



Deliverable 1.3

DISSEMINATION AND EXPLOITATION REPORT

WP1 – Management, Dissemination and Exploitation

Document Type	Document
Document Version	V1.0
Access Level	Public
Submission Date	Sep 2024
Editors	Mantis
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Document History

Date	Version	Editors	Status
01/03/2024	0.1	Mantis	Table of Content
15/04/2024	0.2	Bilbest/Mantis	First draft
20/06/2024	0.5	Mantis and All	Review and update
10/07/2024	0.6	Mantis	Second draft
15/08/2024	0.9	Bilbest and All	Review and update
05/09/2024	1.0	Mantis	Final draft

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Glossary

Acronym	Meaning
CDE	Communication, Dissemination, and Exploitation
CM	Clinical Medicine
DO	Dissemination Objectives
EBM	Evidence-Based Medicine
EU	European Union
EHR	Electronic Health Record
HIS	Hospital Information System
IPR	Inter Partes Review

EXECUTIVE SUMMARY

Communication, dissemination, and exploitation (CDE) are critical components of the HeKDisco project. The project impact can be maximized by effectively communicating and disseminating project results, and we ensure that we reach the broadest possible audience. This will result in a better use of the project's outcomes to develop new products, services, or processes, which can lead to commercial success.

This deliverable reports and describes all CDE activities in the HekDisco project. It discusses the different types of dissemination activities that have been completed during the project as well as exploitation strategies developed.

1 Introduction

CDE is the process of informing others about the project and its outcomes. It is classified into three major categories: communication, dissemination, and exploitation.

Communication entails publicizing the project and its findings to the general public, policymakers, and other stakeholders; dissemination involves discussing project findings with the scientific community and other experts; and exploitation includes employing project findings to develop new products, services, or processes.

The dissemination and exploitation plan of the HeKDisco project is designed to ensure maximum impact in achieving the project's objectives. The parts of the dissemination and exploitation plan that deal with measures will help reach the main goals of the activities related to dissemination and exploitation, which are as follows:

- To enable efficient internal communication through the internal network for knowledge exchange in terms of sharing the information and data that the project will generate.
- To support the communication of the project results at a European, international, national, and local level and to reach all target audiences adequately following the IPR rules.
- To support the exploitation of potential synergies with related EU and nationally funded projects and potentially perform joint dissemination and training activities with these projects.

1.1 HeKDisco project overview

The main purpose of the HeKDisco project is to reduce potential human mistakes in the medical care of patients. Traditional health care systems—clinical medicine (CM)—mainly rely on conservative methods to diagnose diseases and treat patients, depending on the individual knowledge and skills of physicians. On the contrary, evidence-based medicine (EBM) provides a workaround for poorly designed observational treatment that relies on physicians' personal experience with other patients. In this approach, evidence describes average results for groups of patients. HeKDisco, following EBM, aims to use the best (reliable) evidence in making decisions about the care of individual patients so

that the clinician’s experience, the patient’s values and preferences, and the best empirical clinical guidelines are integrated.

In many diseases, especially infectious and chronic diseases, the same treatment may show different outcomes for different groups of patients. Therefore, physicians’ ability to use reliable empirical evidence before any decision-making helps them select the best treatment option and decreases potential mistakes. According to a study by Johns Hopkins in 2016, more than 250,000 people in the U.S. die every year due to medical mistakes, making it the third leading cause of death after heart disease and cancer. In this line, HeKDisco proposes a novel knowledge discovery process for health care systems so as to provide physicians with reliable evidence on different treatment stages and clinical events, thereby reducing individual clinical errors. The overall idea of the HeKDisco project is summarized in Figure 1. It includes five key objectives: (1) Perform multimodal knowledge discovery from medical images and clinical notes in order to extract high-level information, such as descriptive and predictive information, which is lacking in EHR systems. (2) Generate a knowledge base in conjunction with EHRs. (3) Develop a clinical search engine in order to provide a systematic analysis using a common data model as standardization. (4) The use of systematic analyses to create a computational ontology in order to recognize the relationships between the descriptive and predictive parameters. (5) Provide high-quality care

