WEBINAR

One Digital Health and FAIR Principles

15.07.2026 17:00 PM CET Host: SYNYO GmbH

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AGENDA

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Key information

Time	Topic	Presenter
17:00 – 17:05	Welcome and introduction to the webinar	**Alexander Nikolov** SYNYO GmbH, Austria
17:05 – 18:00	One Digital Health: from the Wheel to the Intervention	**Oscar Tamburis** National Research Council, Italy
18:00 – 18:30	Q&A session	All participants
18:30	**END OF THE WEBINAR**	

HOUSEKEEPING RULES

The session will be entirely recorded and published on the OneAquaHealth Open Information Hub.

All participants except speakers and moderators will be **muted by default**.

Feel free to post your questionsions in the **chat**.

If you would like to speak, raise your hand and wait for the moderator to give you the floor.

Agenda

ODH: from the Wheel to the Intervention

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- **The One Digital Health Framework**
- **T3.1: Objectives / Outcomes / Tasks**
- **T3.2: Objectives / Outcomes / Tasks**
- **ODH Intervention & ODH applied to *OneAquaHealth***
- **The One Digital Health Ecosystem**
- **A Unified Terminology for ODH within OAH**
- **Q&A**

The One Digital Health Framework

What is One Digital Health?

The core concepts

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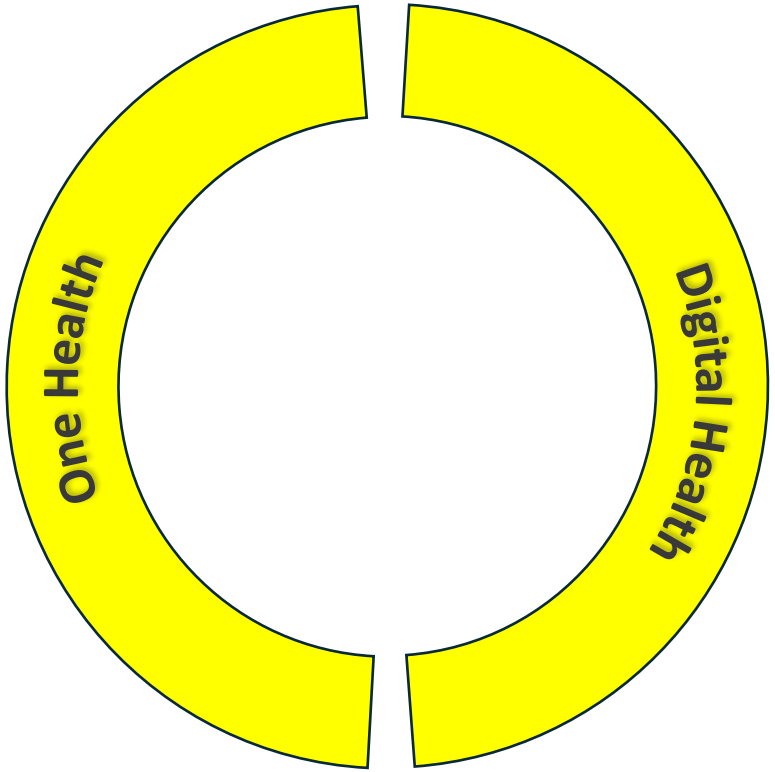
- ***ODH***: A novel scientific framework and research field, whose main goal is to achieve a unified approach in order to a digital interpretation of the existing relationships between human, animal, and environmental domains.
- ODH Based on:
  - *Health Informatics and the broadening of Digital Health;*
  - *One Health, which provides a holistic and systemic view of health and life sciences that are prominent in human health, animal health, and ecosystem research*

What is One Digital Health?

The core concepts

- **Two Enabling *Keys***
  - *DH: Ubiquitous data storing; p-Health; health promotion, self-management;*
  - *OH: health, well-being, individual, population, living quality, and biological systems;*
  - *New strands of research: infodemiology; digital epidemiology;*
  - *Earlier " One Health Informatics" model.*



What is One Digital Health?

The core concepts

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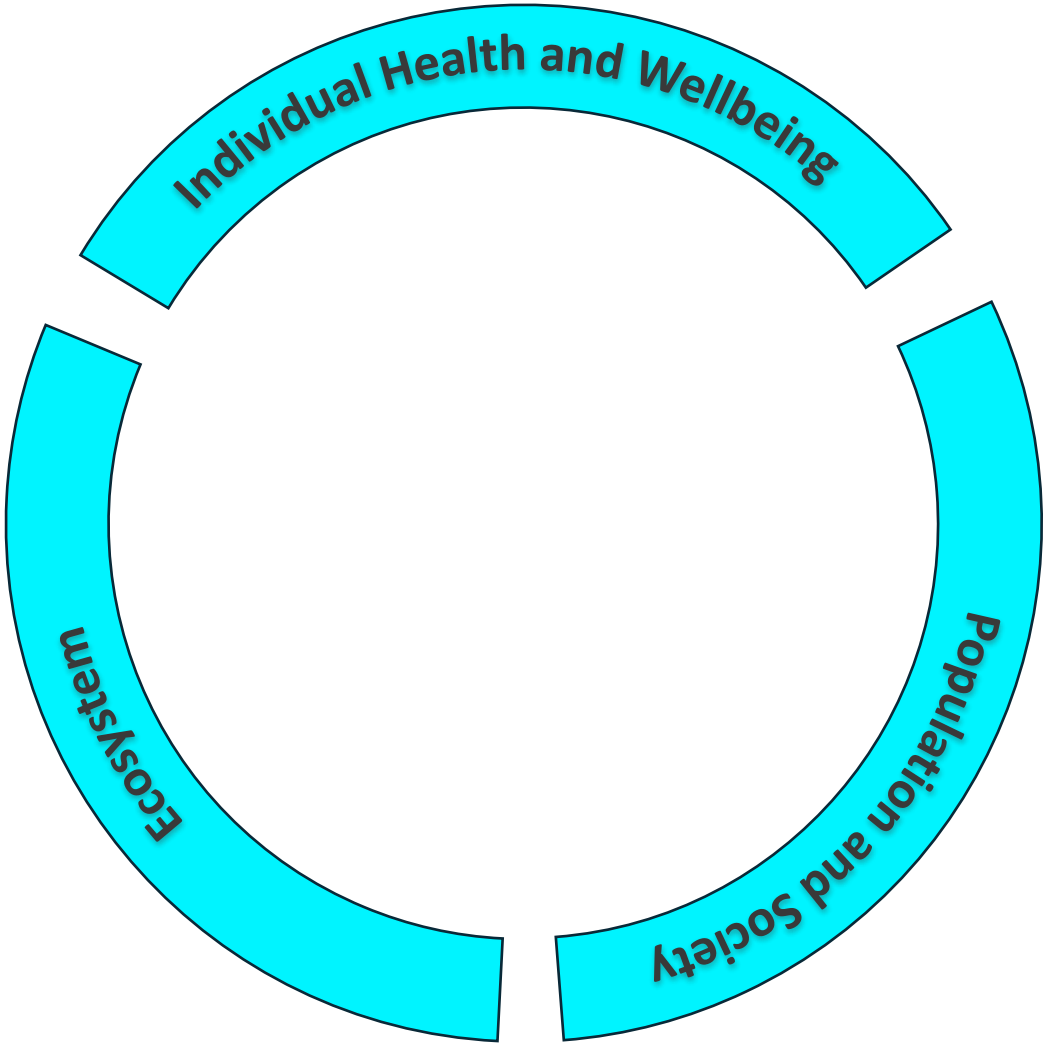
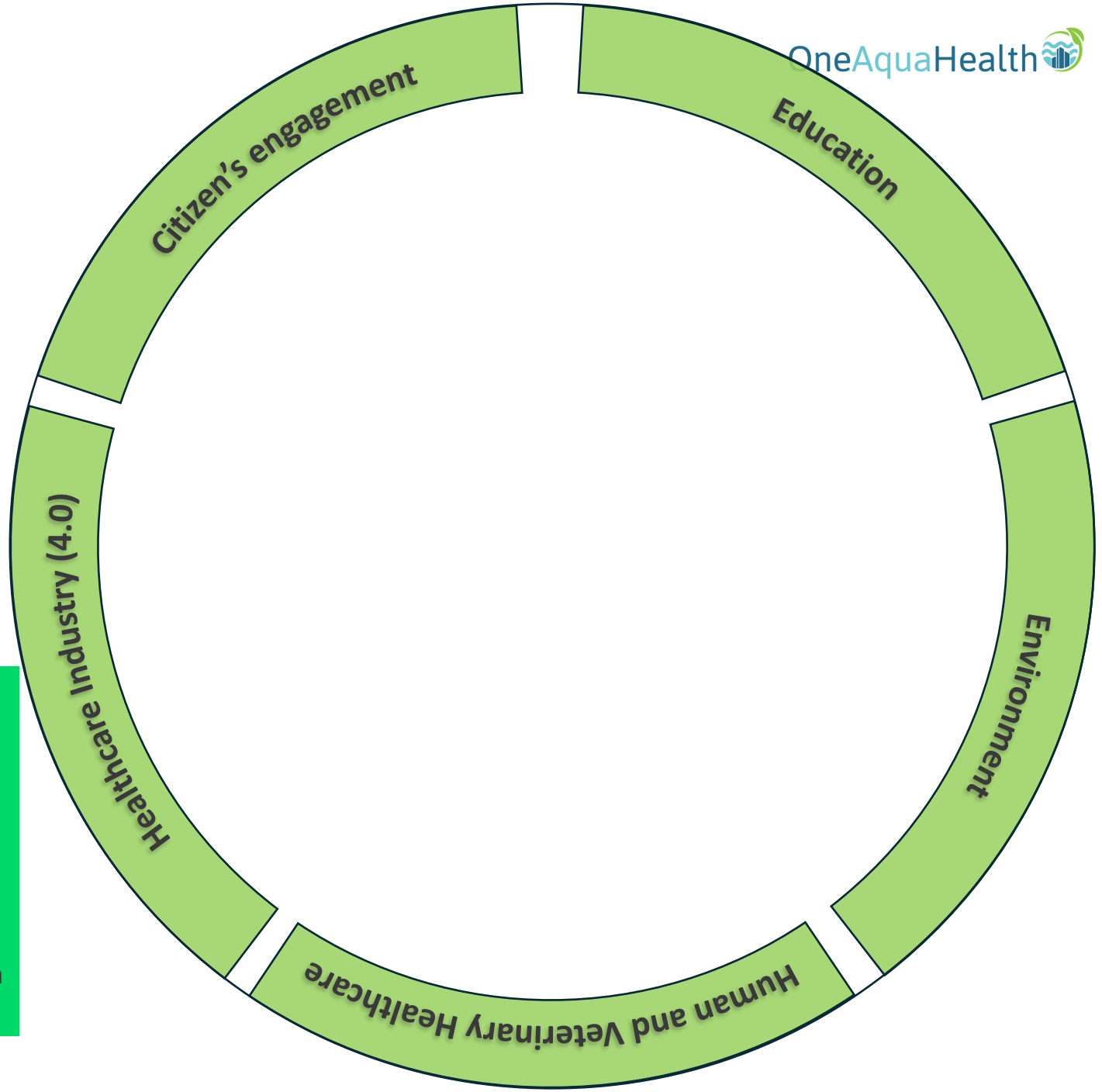
- **Triad of "Individual/Population/Ecosystem"** ***Perspectives***
  - *Identification between the concepts of individual and population;*
  - *Impact of (and interconnection between) population on ecosystem;*
  - *Response of the ecosystem.*



What is One Digital Health?

The core concepts



- **The 5 *Dimensions*: the essential fabric of interconnections**
  - *Critical citizen-centered component to:*
    - ✓ Engage in health prevention and care activities.
    - ✓ Self-monitoring, control and collaboration.
    - ✓ Work out security and privacy concerns as a core part of the effort.
    - ✓ Define standards for Interoperability for making it in the right way.

What is One Digital Health?

The core concepts

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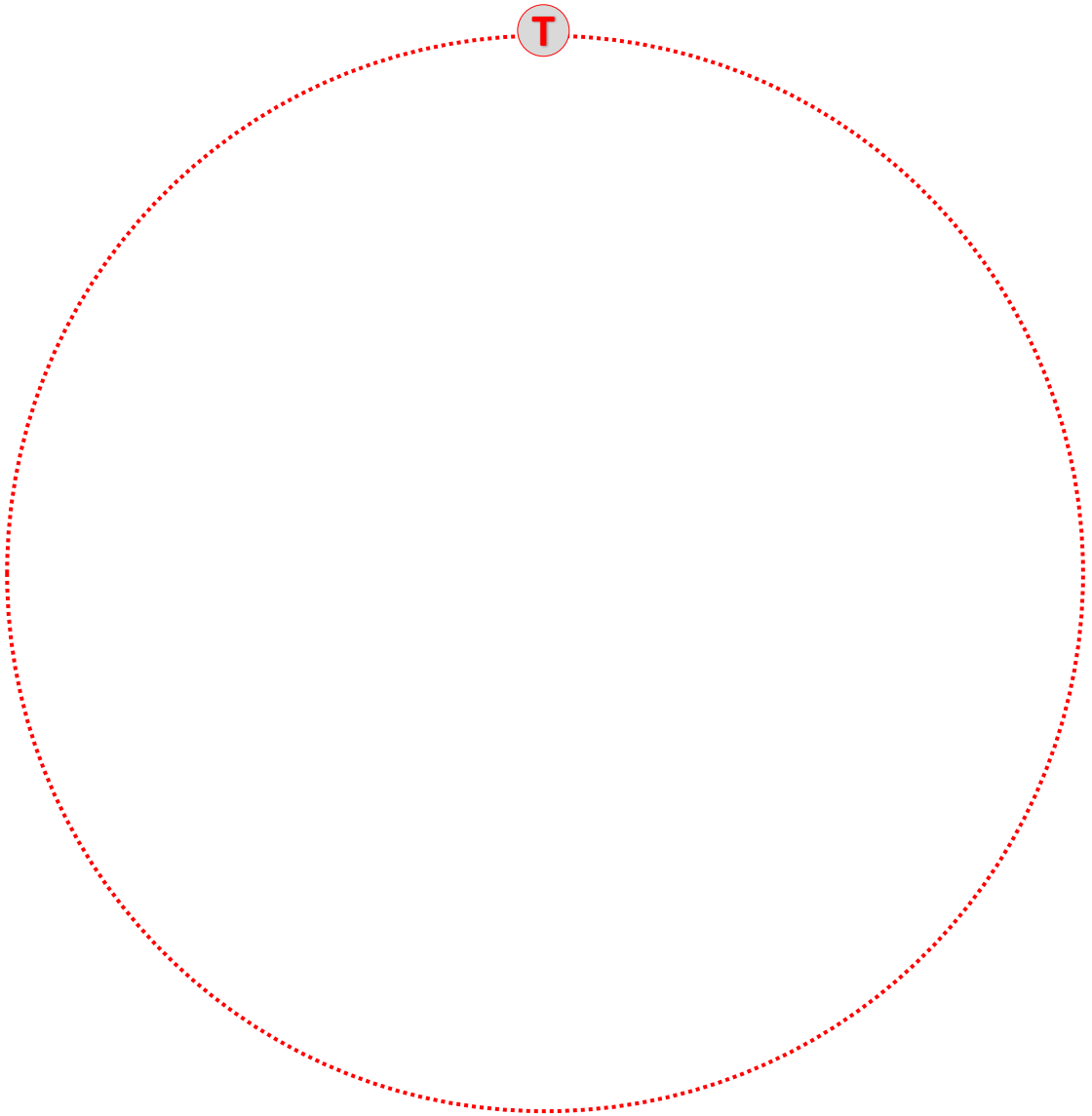

