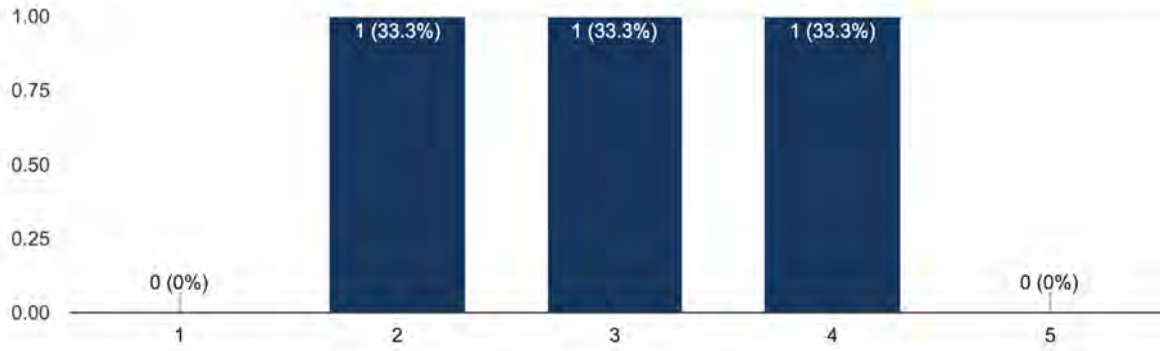
The RAMA score calculator acts as a benchmark for the IT security of a hospital or healthcare facility. It is responsible for estimating the attack s...corporating several critical issues in a live manner.

3 responses



The Machine Learning (ML) anomaly detection and threat classification component provides an efficient event and threat data classification based ...requirements and cyber-threats level of criticality.

3 responses



It is useful to have:

2 responses

Please advise us on what research paths are explored and where to publish (relevant publication events), regarding the publication of scientific results.

1 response

https://2020.wish.org.qa/topics/cyber-security/ AND H-ISAC (Health Information Sharing and Analysis Center

Please advise us on how to disseminate the acquired knowledge (ML-based Anomaly Detection and Threat Classification) to start-up companies, specialized entities, etc.

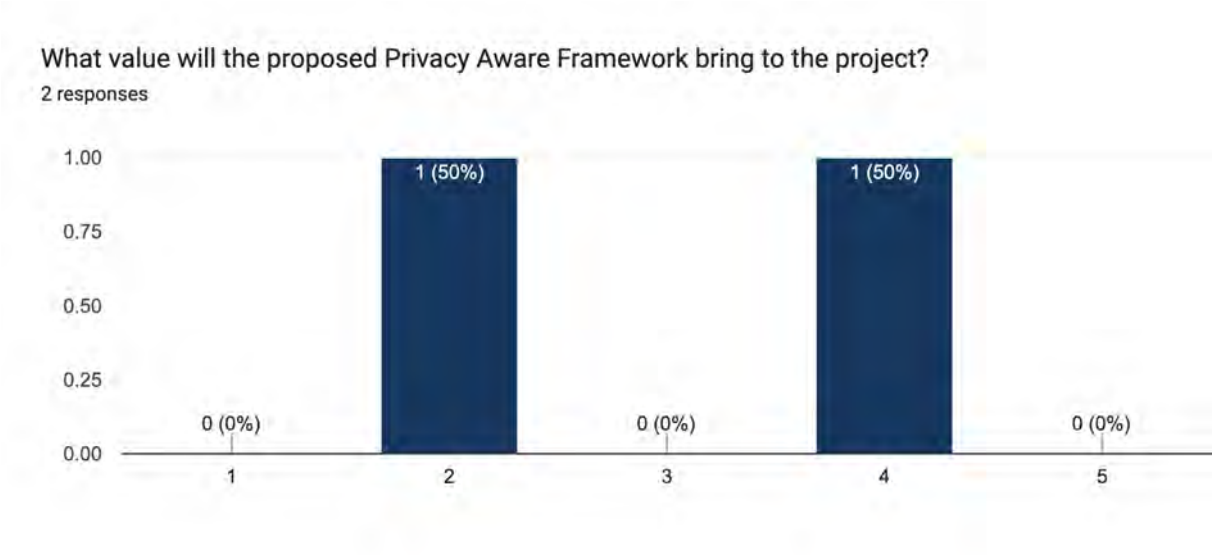
0 responses

No responses yet for this question.

How is RAMA score relevant for future CyberSecurity monitoring?

0 responses

No responses yet for this question.



Are you using custom tools that are not yet supported by our architecture? If so, which tools would you like to be integrated in our architecture?

0 responses

No responses yet for this question.

How will HEIR facilitate the future registry-based research into healthcare problems?

0 responses

No responses yet for this question.

How will HEIR improve the security and privacy access to healthcare systems?

0 responses

No responses yet for this question.

12.2 Horizon Results Booster

The HEIR project applied to the Horizon Results Booster[2] (HRB) service to obtain support in dissemination and exploitation strategy. HEIR applied both as a single project and as the "leader" of a cluster of similar projects, with which we had previously exchanged and cooperated (AI4HealthSec, AERAS, SMART BEAR).

Due to the fact that the findings of the HRB are considered confidential, and that this deliverable is public, we are not including the results of the study herein.

[2] https://www.horizonresultsbooster.eu/