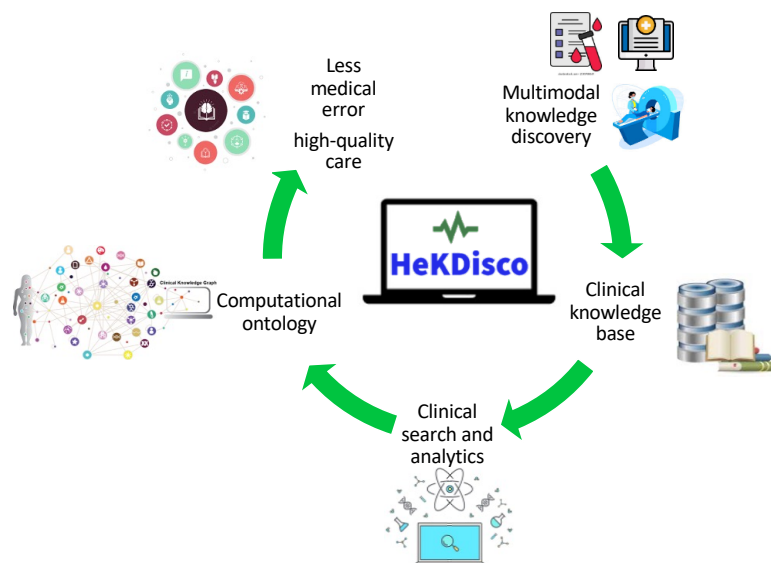


Figure 1. The overall idea of the HeKDisco project.

2 Dissemination activity report

All partners report their dissemination activities to ensure that stakeholders are well-informed, engaged, and connected throughout the implementation of the HeKDisco project based on the project dissemination objectives. These objectives (DO) have been described in Table 1:

Table 1. HeKDisco dissemination objectives

DO1	Widely disseminate activities and results to ensure the achievement of expected objectives and impact.
DO2	Widely disseminate methodologies and practices developed within the scope of the project.
DO3	Ensure policy and decision-makers are informed, inciting political uptake and spill-over.
DO4	Involve and receive support from relevant media to promote further project communication and disseminate the results/expected outputs of the project.

The HekDisco strategy for dissemination is a setup of activities classified into 3 different levels of audience, depending on the type of action, addressed to the interests of stakeholders:

(1) Dissemination for Awareness (General Audience – Gen Aud): aimed at (i) the public and media and to those people that should be aware of the work of HekDisco but do not require detailed knowledge of the project, and (ii) more specifically people with a special interest in the diseases (in terms of diagnosis and treatment), determined within the scope of the project.

(2) Dissemination for Understanding (Target Audience – Tar Aud): aimed at those stakeholders that may benefit from HekDisco but are not directly involved in the project, such as (i) hospitals, academicians, universities, and other educational institutions; (ii) companies, organizations, and private investors with interest in HekDisco’s technological domain; (iii) researchers, students, PhD graduates, and academics who might benefit from HekDisco's methodologies and results.

(3) Dissemination for Action (Project related Audience – Pro Aud): These activities are aimed at changing practices resulting from the adoption of the methodologies and strategies offered by this project. This group comprises researchers and academicians, technology transfer offices, industry, policymakers, and public authorities from Istanbul, Slovenia, and Belgium.

During HekDisco, the project coordinator, Mantis, as part of the dissemination activities, organized numerous promotional and evaluation meetings to explore the utilization of the project’s technical outcomes and the developed technologies in both the healthcare sector and other industries. In this context, multiple meetings were held with FONET, one of the leading companies in Turkey’s Hospital Information Management Systems (HBYS) sector. These meetings focused on assessing potential collaboration opportunities for the dissemination and commercialization of the project outputs to be obtained through the HekDisco project. Furthermore, technical discussions were conducted regarding the architecture of the knowledge discovery portal being developed within the project, with a particular focus on how this portal could be integrated into HBYS systems.