- **Technology Ring**
  - *Initial set of digital functionalities that the ODH framework will rely on;*
  - *Necessary* fil rouge *that connects and unifies the disciplines involved.*

One Digital Health
Steering Wheel

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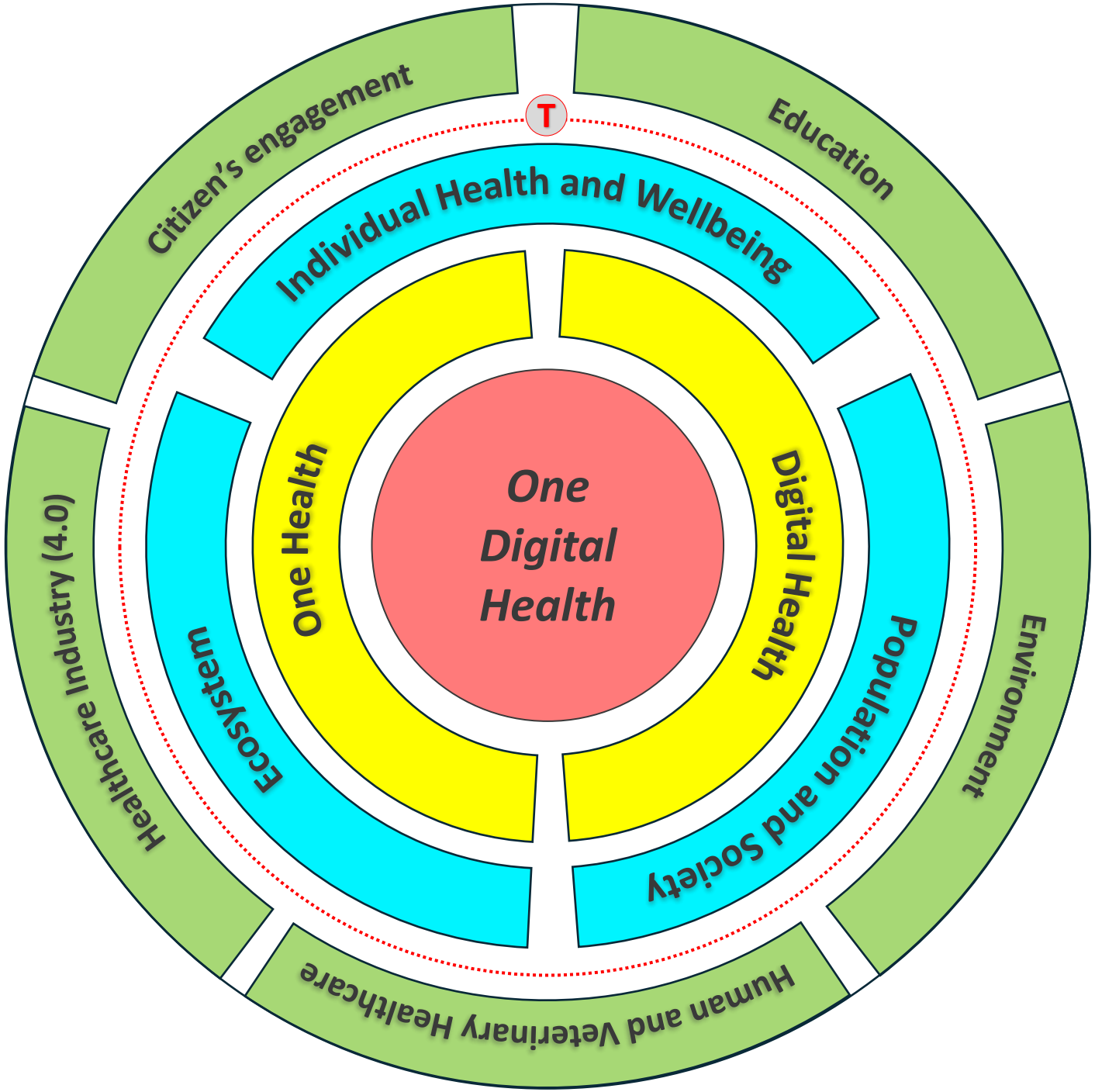

Benis A, Tamburis O, Chronaki C, Moen A
One Digital Health: A Unified Framework for Future Health Ecosystems
J Med Internet Res 2021;23(2):e22189
URL: https://www.jmir.org/2021/2/e22189
DOI: 10.2196/22189
PMID: 33492240 PMCID: 7886486

The One Digital Health Framework

T3.1: Objectives / Outcomes / Tasks

Task 3.1:

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Objectives of the work package 3

- ***Review*** best practice, health and wellbeing indicators, databases of indicators, urban public health and environmental data services in relation to urban aquatic ecosystems;
  - ✓ *Correlation with: key indicators selected in **WP2***
- ***Identify*** positive and negative human behaviours on the urban aquatic ecosystem, as well as social policies encouraging thriving communities and individuals following an One Digital Health approach;
- ***Assess*** health benefits from healthy urban aquatic ecosystems by identifying a set of relevant human indicators linked to thrive, health and wellbeing and test indicators of wellbeing at the Research sites;
  - ✓ *Correlation with: citizen science activities in **WP4***
- ***Establish*** FAIR (Findable, Accessible, Interoperable, and Reusable) processes for data generated in the project and FAIRness assessment for the digital objects generating them, via core validated metrics aligned with the One Digital Health approach;
- ***Review*** and ***validate*** Open standards for applications programming interfaces (APIs) to be developed.
  - ✓ *Correlation with: creation of a robust and resilient early warning system in **WP5**; elaboration of a Decision Support System in **WP6**.*

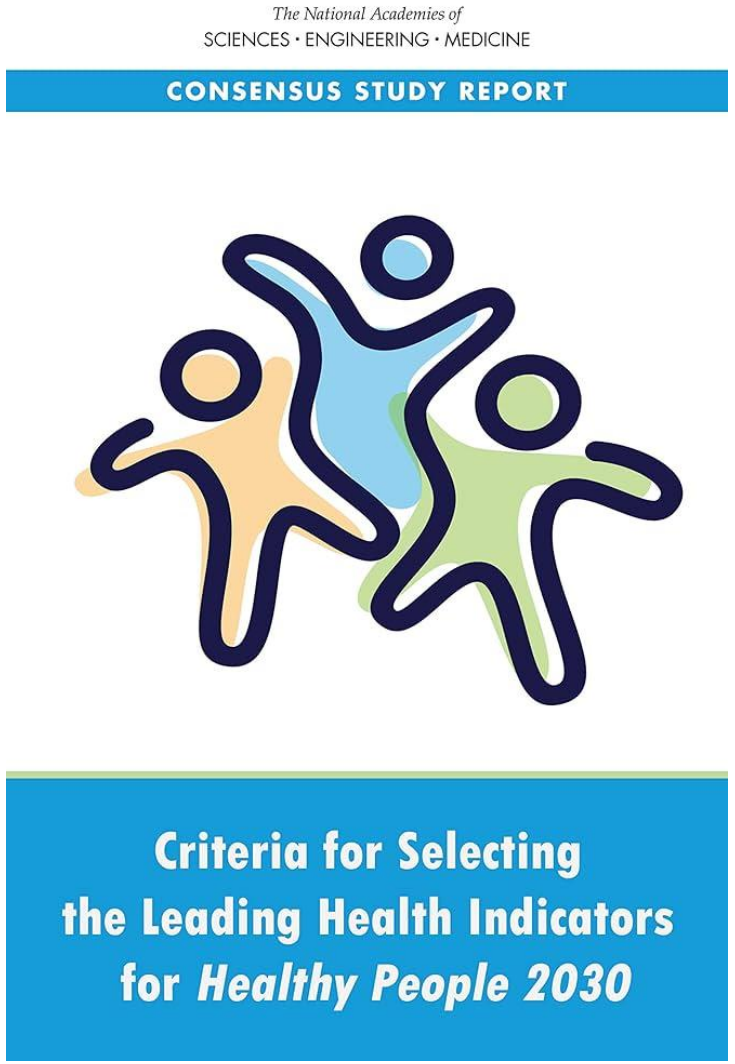
Outcomes of the work package 3

- Figure out a timely list of **selected human health & wellbeing indicators**, behaviours and policies towards the ecosystem leading to thriving communities and individuals → D.3.1–3.3;
- Perform an incremental and periodic process of **FAIRness assessment** of the digital objects and features deployed in the project, as input for (i) the development of the AI-based early warning system; (ii) the deployment of One Digital Health Interventions in the Research sites → D.3.4–3.6;
- Development of a **HL7 Fast Healthcare Interoperability Resources (FHIR) implementation Guide** to connect health data sources in a standard and interoperable way, as input for the predictive model–related activities and the implementation of the research protocols → D.3.7–3.8.

One Digital Health for OAH – The bigger picture

- Within the OAH project, human health and wellbeing indicators were chosen to:
  - *operationalise the ODH framework by focusing on the dynamic relationships between human health and urban freshwater ecosystems;*
  - *provide a quantifiable and integrative foundation for evidence-based interventions across project's work packages;*
  - *anchor OAH's human health perspective within a broader ODH ecosystem that also encompasses ecological, behavioural and digital indicators across the project.*

- By linking these indicators to other data streams in OAH, the goal was to highlight how the connections between *ecological determinants of health* (EDoH, from WP2), *social determinants of health* (SDoH, from WP3 and WP4) and *digital determinants of health* (DDoH, from WP2, WP3, and WP4) co-shape exposure, vulnerability and resilience in urban blue-green environments



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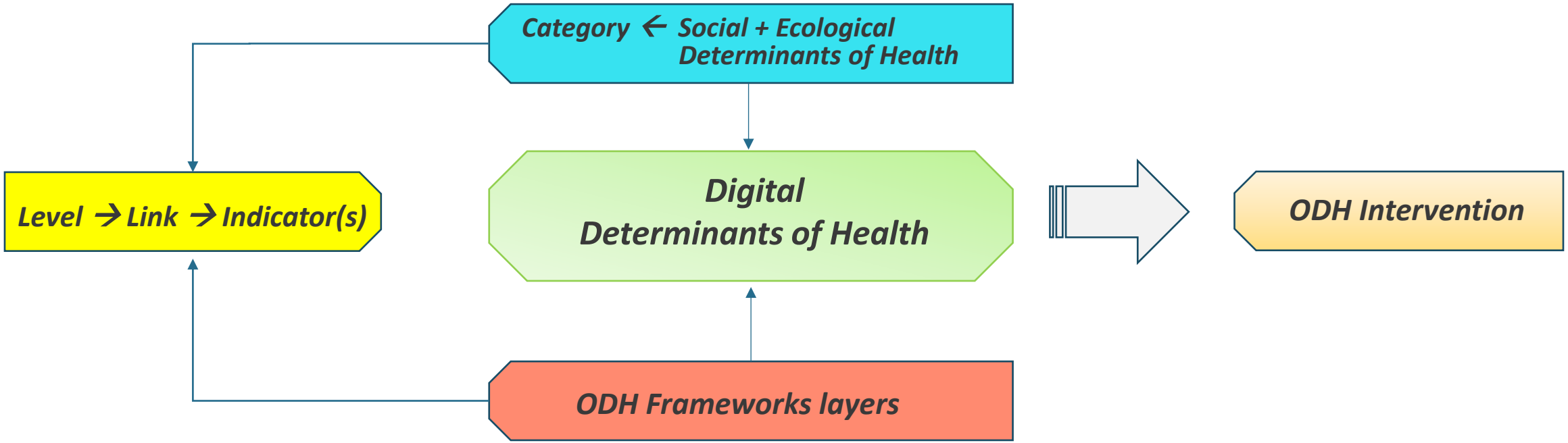

Sources:

Ansari et al., 2003 (https://doi.org/10.1007/s00038-003-2052-4);

Dahlgren & Whitehead, 2021 (https://doi.org/10.1016/j.puhe.2021.08.009);

Benis et al., 2021 (doi: 10.2196/22189);

van Kessel et al., 2024 (ID: BLT.24.292057)

T3.1: Objectives / Outcomes / Tasks

T3.2: Objectives / Outcomes / Tasks

Task 3.2:

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T3.2 *FAIRification of data sets and FAIRness assessment* [M18 – M45]

- Perform an incremental and periodic process of **FAIRness assessment of the digital objects and features of the project** (*consultable databases; citizen science tools*);
  - ✓ *Inputs from: **T2.1, T3.1, T4.3, T4.4***
  - ✓ *Output to: **T3.3***

Focus → goal: FAIRness and FAIRification process and tools vs1

T3.2 Overview by task lead CNR

- **D3.4**

  (submitted M28 / Apr'25)

_The OAH FAIR Data Maturity Model

_Main results of the FAIR assessment

A short reminder about FAIR Guiding Principles

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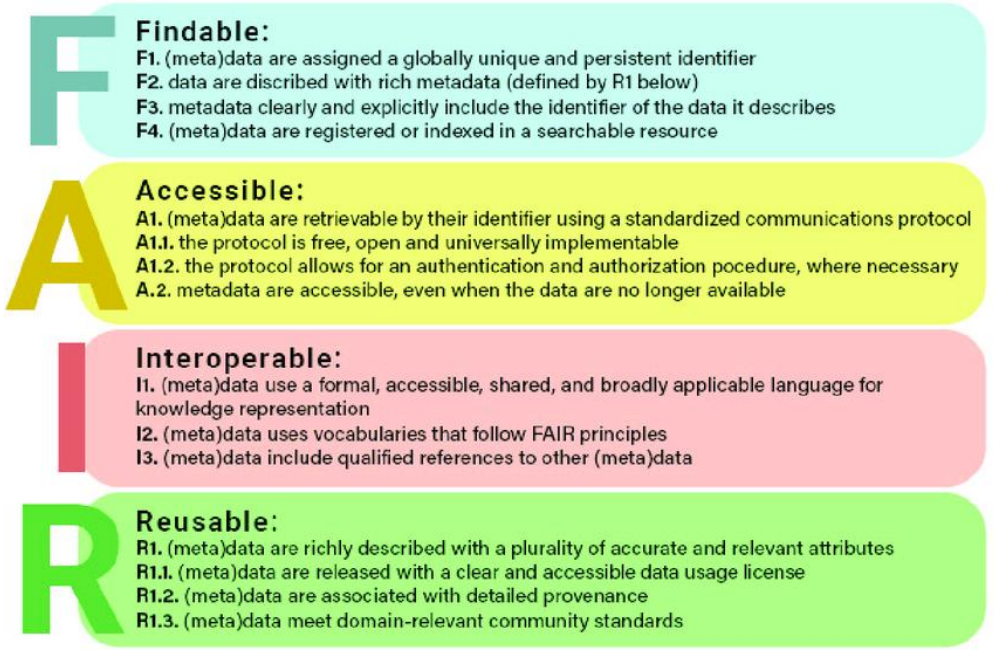
Findability, Accessibility, Interoperability and Reusability – the FAIR principles – intend to define a **minimal set** of related but independent and separable guiding principles and practices that enable both machines and humans to find, access, interoperate and re-use **data** and **metadata**.