Additionally, the architecture developed by Mantis for running machine learning methods on a serverless environment through a Function-as-a-Service (FaaS) architecture, along with the results of performance and efficiency tests, were presented to key companies operating in Turkey’s Defense Industry Sector. Promotional activities were also conducted to demonstrate the potential applicability of this architecture in the defense industry.

Table 2 describes all partners dissemination activities determining their objectives and audience levels:

Table 2. HeKDisco dissemination activities

Activity name	Date (mo/yy)	Description	Goal	Audience
Project Webpage	Feb 2022	The project web page was established (hekdisco.com)	DO1	GenAud
Project social media	Mar 2022	The project’s social media pages were established in Facebook and Twitter	DO1	GenAud
Conference participation	Oct 2022	HeKDisco was introduced by Virasoft at 31st National Pathology Congress	DO2	TarAud (1200+ pathologist)
Conference participation	Mar 2023	Virasoft participated in the 112th International Pathology Congress (USCAP) in New Orleans, LA, USA, opening a stand and by talking about the Hekdisco project and its outputs	DO2	TarAud (1200+ pathologists and oncologists from more than 100 countries)
Conference participation	April 2023	Virasoft attended the HIMSS Global Health Conference in Chicago, USA, where we displayed our promotional wall and introduced the project.	DO2	TarAud (healthcare professionals from all over the world)
Interview	April 2023	Bilbest introduced the HeKDisco project to a government hospital (Sancaktepe Şehit Prof.Dr.İlhan Varank Training and Research Hospital). Bilbest was working with this hospital on the HIS system. During the	DO1, DO2	GenAud, TarAud (especially the management level of the HIS system at the hospital)

		meeting, the real needs of the hospital system and the potential integration of the project's sepsis use case were addressed.		
Collaboration with pioneers	May 2023	Mantis introduced the HeKDisco project to FONET, one of the leading companies in Turkey's Hospital Information Management Systems (HBYS) sector.	DO2 DO3	TarAud
Collaboration with pioneers	Aug 2023	Mantis presented the architecture of the knowledge discovery to FONET, with a particular focus on how this portal could be integrated into HBYS systems.	DO3	TarAud
Conference participation	Oct 2023	Virasoft participated by opening a stand at the 32nd National Pathology Congress. Acıbadem University Dr. Fatma Tokat, who was our academic advisor in the project, presented the Hekdisco Project to over 500 pathologists in collaboration with Virasoft, emphasizing its importance. At this stage, over 50 institutions were contacted, and promotional activities were carried out for the project.	DO2	TarAud (500+ pathologists)
Technology Dissemination	Nov 2023	Mantis presented the HeKDisco project to one of the key companies operating in Turkey's Defense Industry Sector and proposed using the HeKDisco architecture for running machine learning methods on a serverless environment through a Function-as-a-Service (FaaS) architecture.	DO3	TarAud
Collaboration with pioneers	April 2024	Mantis presented the results of the knowledge discovery to FONET, with a particular focus on the results and impact for integrating into HBYS systems.	DO3	TarAud
Poster presentation	June 2024	The project poster was presented at the Global Innovation Summit (GIS) 2024, which took place in Istanbul, Türkiye. The project's approach and results were presented to leaders, companies, and research organizations.	DO1 DO4	GenAud
Fair participation	Nov 2021, 2022,	HeKDisco was introduced by Caretronic each year at Medica -	DO1	Healthcare providers