Machine–readable



Wilkinson, M. D., Dumontier, M., Aalbersberg, I. J., Appleton, G., Axton, M., Baak, A., ... & Mons, B. (2016).
The FAIR Guiding Principles for scientific data management and stewardship.
Scientific data, *3*(1), 1-9.

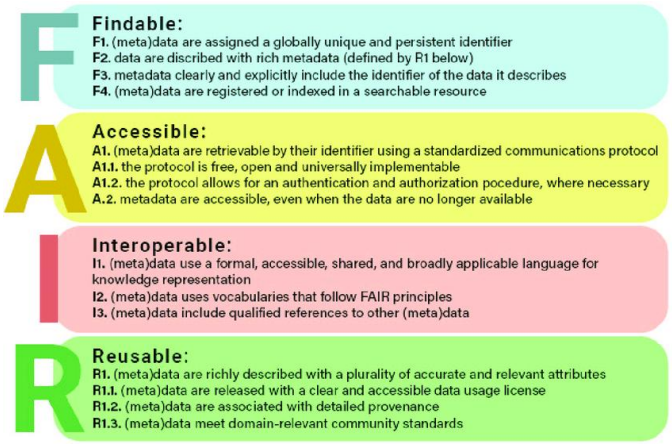
A Digital Object is **any digital resource allowing capturing, storing, communicating, extracting, processing, visualising, and spreading data, information, and knowledge to support developing and enhancing components of the 5 ODH dimensions from the 3 perspectives**.

As an example, chemical sensors measuring the concentration of chemicals in water, a smartwatch, a data server, the electronic version of a scientific publication or of a standard, a dashboard (used by clinicians or for education or to share open data with citizens) are DOs.

A **FAIR Digital Object (DO) is defined as a sequence of bits that represents an informational unit and is presented according to the FAIR principles.**

To be classified as a FAIR Digital Object (FDO), a digital object is referred to as a globally-unique, persistent and resolvable identifier with a predictable resolution behaviour, described by related metadata records (FDOs themselves) and classified by a specific framework.

Main Digital Objects (for ODH_OAH) analyzed



Context	WP / Task	Activity	Results (expressed in digital format → *Digital Resources*)	D.O.s
Ecological and Biological sampling at the five Research Sites	WP2 / T2.2	Biological sampling	Abiotic params, Nutrients, Biological communities and organisms, etc.	Dataset containing data on selected indicators
Human Health Indicators	WP3 / T3.1	Public health DBs search	List of health indicators	Dataset containing selected indicators
Cities data	WP3 / T3.1	Public health DBs search	Data related to: disease prevalence; causes of death	Dataset containing human health data from Research sites

(ODH–related) FAIR Data Maturity Model

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- Many FAIRness measurements retrievable in the literature, based on different interpretations of the principles (e.g., FAIRassist, RDA, FAIR4Health, …);
- In a ***FAIR Data Maturity Model*** a set of indicators, their priorities and evaluation methods are defined for evaluating the FAIR principles to be used;
- The model framework consists of three elements:
  - ✓ ***Indicators***, i.e. the individual aspects of FAIRness that are evaluated
  - ✓ ***Priorities***, i.e. the relative importance of the indicators
  - ✓ ***Evaluation method***, i.e. the way that the results of the evaluation of the indicators can be given a value

Educational, ODH–related

The compliance with the FAIR Principles must be assessed for each DO produced and/or used in the project

Example:

F1 :	[Metadata and data will be assigned an ID]	<*what?*>
[*FAIR Principle #*] :	[*Sentence*]	<*Question Tag*>

[Indicator]

→ 3 - Essential

[FAIR Principle #] priority = {1 – Useful, 2 – Important, 3 – Essential}

$w_{P_i} = P_i\ priority = \{1, 2, 3\}$

F1: A → 1. Data and metadata are assigned non-persistent, non-unique identifiers;

2. identifiers are eternally persistent but not globally unique, or globally unique but not always persistent;
3. identifiers are globally unique and eternally persistent.

[# Stage] = {1 – Minimal, 2 – Intermediate, 3 – Optimal}

$S_{P_i} = Stage\ value = \{1, 2, 3\}$

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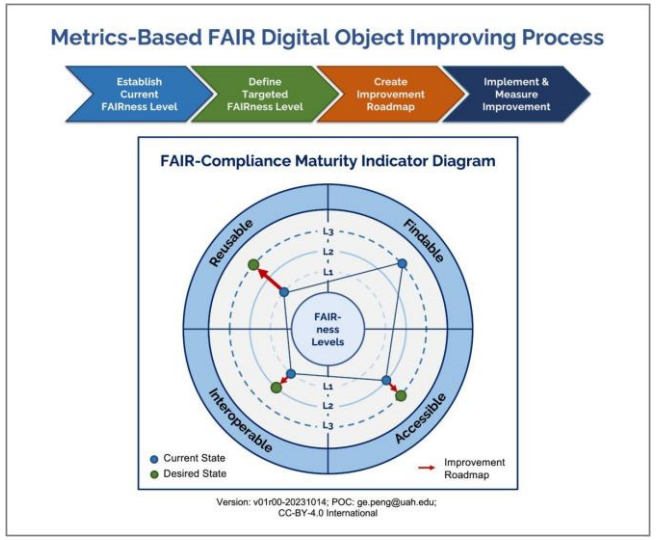
$$FAIR\ Score\ (for\ digital\ resources) = \frac{\sum w_{P_i} * S_{P_i}}{\sum w_{P_i}} \in [1;3]$$



Peng et al., 2024

(Periodic) ***Survey*** to assess the compliance of the DOs to the FAIR Principles:

- *for each principle, and for the whole set*
- *for each sampling site*
- *For the entire project*

(ODH–related) FAIR Data Maturity Model

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FAIR Category	Principle	Sentence	Tag	Priority		Stage	Explanation
Findable	F1_S+Q	Metadata and data will be assigned an ID	<what>	3	Essential		
	F1_A	1. Data and metadata are assigned non-persistent, non-unique identifiers				1	data identifiers are the row Ids
		2. identifiers are eternally persistent but not globally unique, or globally unique but not always persistent					
		3. identifiers are globally unique and eternally persistent					
	F2_S+Q	F2 – S+Q: Data are enriched with metadata	<which>	3	Essential		
	F2_A	1. Basic metadata					
		2. Basic metadata and discovery data				2	data provenance is provided
		3. Basic metadata and enhanced descriptive metadata					
	F3_S+Q	F3 – S+Q: Linkage exists between metadata and the identifier of the data it describes	<wherein>	3	Essential		
	F3_A	1. A free text-based file					
		2. A structured collection-level metadata				2	a linkage between metadata and data identifier exists although is not in machine-readable format (i.e. not quearable)
		3. A structured collection-level metadata with machine-readable formats					
	F4_S+Q	F4 – S+Q: Data and metadata are registered or indexed in digital resources	<what>	3	Essential		
	F4_A	1. Not (online) searchable database or (meta)data management system					
		2. resource searchable with basic search capability				2	(meta)data are hosted on Teams platform which is online and features basic search capabilities
		3. standard-based resource searchable with advanced search capability					
Accessible	A1_S+Q	Communication protocol exists to make data and metadata retrievable by their identifiers	<which>	3	Essential		
	A1_A	1. Direct download with limited access information				1	the xlsx file is needed to be downloaded to retrieve data
		2. Use of web services non-standard-based and/or non-leveraging community standards					
		3. Use of standard-based web services leveraging community standards					
	A1.1_S+Q	Communication protocol is distributed under different licenses	<which>	2	Important		
	A1.1_A	1. Protocol is open					
		2. Protocol is open and free					
		3. Protocol is open, free and universally implemented				3	being the file hosted on Teams which is an HTTP based service, the communication protocol to download the files containing (meta)data is open, free and universally implemented
	A1.2_S+Q	Protocol allows for procedures	<what>	1	Useful		
	A1.2_A	1. General data handling procedures					
		2. Authentication					
		3. Authentication and Authorization				3	HTTP does
	A2_S+Q	A version of the data is always accessed via a metadata	<how many>	3	Essential		
	A2_A	1. Latest					
		2. Latest and n previous				2	via "Version History" command it is possible to show the n-latest version of the document (with relative data) selecting the related metadata (version date and author)
		3. All versions					
Interoperable	I1_S+Q	The representation of the knowledge originated from the data is expressed in different formats	<what>	2	Important		
	I1_A	1. Free/proprietary text-based				1	the knowledge is described via text that is accessible to anyone (having access to the file) but can not be actioned by a machine
		2. Structured, open standard, non-machine-actionable					
		3. Structured, open standard, machine-actionable, non-proprietary					
	I2_S+Q	Data and metadata use vocabularies with different characteristics	<what>	2	Important		
	I2_A	1. For internal use only				1	no universal nor context-specific vocabulary was implemented
		2. Managed, findable and accessible, with an assigned GUPRI					
		3. Managed, FAIR-compliant and version-controlled, with a GUPRI assigned to each term					
	I3_S+Q	Data and metadata include references	<what>	1	Useful		
	I3_A	1. Any kind not falling under 2. and 3.				1	data is referenced to the sampling site only
		2. To other (meta)data that are machine-readable and in non-proprietary formats					
		3. To other qualified (meta)data that follow linked data standards.					
Reusable	R1_S+Q	Data and metadata are described via a quantity of attributes of different quality to enhance data reusability	<how sufficient>	3	Essential		
	R1_A	1. Basic				1	data are provided with metadata related to the sampling site only
		2. Plural and relevant					
		3. Plural, relevant, accurate and comprehensive					
	R1.1_S+Q	Data and metadata are released with a usage license	<what>	2	Important		
	R1.1_A	1. Non-standard, free-text				1	(meta)data produced are actually available only to the project partecipants
		2. Online, non-machine-readable					
		3. Standard-based, machine-readable					
	R1.2_S+Q	Data and metadata include information about the provenance and the history of a resource	<what>	2	Important		
	R1.2_A	1. Basic, free-text information about creators, dates and version					
		2. Limited, structured information about creators, dates, sources, and version				2	"Version History" command allows users to access to information regarding version number, date and author
		3. Omni-comprehensive community standards-based information provided in machine-readable format					
	R1.3_S+Q	Data and metadata are standards compliant	<which>	3	Essential		
	R1.3_A	1. Any standard not falling under 2. and 3.				1	(meta)data do not comply with any acknowledged standards
		2. Domain-relevant standards					
		3. Domain-relevant community standards					

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		2. Authentication					
		3. Authentication and Authorization				3	HTTP does
	A2_S+Q	A version of the data is always accessed via a metadata	*<how many>*	3	Essential		
	A2_A	1. Latest					
		2. Latest and n previous				2	via "Version History" command it is possible to show the n-latest version of the document (with relative data) selecting the related metadata (version date and author)
		3. All versions					
Interoperable	I1_S+Q	The representation of the knowledge originated from the data is expressed in different formats	*<what>*	2	Important		
	I1_A	1. Free/proprietary text-based				1	the knowledge is described via text that is accessible to anyone (having access to the file) but can not be actioned by a machine
		2. Structured, open standard, non-machine-actionable					
		3. Structured, open standard, machine-actionable, non-proprietary					
	I2_S+Q	Data and metadata use vocabularies with different characteristics	*<what>*	2	Important		
	I2_A	1. For internal use only				1	no universal nor context-specific vocabulary was implemented
		2. Managed, findable and accessible, with an assigned GUPRI					
		3. Managed, FAIR-compliant and version-controlled, with a GUPRI assigned to each term					
	I3_S+Q	Data and metadata include references	*<what>*	1	Useful		
	I3_A	1. Any kind not falling under 2. and 3.				1	data is referenced to the sampling site only
		2. To other (meta)data that are machine-readable and in non-proprietary formats					
		3. To other qualified (meta)data that follow linked data standards.					
Reusable	R1_S+Q	Data and metadata are described via a quantity of attributes of different quality to enhance data reusability	*<how sufficient>*	3	Essential		
	R1_A	1. Basic				1	data are provided with metadata related to the sampling site only
		2. Plural and relevant					
		3. Plural, relevant, accurate and comprehensive					
	R1.1_S+Q	Data and metadata are released with a usage license	*<what>*	2	Important		
	R1.1_A	1. Non-standard, free-text				1	(meta)data produced are actually available only to the project partecipants
		2. Online, non-machine-readable					
		3. Standard-based, machine-readable					
	R1.2_S+Q	Data and metadata include information about the provenance and the history of a resource	*<what>*	2	Important		
	R1.2_A	1. Basic, free-text information about creators, dates and version					
		2. Limited, structured information about creators, dates, sources, and version				2	"Version History" command allows users to access to information regarding version number, date and author
		3. Omni-comprehensive community standards-based information provided in machine-readable format					
	R1.3_S+Q	Data and metadata are standards compliant	*<which>*	3	Essential		
	R1.3_A	1. Any standard not falling under 2. and 3.				1	(meta)data do not comply with any acknowledged standards
		2. Domain-relevant standards					
		3. Domain-relevant community standards					

(ODH–related) FAIR Data Maturity Model

OneAquaHealth

- Many FAIRness measurements retrievable in the literature, based on different interpretations of the principles (e.g., FAIRassist, RDA, FAIR4Health, …);
- In a ***FAIR Data Maturity Model*** a set of indicators, their priorities and evaluation methods are defined for evaluating the FAIR principles to be used;
- The model framework consists of three elements:
  - ✓ ***Indicators***, i.e. the individual aspects of FAIRness that are evaluated
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$$FAIR\ Score\ (for\ digital\ resources) = \frac{\sum w_{P_i} * S_{P_i}}{\sum w_{P_i}} \in [1;3]$$

(Periodic) ***Survey***

to assess the compliance of the DOs

to the FAIR Principles

Digital Object	T3.1_Cities data (Benevento / Oslo / Coimbra)	https://universidadedecoimbra154.sharepoint.com/:x:/r/sites/OneAquaHealth/_layouts/15/Doc.aspx?sourcedoc=%7B0931FB33-35ED-4A16-8525-ABA2EC743D4E%7D&file=Benevento%20data%20for%20OAH_2025.02.18.xlsx&action=default&mobileredirect=true				