	2023	Trade Fair for Medical Technology & Healthcare in Düsseldorf, Germany		
Fair participation	Jan, 2022, 2023, 2024	HeKDisco was introduced by Caretronic each year at ArabHealth Dubai - Global Healthcare Medical Expo	DO1	Healthcare providers
Fair participation	April 2023	HeKDisco was introduced by Caretronic at HIMSS Health, McCormick Place, Chicago	DO1	Healthcare providers
Fair participation	Nov 2023	HeKDisco was introduced by Caretronic at LeadingAge, McCormick Place, Chicago	DO1	Healthcare providers
Fair participation	April 2024	HeKDisco was introduced by Caretronic at AltenPflege in Germany	DO1	Healthcare providers
Congress participation	Sept 2023	HeKDisco was introduced by Caretronic at Nursing and Care Leaders' Activation Meeting in Slovenia	DO1	Healthcare providers
Interview	Sept 2023	Bilbest had an online discussion with Roche-Turkey. Bilbest introduced the project and provided general information about the activities and objectives of the Sepsis use case.	DO1, DO2	GenAud, TarAud (especially R&D Team of the company)
Presentations & posters at international conferences	Oct 2023	Virasoft co-authored a perspective article on "Digital analysis of breast cancer Ki-67 scores in different whole slide image formats." Digital Pathology Association / Pathology Visions 2023, Oct 29 - 31 2023, Orlando, Florida. Abstract in Journal of Pathology Informatics, in press	DO1, DO2	TarAud
Presentations & posters at international conferences	Mar 2024	Virasoft co-authored a perspective article on "AI-Powered Automated Analysis of Mitotic Figures in Soft Tissue Sarcomas Whole Slide Images." United States & Canadian Academy of Pathology (USCAP) 113th Annual Meeting, March 23-28, 2024, Baltimore, Maryland. Abstract #69 in Laboratory Investigation 104 (Suppl 1): S76-S77, 2024	DO1, DO2	TarAud
Presentations & posters at international conferences	Mar 2024	Virasoft co-authored a perspective poster presentation on "Validation of Algorithmic Ki-67 Scoring in Breast Cancer Using Four Different Whole Slide Image Formats." United States & Canadian Academy of Pathology	DO1, DO2	TarAud

		(USCAP) 113th Annual Meeting, March 23-28, 2024, Baltimore, Maryland. Abstract #1295 in Laboratory Investigation 104 (Suppl 1): S1623, 2024		
Presentations & posters at international conferences	Mar 2024	Virasoft co-authored a perspective poster presentation on “Comparison of Two Quality Control Algorithms for Artifacts of Whole Slide Images” United States & Canadian Academy of Pathology (USCAP) 113th Annual Meeting, March 23-28, 2024, Baltimore, Maryland. Abstract #1258 in Laboratory Investigation 104 (Suppl 1): S1572-S1573, 2024	DO1, DO2	TarAud
Presentations & posters at international conferences	Jun 2024	Virasoft co-authored a perspective poster presentation on “Ki-67 Decision Support Algorithm for Pathology Residents.” 20th European Congress on Digital Pathology (ECDP2024), June 5-8, 2024, Vilnius, Lithuania. accepted as oral presentation	DO1, DO2	TarAud
Congress participation	Sept/Oct 2022, 2023, 2024	HeKDisco was introduced by icomatrix at the annual meetings of ECTRIMS, the European committee for treatment and research in multiple sclerosis	D01, D02	TarAud (MS healthcare providers)
Congress participation	June/July 2022, 2023, 2024	HeKDisco was introduced by icomatrix at the annual meetings of EAN, the European academy of neurology	D01, D02	TarAud (neurologists)
Congress participation	June 2022, 2023, 2024	HeKDisco was introduced by icomatrix at the annual meetings of CMSC, the Consortium of Multiple Sclerosis Centers	D01, D02	TarAud (neuroradiologists)
Interview	Mar 2024	icomatrix featured in the ITEA magazine as SME in the spotlight promoting HeKDisco: https://itea4.org/magazine/47/march-2024/sme-in-the-spotlight-icomatrix.html	D04	GenAud
Peer-reviewed publication	Aug 2024	icomatrix co-authored a perspective article on “A future of AI-driven personalized care for people with multiple sclerosis” in Front. Immunol. (doi.org/10.3389/fimmu.2024.1446748) partly based on HeKDisco knowledge	D01, D02	GenAud

ITEA PO days participation	Sept 2024	icomatrix presents HeKDisco at the ITEA PO Days	D02, D03	TarAud
Interview	Sept 2024	Bilbest had an online discussion with Novartis-AI Team, which works with policymakers to develop new AI solutions for early prognosis of different diseases in the Turkish healthcare system. Bilbest provided general information about the project and especially about the activities and project partners of the Sepsis use case.	D01, D03	GenAud, TarAud (policymakers)

The photos of dissemination activities during various events are presented below:



Figure 2. At the HIMSS Global Health, the Hekdisco project was mentioned by the Deputy Minister of Health of Turkey, Dr. Şuayip Birinci, and it was stated that it was a pioneering project in terms of innovation.