FAIR Category	Principle	Sentence	Tag	Priority		Stage	Explanation
Findable	F1_S+Q	Metadata and data will be assigned an ID	<what>	3	Essential		
	F1_A	1. Data and metadata are assigned non-persistent, non-unique identifiers				1	data identifiers are the row Ids
		2. identifiers are eternally persistent but not globally unique, or globally unique but not always persistent					
		3. identifiers are globally unique and eternally persistent					
	F2_S+Q	F2 – S+Q: Data are enriched with metadata	<which>	3	Essential		
	F2_A	1. Basic metadata					
		2. Basic metadata and discovery data				2	data provenance is provided
		3. Basic metadata and enhanced descriptive metadata					
	F3_S+Q	F3 – S+Q: Linkage exists between metadata and the identifier of the data it describes	<wherein>	3	Essential		
	F3_A	1. A free text-based file					
		2. A structured collection-level metadata				2	a linkage between metadata and data identifier exists although is not in machine-readable format (i.e. not quearable)
		3. A structured collection-level metadata with machine-readable formats					
	F4_S+Q	F4 – S+Q: Data and metadata are registered or indexed in digital resources	<what>	3	Essential		
	F4_A	1. Not (online) searchable database or (meta)data management system					
		2. resource searchable with basic search capability				2	(meta)data are hosted on Teams platform which is online and features basic search capabilities
		3. standard-based resource searchable with advanced search capability					
Accessible	A1_S+Q	Communication protocol exists to make data and metadata retrievable by their identifiers	<which>	3	Essential		
	A1_A	1. Direct download with limited access information				1	the xlsx file is needed to be downloaded to retrieve data
		2. Use of web services non-standard-based and/or non-leveraging community standards					
		3. Use of standard-based web services leveraging community standards					
	A1.1_S+Q	Communication protocol is distributed under different licenses	<which>	2	Important		
	A1.1_A	1. Protocol is open					
		2. Protocol is open and free					
		3. Protocol is open, free and universally implemented				3	being the file hosted on Teams which is an HTTP based service, the communication protocol to download the files containing (meta)data is open, free and universally implemented
	A1.2_S+Q	Protocol allows for procedures	<what>	1	Useful		
	A1.2_A	1. General data handling procedures					
		2. Authentication					
		3. Authentication and Authorization				3	HTTP does
	A2_S+Q	A version of the data is always accessed via a metadata	<how many>	3	Essential		
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Main Results of the FAIR assessment

OneAquaHealth

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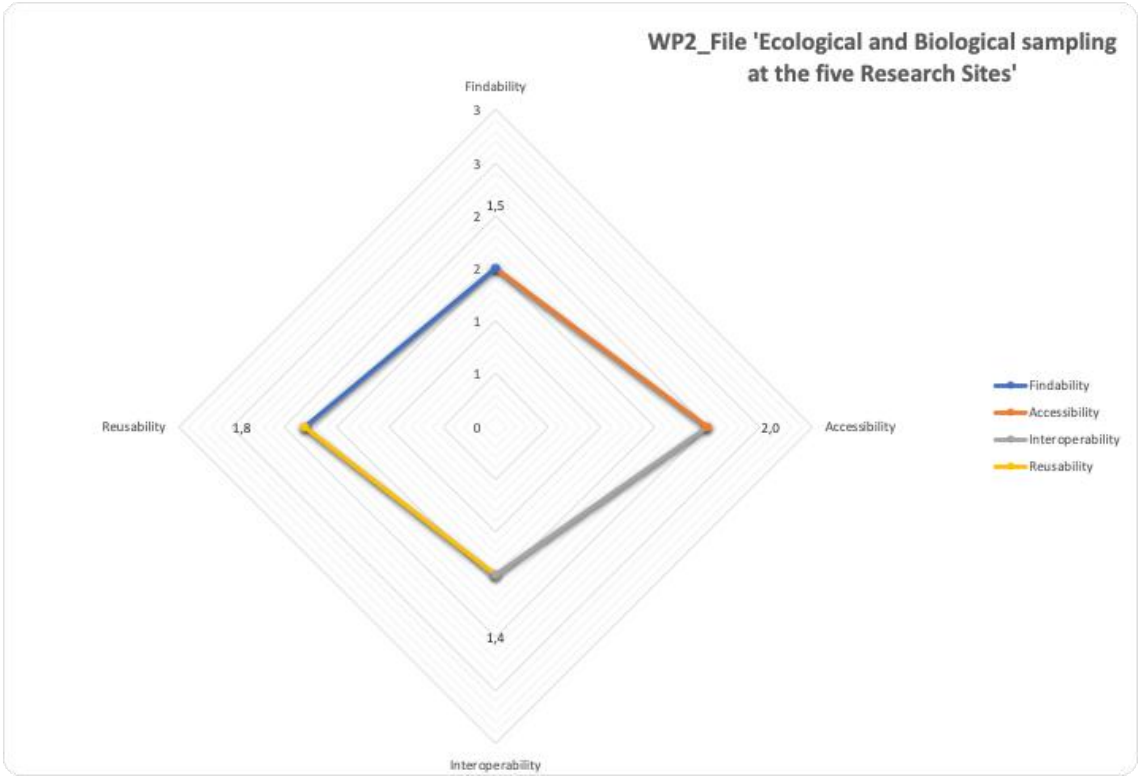
FAIR SCORES	
TOTAL	*1,7*
Findability	*1,5*
Accessibility	*2,0*
Interoperability	*1,4*
Reusability	*1,8*



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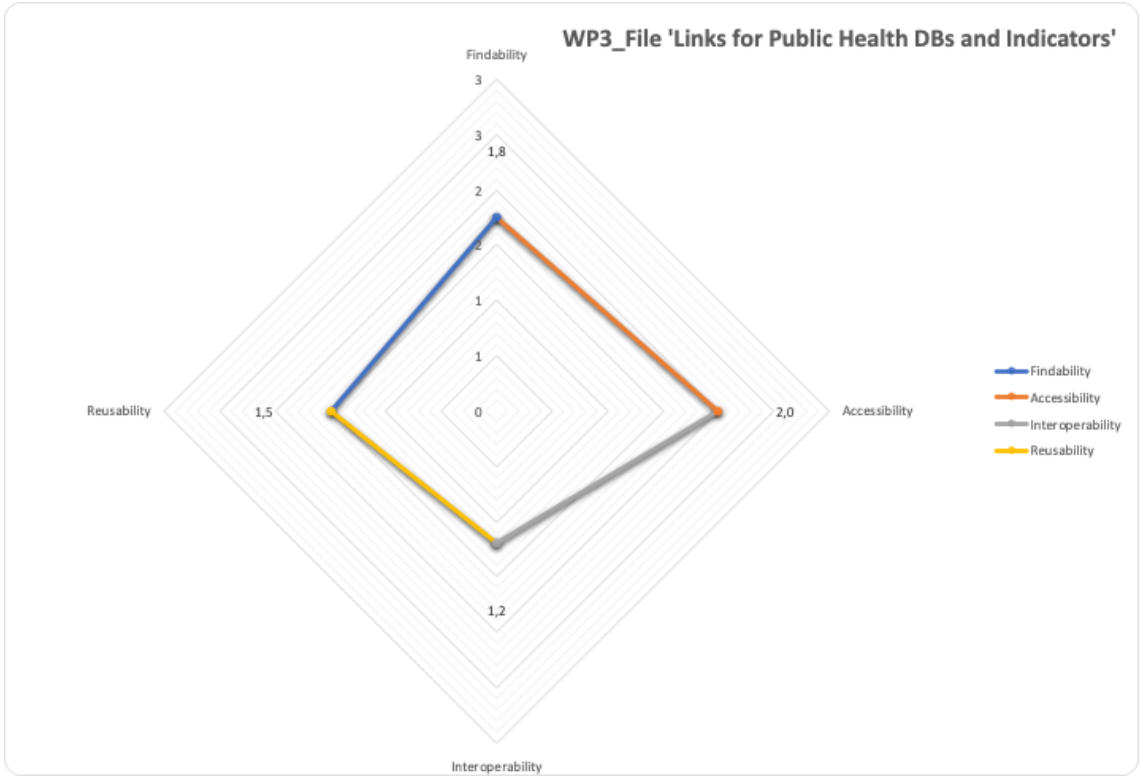

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FAIR SCORES	
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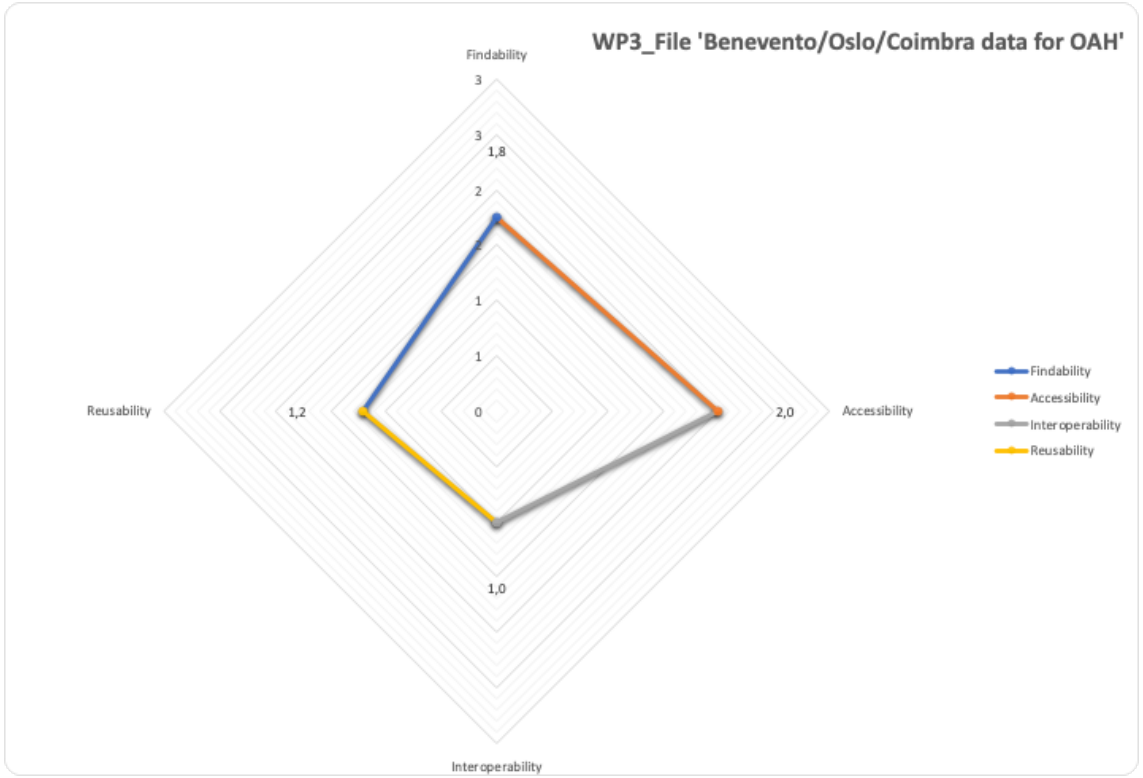
Findability	*1,8*
Accessibility	*2,0*
Interoperability	*1,0*
Reusability	*1,2*



Main Results of the FAIR assessment (overall)

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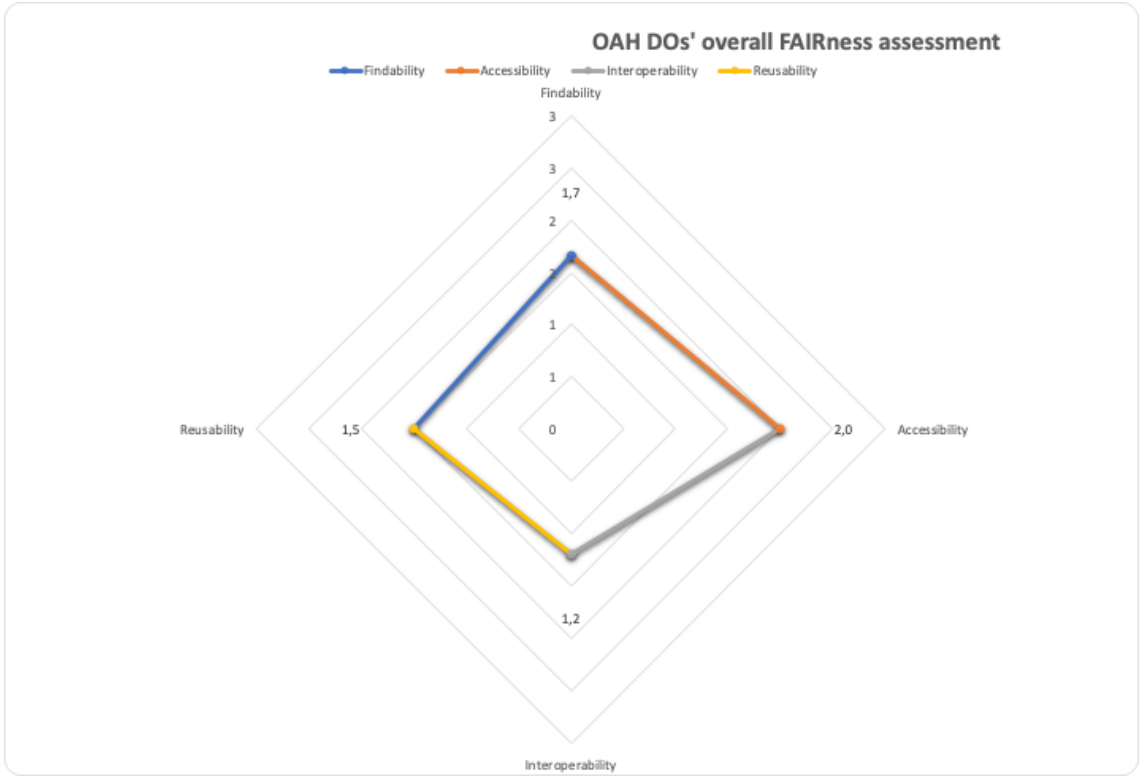

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OneAquaHealth

F	Findability	All digital objects were assigned unique identifiers within the context of the project (F1), and metadata were provided to support discoverability (F2). In most cases, identifiers were not globally unique or persistent outside the project scope. Metadata and data were correctly linked (F3), and indexing in searchable systems (F4) was limited to local project environments, reducing broader visibility.
A	Accessibility	Access mechanisms for all datasets were well-defined and documented using standardized or semi-standardized protocols (A1, A1.1). Authentication and authorization mechanisms (A1.2) were inconsistently applied. Most datasets were accessible through metadata, but versioning policies (A2) varied (only some datasets tracked multiple historical versions).
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T3.2: Objectives / Outcomes / Tasks

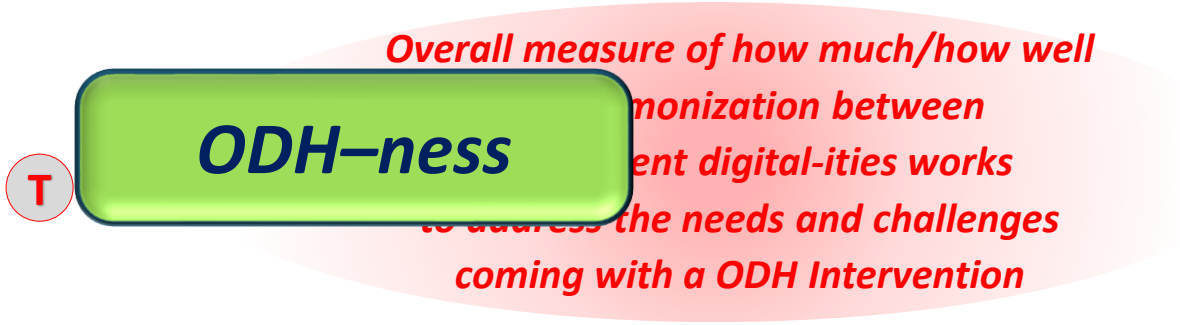
ODH Intervention & ODH applied to *OneAquaHealth*

A short reminder about One Digital Health Intervention

OneAquaHealth

- **Set of digital functionalities (digital-ities) designed and deployed to:**
  - ***support*** *specific initiatives that address human, animal, and environmental systems' needs and challenges.*
  - ***assess*** *and study these systems' expected outcomes, unexpected outcomes, and effects, and collect related data.*
  - *(selection of timely* ***metrics*** *for the outcomes of multicriteria decision analyses).*

- **An ODH intervention is implemented to:**
  - ***address*** *One Health–related challenges;*
  - ***achieve*** *One Health–related important and strategic outcomes for clinical follow-up and practice, such as for technology improvements needed; and*
  - ***achieve*** *FAIR uses of digital technologies.*



Focus → goal: FAIRness and FAIRification process and tools vs2

T3.2 Overview by task lead CNR

- **D3.5**

  (submitted M36 / Dec'25)

_Use Case Definition

(What steps/actions make up the intervention?)