Figure 3. Acıbadem University Dr. Fatma Tokat, who was our academic advisor in the project, presented the Hekdisco Project to over 500 pathologists in the 32nd National Pathology Congress.



Figure 4. HeKDisco project at the ITEA PO days 2024



2022



2023



2024

Figure 5. icomatrix introduced HeKDisco at the European Academy of Neurology.

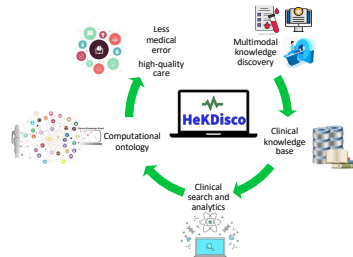


Healthcare Knowledge Discovery

Aim of the Project

- Multimodal knowledge discovery process to provide physicians with data and domain understanding
- Increase physicians' ability to use reliable empirical evidence before any decision-making

Challenges



Scientific Background / Technology applied

- Multimodal knowledge discovery from medical images: AI-based software for (1) brain image quantification and tracking of MS disease progression; (2) extracting pathology parameters from histopathology images.
- Generate a knowledge base in conjunction with electronic health records
- Clinical search engine to provide a systematic analysis based on the OMOP Common Data Model.
- Computational ontology to recognize the relationships between the descriptive and predictive knowledge parameters.

Impact

HeKDisco offers health information systems multimodal data processing and knowledge discovery in conjunction with a semantic clinical search engine.

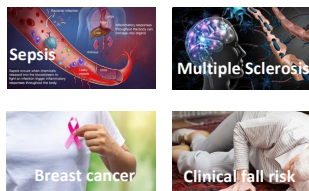
Project Budget

- 927 k€

Project Timeline

- Start date: 01 Oct 2021
- End date: 30 Sep 2024

Project use cases



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Project consortium



Funding agencies



REPUBLIKA SLOVENIJA
MINISTRSTVO ZA VISOKO ŠOLSTVO,
ZNANOST IN INOVACIJE

Project webpage



Figure 6. HeKDisco poster at GIS 2024.

3 Exploitation report

The HeKDisco exploitation strategy is streamlined based on 3 main project outcomes, as follows:

- **O1.** HeKDisco's exploitation related to knowledge discovery platform with a common data model for semantic search and analysis:

HeKDisco has developed a prototype for a knowledge discovery platform that seamlessly integrates various clinical applications using a standard common data model. The platform integrates knowledge from various resources related to project use cases, offering an integrated system for analysis and search that can be exploited as a system in a healthcare provider or across multiple providers.

- **O2.** HeKDisco's exploitation related to knowledge extraction modules for individual use cases:

HeKDisco has developed several AI-based software applications for knowledge extraction from (1) brain images for quantification and tracking of multiple sclerosis (MS) disease progression; (2) histopathology images and reports for breast cancer tumor analysis, including tumor morphology, tumor grade, mitotic index, etc; (3) electronic health records for sepsis; and (4) sensor data for fall risk assessment. All these modules have exploitable outcomes for project partners.

- **O3.** HeKDisco's exploitation related to AI prediction models developed in each use case:

The HeKDisco project has developed several AI prediction models for different tasks in each use case, which can be exploited independently in healthcare systems.

The HeKDisco project defines two types of exploitation:

(1) Exploitable result, which refers to any project outputs that have been studied, developed, and validated from the business and academic point of view.

(2) Exploitable knowledge, which refers to methodologies and expertise that HeKDisco partners have acquired during the project.

Table 3. HeKDisco exploitable results with respect to project outcomes.