_FAIR Data Maturity Model

(How FAIR are the Digital Objects involved?)

_Digital Objects Relevance Assessment

(Which Digital Objects matter the most?)

_Multi–Criteria Decision Analysis (MCDA): model design

(How do FAIRness and ODH performance interact?)

_One Digital Health Target

(How can digital relations be visually and geometrically represented?)

_ODHness calculation

(What is the final measure of the overall harmonization of the intervention?)

Digital Object	T3.1_Cities data (Benevento / Oslo / Coimbra)	https://universidadedecoimbra154.sharepoint.com/:x:/r/sites/OneAquaHealth/_layouts/15/Doc.aspx?sourcedoc=%7B0931FB33-35ED-4A16-8525-ABA2EC743D4E%7D&file=Benevento%20data%20for%20OAH_2025.02.18.xlsx&action=default&mobileredirect=true				

FAIR Category	Principle	Sentence	Tag	Priority	Stage	Explanation
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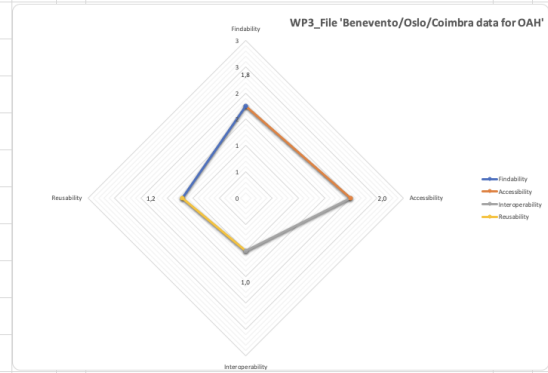
	F2_S+Q	F2 – S+Q: Data are enriched with metadata	<which>	3 Essential		
	F2_A	1. Basic metadata				
		2. Basic metadata and discovery data			2	data provenance is provided
		3. Basic metadata and enhanced descriptive metadata				
	F3_S+Q	F3 – S+Q: Linkage exists between metadata and the identifier of the data it describes	<wherein>	3 Essential		
	F3_A	1. A free text-based file				
		2. A structured collection-level metadata			2	a linkage between metadata and data identifier exists although is not in machine-readable format (i.e. not quearable)
		3. A structured collection-level metadata with machine-readable formats				
	F4_S+Q	F4 – S+Q: Data and metadata are registered or indexed in digital resources	<what>	3 Essential		
	F4_A	1. Not (online) searchable database or (meta)data management system				
		2. resource searchable with basic search capability			2	(meta)data are hosted on Teams platform which is online and features basic search capabilities
		3. standard-based resource searchable with advanced search capability				
Accessible	A1_S+Q	Communication protocol exists to make data and metadata retrievable by their identifiers	<which>	3 Essential		
	A1_A	1. Direct download with limited access information			1	the xlsx file is needed to be downloaded to retrieve data
		2. Use of web services non-standard-based and/or non-leveraging community standards				
		3. Use of standard-based web services leveraging community standards				
	A1.1_S+Q	Communication protocol is distributed under different licenses	<which>	2 Important		
	A1.1_A	1. Protocol is open				
		2. Protocol is open and free				
		3. Protocol is open, free and universally implemented			3	being the file hosted on Teams which is an HTTP based service, the communication protocol to download the files containing (meta)data is open, free and universally implemented
	A1.2_S+Q	Protocol allows for procedures	<what>	1 Useful		
	A1.2_A	1. General data handling procedures				
		2. Authentication				
		3. Authentication and Authorization			3	HTTP does
	A2_S+Q	A version of the data is always accessed via a metadata	<how many>	3 Essential		
	A2_A	1. Latest				
		2. Latest and n previous			2	via "Version History" command it is possible to show the n-latest version of the document (with relative data) selecting the related metadata (version date and author)
		3. All versions				
Interoperable	I1_S+Q	The representation of the knowledge originated from the data is expressed in different formats	<what>	2 Important		
	I1_A	1. Free/proprietary text-based			1	the knowledge is described via text that is accessible to anyone (having access to the file) but can not be actioned by a machine
		2. Structured, open standard, non-machine-actionable				
		3. Structured, open standard, machine-actionable, non-proprietary				
	I2_S+Q	Data and metadata use vocabularies with different characteristics	<what>	2 Important		
	I2_A	1. For internal use only			1	no universal nor context-specific vocabulary was implemented
		2. Managed, findable and accessible, with an assigned GUPRI				
		3. Managed, FAIR-compliant and version-controlled, with a GUPRI assigned to each term				
	I3_S+Q	Data and metadata include references	<what>	1 Useful		
	I3_A	1. Any kind not falling under 2. and 3.			1	data is referenced to the sampling site only
		2. To other (meta)data that are machine-readable and in non-proprietary formats				
		3. To other qualified (meta)data that follow linked data standards.				
Reusable	R1_S+Q	Data and metadata are described via a quantity of attributes of different quality to enhance data reusability	<how sufficient>	3 Essential		
	R1_A	1. Basic			1	data are provided with metadata related to the sampling site only
		2. Plural and relevant				
		3. Plural, relevant, accurate and comprehensive				
	R1.1_S+Q	Data and metadata are released with a usage license	<what>	2 Important		
	R1.1_A	1. Non-standard, free-text			1	(meta)data produced are actually available only to the project partecipants
		2. Online, non-machine-readable				
		3. Standard-based, machine-readable				
	R1.2_S+Q	Data and metadata include information about the provenance and the history of a resource	<what>	2 Important		
	R1.2_A	1. Basic, free-text information about creators, dates and version				
		2. Limited, structured information about creators, dates, sources, and version			2	"Version History" command allows users to access to information regarding version number, date and author
		3. Omni-comprehensive community standards-based information provided in machine-readable format				
	R1.3_S+Q	Data and metadata are standards compliant	<which>	3 Essential		
	R1.3_A	1. Any standard not falling under 2. and 3.			1	(meta)data do not comply with any acknowledged standards
		2. Domain-relevant standards				
		3. Domain-relevant community standards				

FAIR SCORES	
TOTAL	1,6
Findability	1,8
Accessibility	2,0
Interoperability	1,0
Reusability	1,2



_Digital Objects Relevance Assessment Tool

OneAquaHealth

- ***Relevance of a DO produced in an Use Case***: its capacity to provide an effective contribution to the overall advancement of the research activity, as an actionable knowledge unit

$$\alpha_F = \left\{\left[\left(\frac{\sum_{i=1}^{3} S_{P_{i,ESS}} . \#St_{i,ESS}}{\#ESS\ Criteria_F}\right)\right] \cdot w_{ESS} + \left[\left(\frac{\sum_{i=1}^{3} S_{P_{i,IMP}} . \#St_{i,IMP}}{\#IMP\ Criteria_F}\right)\right] \cdot w_{IMP} + \left[\left(\frac{\sum_{i=1}^{3} S_{P_{i,USF}} . \#St_{i,USF}}{\#USF\ Criteria_F}\right)\right] \cdot w_{USF}\right\} \cdot w_F$$

$$\alpha_A = \left\{\left[\left(\frac{\sum_{i=1}^{3} S_{P_{i,ESS}} . \#St_{i,ESS}}{\#ESS\ Criteria_A}\right)\right] \cdot w_{ESS} + \left[\left(\frac{\sum_{i=1}^{3} S_{P_{i,IMP}} . \#St_{i,IMP}}{\#IMP\ Criteria_A}\right)\right] \cdot w_{IMP} + \left[\left(\frac{\sum_{i=1}^{3} S_{P_{i,USF}} . \#St_{i,USF}}{\#USF\ Criteria_A}\right)\right] \cdot w_{USF}\right\} \cdot w_A$$

$$\alpha_I = \left\{\left[\left(\frac{\sum_{i=1}^{3} S_{P_{i,ESS}} . \#St_{i,ESS}}{\#ESS\ Criteria_I}\right)\right] \cdot w_{ESS} + \left[\left(\frac{\sum_{i=1}^{3} S_{P_{i,IMP}} . \#St_{i,IMP}}{\#IMP\ Criteria_I}\right)\right] \cdot w_{IMP} + \left[\left(\frac{\sum_{i=1}^{3} S_{P_{i,USF}} . \#St_{i,USF}}{\#USF\ Criteria_I}\right)\right] \cdot w_{USF}\right\} \cdot w_I$$

$$\alpha_R = \left\{\left[\left(\frac{\sum_{i=1}^{3} S_{P_{i,ESS}} . \#St_{i,ESS}}{\#ESS\ Criteria_R}\right)\right] \cdot w_{ESS} + \left[\left(\frac{\sum_{i=1}^{3} S_{P_{i,IMP}} . \#St_{i,IMP}}{\#IMP\ Criteria_R}\right)\right] \cdot w_{IMP} + \left[\left(\frac{\sum_{i=1}^{3} S_{P_{i,USF}} . \#St_{i,USF}}{\#USF\ Criteria_R}\right)\right] \cdot w_{USF}\right\} \cdot w_R$$

$$R_i = \alpha_F + \alpha_A + \alpha_I + \alpha_R$$

	Digital Object		DO.01: Dataset containing data on selected indicators (Biological Sampling)		DO.02: Dataset containing selected Public Health Indicators		DO.03: Dataset containing human health data from Research sites	
	Criterion category_Stage value		# of Criteria per category and stage value	Product between % of Criteria and stage value	# of Criteria per category and stage value	Product between % of Criteria and stage value	# of Criteria per category and stage value	Product between % of Criteria and stage value
F	# *Essential* criteria					4		
	1	Minimally fulfilled	2	0.5	1	0.3	1	0.3
	2	Partially fulfilled	2	1.0	3	1.5	3	1.5
	3	Totally fulfilled	0	0.0	0	0.0	0	0.0
	Sub-TOT Ess.			**0.8**		**0.9**		**0.9**
	# *Important* criteria					0		
	1	Minimally fulfilled	0	0.0	0	0.0	0	0.0
	2	Partially fulfilled	0	0.0	0	0.0	0	0.0
	3	Totally fulfilled	0	0.0	0	0.0	0	0.0
	Sub-TOT Imp.			**0.0**		**0.0**		**0.0**
	# *Useful* criteria					0		
	1	Minimally fulfilled	0	0.0	0	0.0	0	0.0
	2	Partially fulfilled	0	0.0	0	0.0	0	0.0
	3	Totally fulfilled	0	0.0	0	0.0	0	0.0
	Sub-TOT Usf.			**0.0**		**0.0**		**0.0**
	Sub-TOT F			***0.3***		***0.3***		***0.3***
A	# *Essential* criteria					2		
	1	Minimally fulfilled	1	0.5	1	0.5	1	0.3
	2	Partially fulfilled	1	1.0	1	1.0	1	0.5
	3	Totally fulfilled	0	0.0	0	0.0	0	0.0
	Sub-TOT Ess.			**0.8**		**0.8**		**0.4**
	# *Important* criteria					1		
	1	Minimally fulfilled	0	0.0	0	0.0	0	0.0
	2	Partially fulfilled	0	0.0	0	0.0	0	0.0
	3	Totally fulfilled	1	3.0	1	3.0	1	3.0
	Sub-TOT Imp.			**1.0**		**1.0**		**1.0**
	# *Useful* criteria					1		
	1	Minimally fulfilled	0	0.0	0	0.0	0	0.0
	2	Partially fulfilled	0	0.0	0	0.0	0	0.0
	3	Totally fulfilled	1	3.0	1	3.0	1	3.0
	Sub-TOT Usf.			**0.4**		**0.4**		**0.4**
	Sub-TOT A			***0.6***		***0.6***		***0.5***
I	# *Essential* criteria					0		
	1	Minimally fulfilled	0	0.0	0	0.0	0	0.0
	2	Partially fulfilled	0	0.0	0	0.0	0	0.0
	3	Totally fulfilled	0	0.0	0	0.0	0	0.0
	Sub-TOT Ess.			**0.0**		**0.0**		**0.0**
	# *Important* criteria					2		
	1	Minimally fulfilled	1	0.5	2	1.0	2	1.0
	2	Partially fulfilled	1	1.0	0	0.0	0	0.0
	3	Totally fulfilled	0	0.0	0	0.0	0	0.0
	Sub-TOT Imp.			**0.5**		**0.3**		**0.3**
	# *Useful* criteria					1		
	1	Minimally fulfilled	1	1.0	0	0.0	1	1.0
	2	Partially fulfilled	0	0.0	1	2.0	0	0.0
	3	Totally fulfilled	0	0.0	0	0.0	0	0.0
	Sub-TOT Usf.			**0.1**		**0.3**		**0.1**
	Sub-TOT I			***0.1***		***0.1***		***0.1***
R	# *Essential* criteria					2		
	1	Minimally fulfilled	0	0.0	1	0.5	2	1.0
	2	Partially fulfilled	2	2.0	1	1.0	0	0.0
	3	Totally fulfilled	0	0.0	0	0.0	0	0.0
	Sub-TOT Ess.			**1.1**		**0.8**		**0.5**
	# *Important* criteria					2		
	1	Minimally fulfilled	1	0.5	1	0.5	1	0.3
	2	Partially fulfilled	1	1.0	1	1.0	1	0.5
	3	Totally fulfilled	0	0.0	0	0.0	0	0.0
	Sub-TOT Imp.			**0.5**		**0.5**		**0.3**
	# *Useful* criteria					0		
	1	Minimally fulfilled	0	0.0	0	0.0	0	0.0
	2	Partially fulfilled	0	0.0	0	0.0	0	0.0
	3	Totally fulfilled	0	0.0	0	0.0	0	0.0
	Sub-TOT Usf.			**0.0**		**0.0**		**0.0**
	Sub-TOT I			***0.4***		***0.4***		***0.2***
	TOT Relevance			***1.3*** **Intermediate**		***1.3*** **Intermediate**		***1.0*** **Low**

_Digital Objects Relevance Assessment Tool

OneAquaHealth

- ***Relevance of a DO produced in an Use Case***: its capacity to provide an effective contribution to the overall advancement of the research activity, as an actionable knowledge unit

$$\alpha_F = \left\{\left[\left(\frac{\sum_{i=1}^{3} S_{P_{i,ESS}}.\#St_{i,ESS}}{\#ESS\ Criteria_F}\right)\right]\cdot w_{ESS} + \left[\left(\frac{\sum_{i=1}^{3} S_{P_{i,IMP}}.\#St_{i,IMP}}{\#IMP\ Criteria_F}\right)\right]\cdot w_{IMP} + \left[\left(\frac{\sum_{i=1}^{3} S_{P_{i,USF}}.\#St_{i,USF}}{\#USF\ Criteria_F}\right)\right]\cdot w_{USF}\right\}\cdot w_F$$

$$\alpha_A = \left\{\left[\left(\frac{\sum_{i=1}^{3} S_{P_{i,ESS}}.\#St_{i,ESS}}{\#ESS\ Criteria_A}\right)\right]\cdot w_{ESS} + \left[\left(\frac{\sum_{i=1}^{3} S_{P_{i,IMP}}.\#St_{i,IMP}}{\#IMP\ Criteria_A}\right)\right]\cdot w_{IMP} + \left[\left(\frac{\sum_{i=1}^{3} S_{P_{i,USF}}.\#St_{i,USF}}{\#USF\ Criteria_A}\right)\right]\cdot w_{USF}\right\}\cdot w_A$$

$$\alpha_I = \left\{\left[\left(\frac{\sum_{i=1}^{3} S_{P_{i,ESS}}.\#St_{i,ESS}}{\#ESS\ Criteria_I}\right)\right]\cdot w_{ESS} + \left[\left(\frac{\sum_{i=1}^{3} S_{P_{i,IMP}}.\#St_{i,IMP}}{\#IMP\ Criteria_I}\right)\right]\cdot w_{IMP} + \left[\left(\frac{\sum_{i=1}^{3} S_{P_{i,USF}}.\#St_{i,USF}}{\#USF\ Criteria_I}\right)\right]\cdot w_{USF}\right\}\cdot w_I$$

$$\alpha_R = \left\{\left[\left(\frac{\sum_{i=1}^{3} S_{P_{i,ESS}}.\#St_{i,ESS}}{\#ESS\ Criteria_R}\right)\right]\cdot w_{ESS} + \left[\left(\frac{\sum_{i=1}^{3} S_{P_{i,IMP}}.\#St_{i,IMP}}{\#IMP\ Criteria_R}\right)\right]\cdot w_{IMP} + \left[\left(\frac{\sum_{i=1}^{3} S_{P_{i,USF}}.\#St_{i,USF}}{\#USF\ Criteria_R}\right)\right]\cdot w_{USF}\right\}\cdot w_R$$

$$R_i = \alpha_F + \alpha_A + \alpha_I + \alpha_R$$

- *Low* Relevance: $R_i \in]0.7;1.2[$
- *Intermediate* Relevance: $R_i \in [1.2;1.7[$
- *High* Relevance: $R_i \in [1.7;2.2[$

	Digital Object		DO.01: Dataset containing data on selected indicators (Biological Sampling)		DO.02: Dataset containing selected Public Health Indicators		DO.03: Dataset containing human health data from Research sites	
	Criterion category_Stage value		# of Criteria per category and stage value	Product between % of Criteria and stage value	# of Criteria per category and stage value	Product between % of Criteria and stage value	# of Criteria per category and stage value	Product between % of Criteria and stage value
F	# *Essential* criteria				4			
	1	Minimally fulfilled	2	0.5	1	0.3	1	0.3
	2	Partially fulfilled	2	1.0	3	1.5	3	1.5
	3	Totally fulfilled	0	0.0	0	0.0	0	0.0
	Sub-TOT Ess.			**0.8**		**0.9**		**0.9**
	# *Important* criteria				0			
	1	Minimally fulfilled	0	0.0	0	0.0	0	0.0
	2	Partially fulfilled	0	0.0	0	0.0	0	0.0
	3	Totally fulfilled	0	0.0	0	0.0	0	0.0
	Sub-TOT Imp.			**0.0**		**0.0**		**0.0**
	# *Useful* criteria				0			
	1	Minimally fulfilled	0	0.0	0	0.0	0	0.0
	2	Partially fulfilled	0	0.0	0	0.0	0	0.0
	3	Totally fulfilled	0	0.0	0	0.0	0	0.0
	Sub-TOT Usf.			**0.0**		**0.0**		**0.0**
	Sub-TOT F			***0.3***		***0.3***		***0.3***
A	# *Essential* criteria				2			
	1	Minimally fulfilled	1	0.5	1	0.5	1	0.3
	2	Partially fulfilled	1	1.0	1	1.0	1	0.5
	3	Totally fulfilled	0	0.0	0	0.0	0	0.0
	Sub-TOT Ess.			**0.8**		**0.8**		**0.4**
	# *Important* criteria				1			
	1	Minimally fulfilled	0	0.0	0	0.0	0	0.0
	2	Partially fulfilled	0	0.0	0	0.0	0	0.0
	3	Totally fulfilled	1	3.0	1	3.0	1	3.0
	Sub-TOT Imp.			**1.0**		**1.0**		**1.0**
	# *Useful* criteria				1			
	1	Minimally fulfilled	0	0.0	0	0.0	0	0.0
	2	Partially fulfilled	0	0.0	0	0.0	0	0.0
	3	Totally fulfilled	1	3.0	1	3.0	1	3.0
	Sub-TOT Usf.			**0.4**		**0.4**		**0.4**
	Sub-TOT A			***0.6***		***0.6***		***0.5***
I	# *Essential* criteria				0			
	1	Minimally fulfilled	0	0.0	0	0.0	0	0.0
	2	Partially fulfilled	0	0.0	0	0.0	0	0.0
	3	Totally fulfilled	0	0.0	0	0.0	0	0.0
	Sub-TOT Ess.			**0.0**		**0.0**		**0.0**
	# *Important* criteria				2			
	1	Minimally fulfilled	1	0.5	2	1.0	2	1.0
	2	Partially fulfilled	1	1.0	0	0.0	0	0.0
	3	Totally fulfilled	0	0.0	0	0.0	0	0.0
	Sub-TOT Imp.			**0.5**		**0.3**		**0.3**
	# *Useful* criteria				1			
	1	Minimally fulfilled	1	1.0	0	0.0	1	1.0
	2	Partially fulfilled	0	0.0	1	2.0	0	0.0
	3	Totally fulfilled	0	0.0	0	0.0	0	0.0
	Sub-TOT Usf.			**0.1**		**0.3**		**0.1**
	Sub-TOT I			***0.1***		***0.1***		***0.1***
R	# *Essential* criteria				2			
	1	Minimally fulfilled	0	0.0	1	0.5	2	1.0
	2	Partially fulfilled	2	2.0	1	1.0	0	0.0
	3	Totally fulfilled	0	0.0	0	0.0	0	0.0
	Sub-TOT Ess.			**1.1**		**0.8**		**0.5**
	# *Important* criteria				2			
	1	Minimally fulfilled	1	0.5	1	0.5	1	0.3
	2	Partially fulfilled	1	1.0	1	1.0	1	0.5
	3	Totally fulfilled	0	0.0	0	0.0	0	0.0
	Sub-TOT Imp.			**0.5**		**0.5**		**0.3**
	# *Useful* criteria				0			
	1	Minimally fulfilled	0	0.0	0	0.0	0	0.0
	2	Partially fulfilled	0	0.0	0	0.0	0	0.0
	3	Totally fulfilled	0	0.0	0	0.0	0	0.0
	Sub-TOT Usf.			**0.0**		**0.0**		**0.0**
	Sub-TOT I			***0.4***		***0.4***		***0.2***
	TOT Relevance			***1.3*** **Intermediate**		***1.3*** **Intermediate**		***1.0*** **Low**

_Use Case Definition

OneAquaHealth

OAH as a (big–sized) OH ***use case***,
to be articulated in a ***sequence of steps***

FAIR uses of digital technologies

Timely metrics for the outcomes

**OAH as a (big–sized) *ODH use case*,
to be articulated in a *sequence of steps***

1. Project Storytelling
2. ODHscore
3. FAIRness level

# Step	Timeframe (Months)	Step Name	Main Objective	Main Activities	WP Lead(s)	ODH Dimension(s) + Scores					Digital Objects (DOs)	FAIRness level	Main Digitality Domain (H/A/S)		Related Digitality Domain (H/A/S)		Related Digitality Domain (H/A/S)		Data Linkage
						C	E	M	I	S			Specialities	Technology (ies)	Specialities	Technology (ies)	Specialities	Technology (ies)	
3	M9–M18	**Pilot Environmental Surveillance System (ESS) Design**	Design and implement the first prototype of the ODH-based ESS for early warning and monitoring.	Develop architecture for the Environmental Surveillance System (ESS); integrate sensors, IoT nodes, and data collection pipelines; test FAIRification tools.	WP3; WP4	3	2	1	0	5	DO.01: *Dataset containing data on selected indicators (Biological Sampling)*	1,7	Ecology: $S(S_1)$	LLM; Production Suite; Share space	Biology: $A(S_1)$	LLM; Production Suite; Share space			$S(S_1) \oplus A(S_1)$
						0	0	5	0	3	DO.02: *Dataset containing selected Public Health Indicators*	1,7	Public Health: $H(S_1)$	LLM; Production Suite; Share space	Environmental Health: $S(S_2)$	LLM; Production Suite; Share space			$H(S_1) \oplus S(S_2)$
4	M12–M24	**Citizen Science Tools and Engagement**	Engage citizens in aquatic ecosystem monitoring through participatory sensing and feedback tools.	Co-design citizen science app; train local communities; integrate feedback loops into ESS; ensure ethical and legal compliance.	WP4	0	0	5	0	3	DO.03: *Dataset containing human health data from Research sites*	1,6	Public Health: $H(S_1)$	ODBC; DMT; Production Suite; Share space	Environmental Health: $S(S_2)$	ODBC; DMT; Production Suite; Share space			$H(S_1) \oplus S(S_2)$

_Use Case Definition

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OAH as a (big–sized) *ODH use case*, to be articulated in a *sequence of steps*

1. **Project Storytelling**
2. **ODHscore**
3. **FAIRness level**

Dimensions of the ODH framework, also defined as *ODH performance*:

- **C**: Citizen Engagement;
- **E**: Education;
- **M**: Medical (Human and Veterinary health care);
- **I**: Industry 4.0;
- **S**: Surrounding Environment

The overall compliance to the five dimensions calculated as a normalized value

$$ODH_{score} = \frac{\sum D_i}{25}$$

# Step	Timeframe (Months)	Step Name	Main Objective	Main Activities	WP Lead(s)	ODH Dimension(s) + Scores					Digital Objects (DOs)	FAIRness level	Main Digitality Domain (H/A/S)		Related Digitality Domain (H/A/S)		Related Digitality Domain (H/A/S)		Data Linkage
						C	E	M	I	S			Specialities	Technology (ies)	Specialities	Technology (ies)	Specialities	Technology (ies)	
3	M9–M18	**Pilot Environmental Surveillance System (ESS) Design**	Design and implement the first prototype of the ODH-based ESS for early warning and monitoring.	Develop architecture for the Environmental Surveillance System (ESS); integrate sensors, IoT nodes, and data collection pipelines; test FAIRification tools.	WP3; WP4	3	2	1	0	5	DO.01: *Dataset containing data on selected indicators (Biological Sampling)*	1,7	Ecology: $S(S_1)$	LLM; Production Suite; Share space	Biology: $A(S_1)$	LLM; Production Suite; Share space			$S(S_1) \oplus A(S_1)$
						0	0	5	0	3	DO.02: *Dataset containing selected Public Health Indicators*	1,7	Public Health: $H(S_1)$	LLM; Production Suite; Share space	Environmental Health: $S(S_2)$	LLM; Production Suite; Share space			$H(S_1) \oplus S(S_2)$
4	M12–M24	**Citizen Science Tools and Engagement**	Engage citizens in aquatic ecosystem monitoring through participatory sensing and feedback tools.	Co-design citizen science app; train local communities; integrate feedback loops into ESS; ensure ethical and legal compliance.	WP4	0	0	5	0	3	DO.03: *Dataset containing human health data from Research sites*	1,6	Public Health: $H(S_1)$	ODBC; DMT; Production Suite; Share space	Environmental Health: $S(S_2)$	ODBC; DMT; Production Suite; Share space			$H(S_1) \oplus S(S_2)$

_Use Case Definition

OneAquaHealth

OAH as a (big–sized) OH ***use case***, to be articulated in a ***sequence of steps***

FAIR uses of digital technologies

Timely metrics for the outcomes

OAH as a (big–sized) *ODH use case*, to be articulated in a *sequence of steps*

1. Project Storytelling
2. ODHscore
3. FAIRness level

# Step	Timeframe (Months)	Step Name	Main Objective	Main Activities	WP Lead(s)	ODH Dimension(s) + Scores					Digital Objects (DOs)	FAIRness level	Main Digitality Domain (H/A/S)		Related Digitality Domain (H/A/S)		Related Digitality Domain (H/A/S)		Data Linkage
						C	E	M	I	S			Specialities	Technology (ies)	Specialities	Technology (ies)	Specialities	Technology (ies)	
3	M9–M18	**Pilot Environmental Surveillance System (ESS) Design**	Design and implement the first prototype of the ODH-based ESS for early warning and monitoring.	Develop architecture for the Environmental Surveillance System (ESS); integrate sensors, IoT nodes, and data collection pipelines; test FAIRification tools.	WP3; WP4	3	2	1	0	5	DO.01: *Dataset containing data on selected indicators (Biological Sampling)*	1,7	Ecology: $S(S_1)$	LLM; Production Suite; Share space	Biology: $A(S_1)$	LLM; Production Suite; Share space			$S(S_1) \oplus A(S_1)$
						0	0	5	0	3	DO.02: *Dataset containing selected Public Health Indicators*	1,7	Public Health: $H(S_1)$	LLM; Production Suite; Share space	Environmental Health: $S(S_2)$	LLM; Production Suite; Share space			$H(S_1) \oplus S(S_2)$
4	M12–M24	**Citizen Science Tools and Engagement**	Engage citizens in aquatic ecosystem monitoring through participatory sensing and feedback tools.	Co-design citizen science app; train local communities; integrate feedback loops into ESS; ensure ethical and legal compliance.	WP4	0	0	5	0	3	DO.03: *Dataset containing human health data from Research sites*	1,6	Public Health: $H(S_1)$	ODBC; DMT; Production Suite; Share space	Environmental Health: $S(S_2)$	ODBC; DMT; Production Suite; Share space			$H(S_1) \oplus S(S_2)$

_Use Case Definition

OneAquaHealth

OAH as a (big–sized) OH ***use case***, to be articulated in a ***sequence of steps***

FAIR uses of digital technologies

Timely metrics for the outcomes

OAH as a (big–sized) *ODH use case*, to be articulated in a *sequence of steps*

Goal: to establish a quantitative link between two different kinds of compliance scores.