Id	Exploitable Result	Description	Out. Id	Involved Partner
R01	Stream-based data monitoring and analytics system	A health data monitoring system based on stream management approach that uses a message broker to provide asynchronous service-to-service communication between different components of the system	O1	Mantis, Caretronic, Bilbest
R02	Event-based data monitoring and analytics system	A health data monitoring system based on serverless architecture that uses FaaS technology to provide synchronous service-to-service communication between different components of the system.	O1	Mantis
R03	Fall prediction system	AI prediction models developed in Fall prediction for elderly use case	O3	Caretronic
R04	Digital tests for cognitive decline in multiple sclerosis (MS)	Multiple digital tests related to measuring cognitive decline in MS (icognition) as a feature included in the icompanion ms patient app for MS monitoring	O2	icometrix
R05	Multiple sclerosis AI prediction models	AI prediction models developed in the MS use case	O3	icometrix
R06	Decision support systems on histopathology images	AI based image analysis to assist pathologists for the diagnostic decision of breast cancer cases	O2	Virasoft
R07	Extractive Question answering NLP models	AI based pathology report analysis to assist oncologists to facilitate the parameter extraction	O2	Virasoft
R08	Early prognosis system for the Sepsis	AI prediction models developed for the early prognosis of Sepsis	O3	Bilbest

Table 4. HeKDisco exploitable knowledges with respect to project outcomes.

Id	Exploitable Knowledge	Description	Out. Id	Involved Partner
K01	Event-based data monitoring	Serverless architecture using FaaS technology for data monitoring	O1	Mantis, Caretronic
K02	Column-oriented DBMS for data monitoring and analytics	Using Cassandra for data monitoring & analytics in a serverless environment	O1	Mantis
K03	Search engines for data monitoring and analytics	Using Elasticsearch for data monitoring & analytics in a stream management system	O1	Mantis
K04	Scalable learning	Online learning approach with automatic scalability	O3	Mantis
K05	Neuroimaging insights into multiple sclerosis	Population graphs of MS lesions and brain volumes based on icobrain ms software for MRI volumetry	O2	icomatrix
K06	Data Collection and Curation	Data cleaning processes, True annotation processes with multiple pathologists	O2	Virasoft
K07	Deep learning-based AI algorithms	Object detection and segmentation architectures and their mechanisms	O2	Virasoft
K08	NLP pipeline	BERT and GPT models mechanisms	O2	Virasoft
K09	Sepsis AI models	Early prognosis models by using Deep Learning Algorithms	O3	Bilbest
K10	Data Parsing and Enrichment of Sepsis	Data was reached/anonymized. Then, cleaned by the data scientists in cooperation with the medical consultants	O2	Bilbest

4 Business Model

The HeKDisco project involves several exploitable outcomes that can provide value for the healthcare markets targeted in the project. The exploitable outcomes have been categorized based on project outcomes to demonstrate their integration into the project's business model. Given the exploitable outcomes, the project's business model is designed as follows:

Key stakeholders:

- Research Institution
- Healthcare Institutions
- Hospitals & Care Centers

Key activities:

- Learning about customers
- Learning about AI systems integrated into patient's care in different healthcare systems
- Continuously studying the market and competitors
- Recognize customers' needs
- Technology monitoring
- Dissemination

Value propositions:

Innovative knowledge discovery platform that allows healthcare systems or third parties to exploit their source data effectively and integrate it into patients' care.

Knowledge extraction modules that use AI techniques to identify clinical parameters related to disease progression from electronic health records (EHRs), medical images, and clinical reports.

Monitoring, analytics, and search modules that process data and retrieve the relevant information based on client queries.

Customer relationships:

- Added value product (exploitable outcomes) provided to right customers.
- Special offers to companies or health providers that can engage in the project development to include more use cases.
- Free trials for healthcare systems.

Customer segments:

- Health care providers
- Health insurers
- Patients and caregivers
- Large enterprises
- Pharmaceutical companies
- Clinical devices manufacturers
- Network of Caretronic partners worldwide

Resources:

- Knowledge
- Technologies
- Existing infrastructure

Channels:

- Direct contact and external & internal collaborators
- Online stores
- Healthcare webpages
- Patient associations
- Healthcare fairs

Cost structure:

- Human resources
- Research and Development
- Maintenance cost

Revenue Streams

- Licensing technologies and fees with payment options
- Additional maintenance fees
- Annual Subscriptions to our services