How well the digital dimension of an Intervention step (*FAIR-compliant data layer*) enhances its ODH performance (*Dimension-compliant data layer's systemic impact*)?

A coupling function

$ODHamp = \Phi(ODH_n , FAIR_n)$

is defined, which quantifies how FAIRness amplifies or limits an ODH performance.

# Step	Timeframe (Months)	Step Name	Main Objective	Main Activities	WP Lead(s)	ODH Dimension(s) + Scores					Digital Objects (DOs)	FAIRness level	Main Digitality Domain (H/A/S)		Related Digitality Domain (H/A/S)		Related Digitality Domain (H/A/S)		Data Linkage
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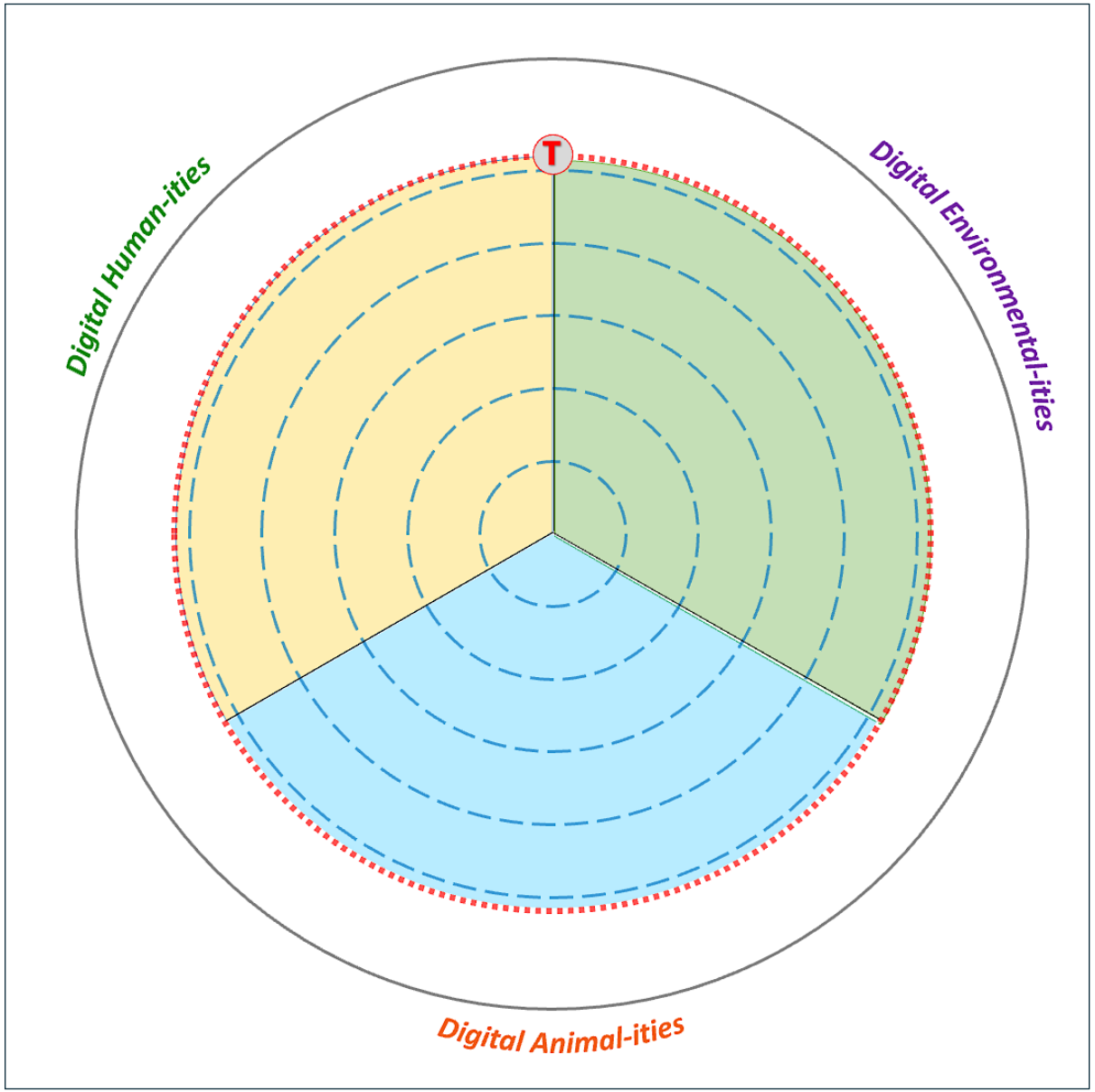
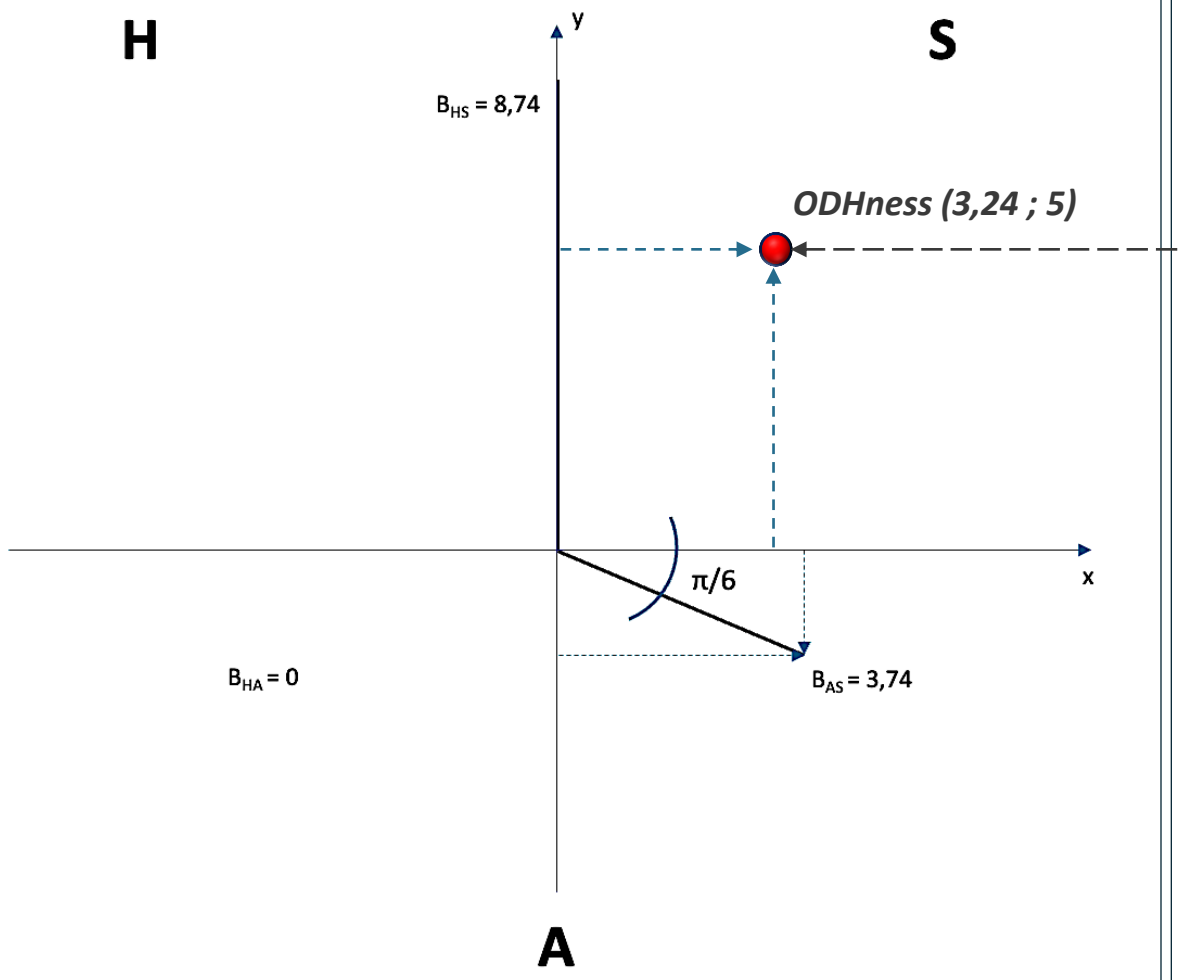
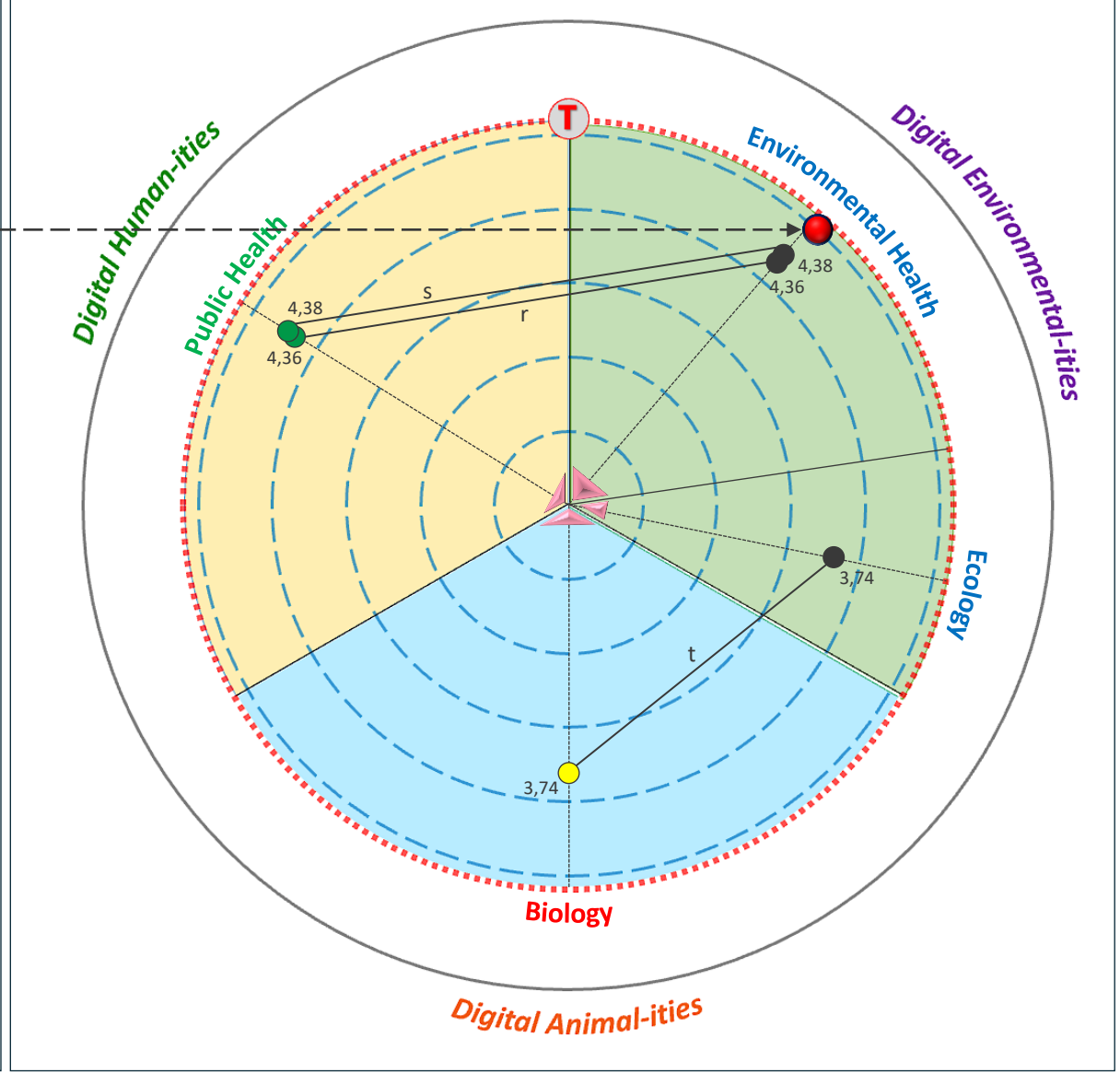
_ODH Target


T
Digital Human-ities
Digital Environmental-ities
Digital Animal-ities

_ODHness calculation (ODH Intervention, first iteration)



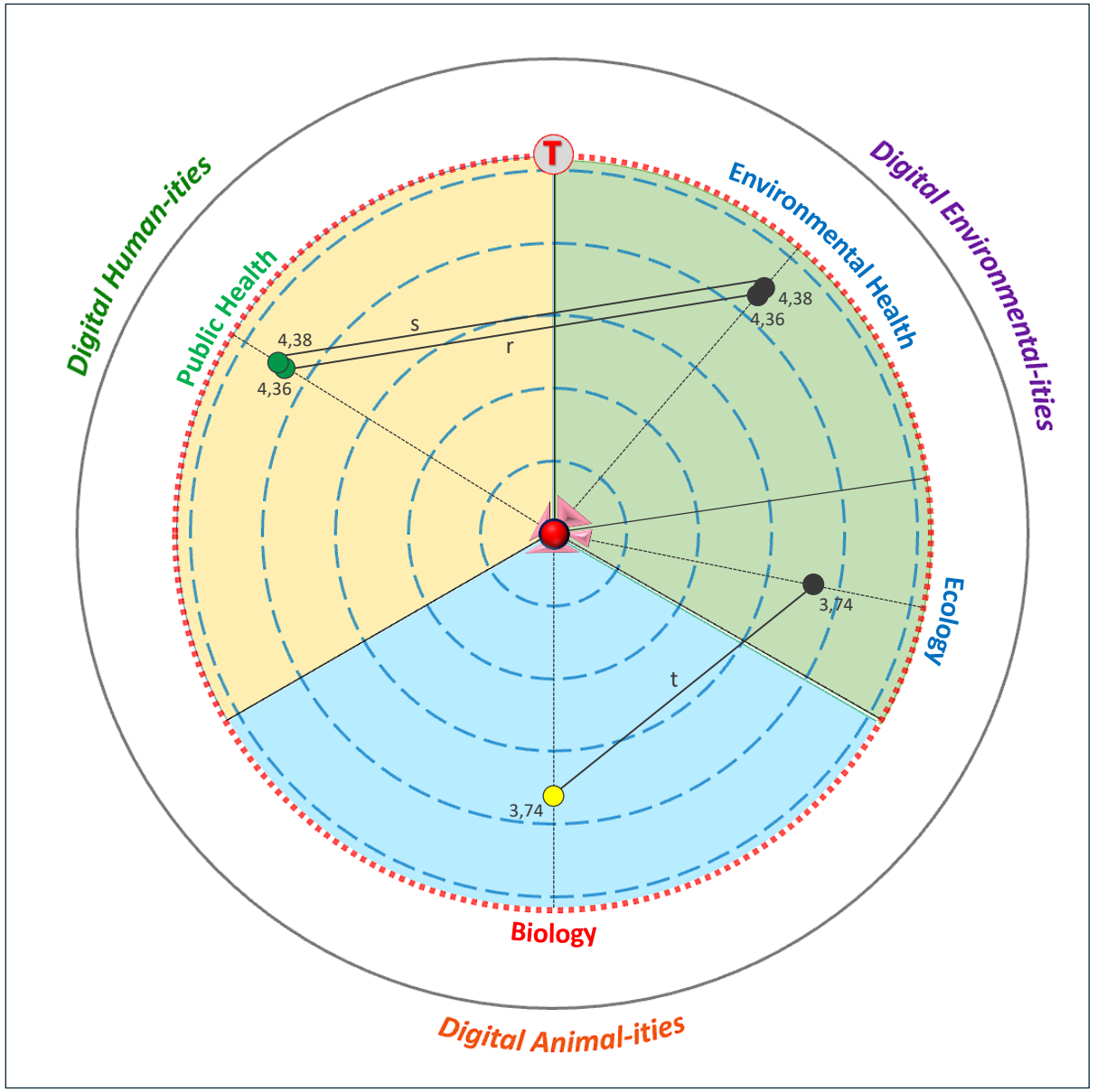


_ODHness calculation (ODH Intervention, next iterations)

- Improve FAIRness compliance for existing DOs (*FAIRification*)

and/or

Feature *new* DOs produced in the project



ODH Intervention & ODH applied to *OneAquaHealth*

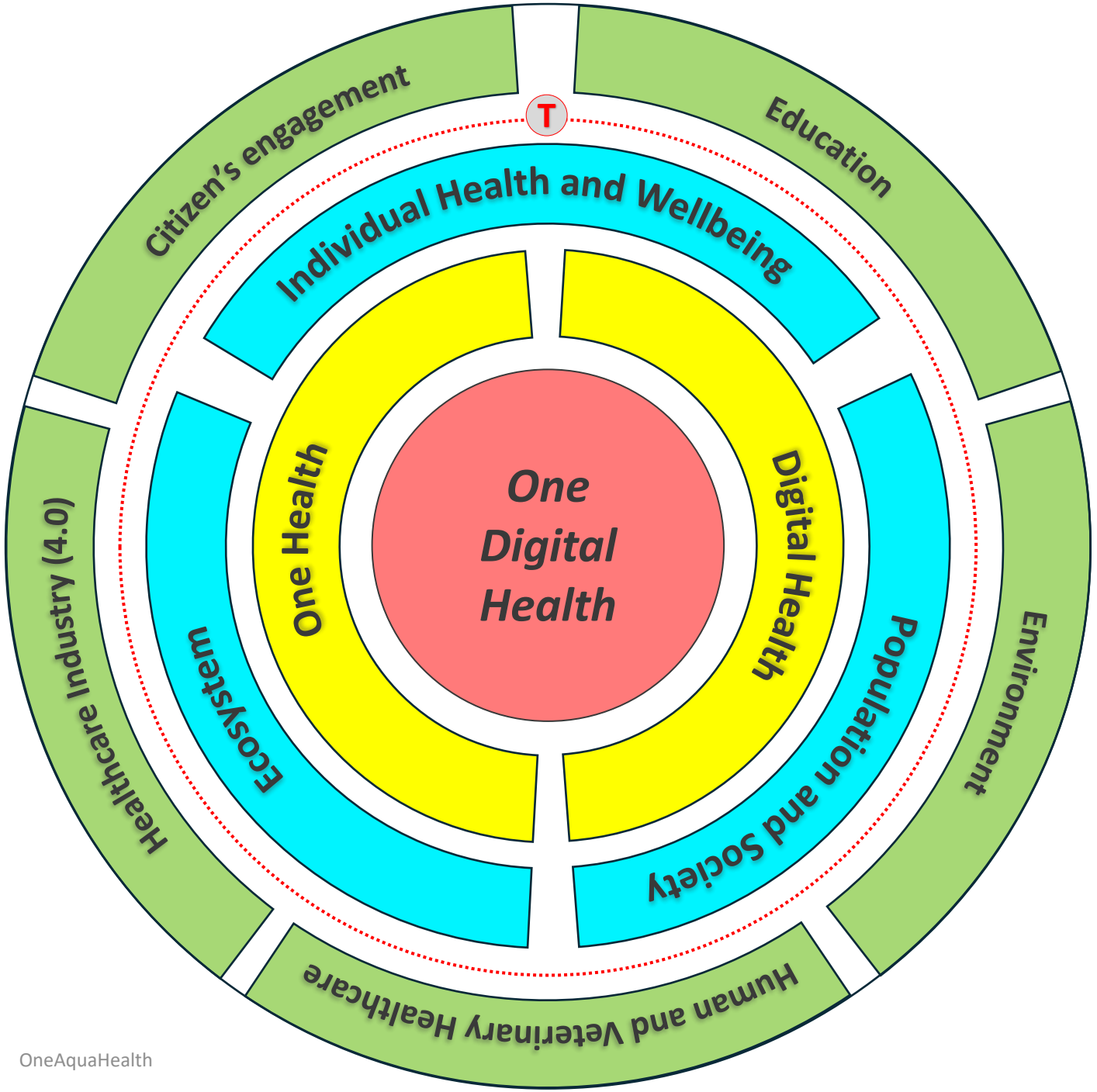
The One Digital Health Ecosystem

What is the ODH *Ecosystem*?

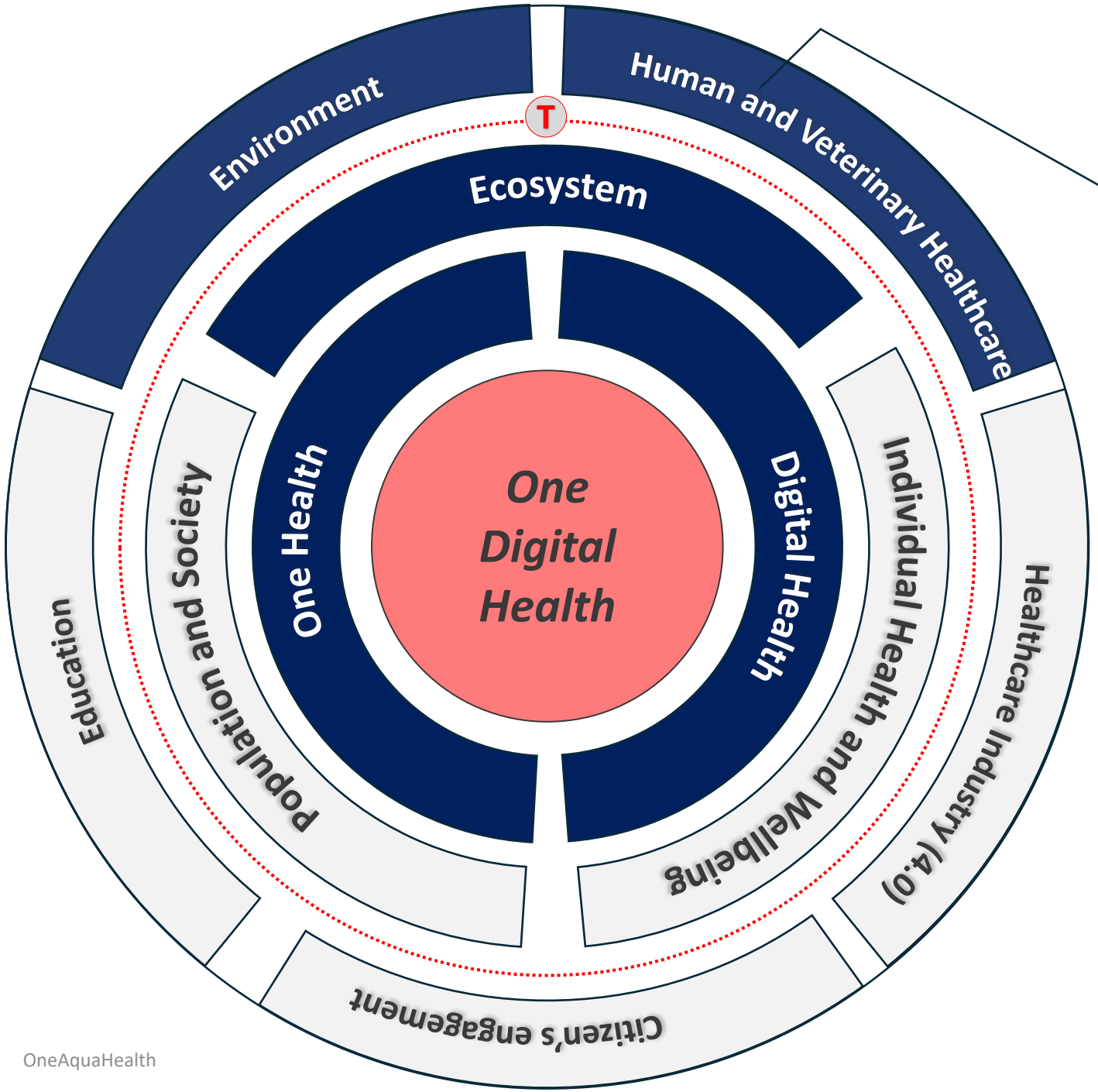
A dynamic, self-sustaining socio-technical organism translating One Health principles into active digital infrastructure

- A complex, interconnected galaxy of human stakeholders, animal networks, environmental sensors, and advanced computational agents operating as a unified whole to co-create systemic value.
- Data behaves as a metabolic currency, informational flows are continuously circulated, integrated, and transformed across traditionally separated boundaries.
- The ODH Ecosystem establishes an open-horizon digital environment capable of continuous self-correction, dynamic planning, and real-time scaling.

OneAquaHealth



ODH – BMHI - NLP
Steering Wheel Overlay



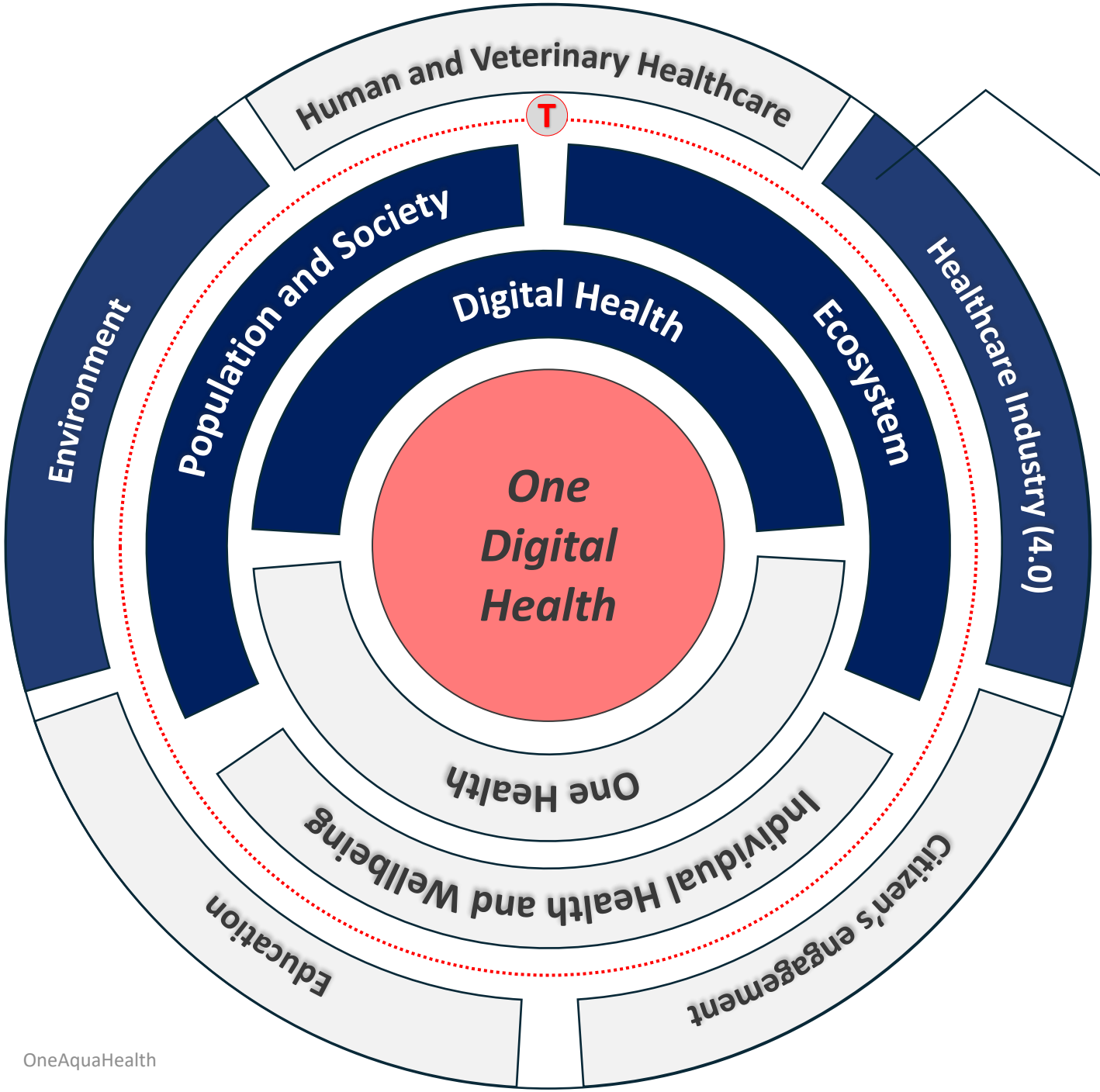
OneAquaHealth

Pillar: *ODH Intervention*

Scope: Deploying targeted digital actions (digital-ities) to manage concurrent ecological and health crises.

doi: 10.2196/43871

ODH – BMHI - NLP
Steering Wheel Overlay

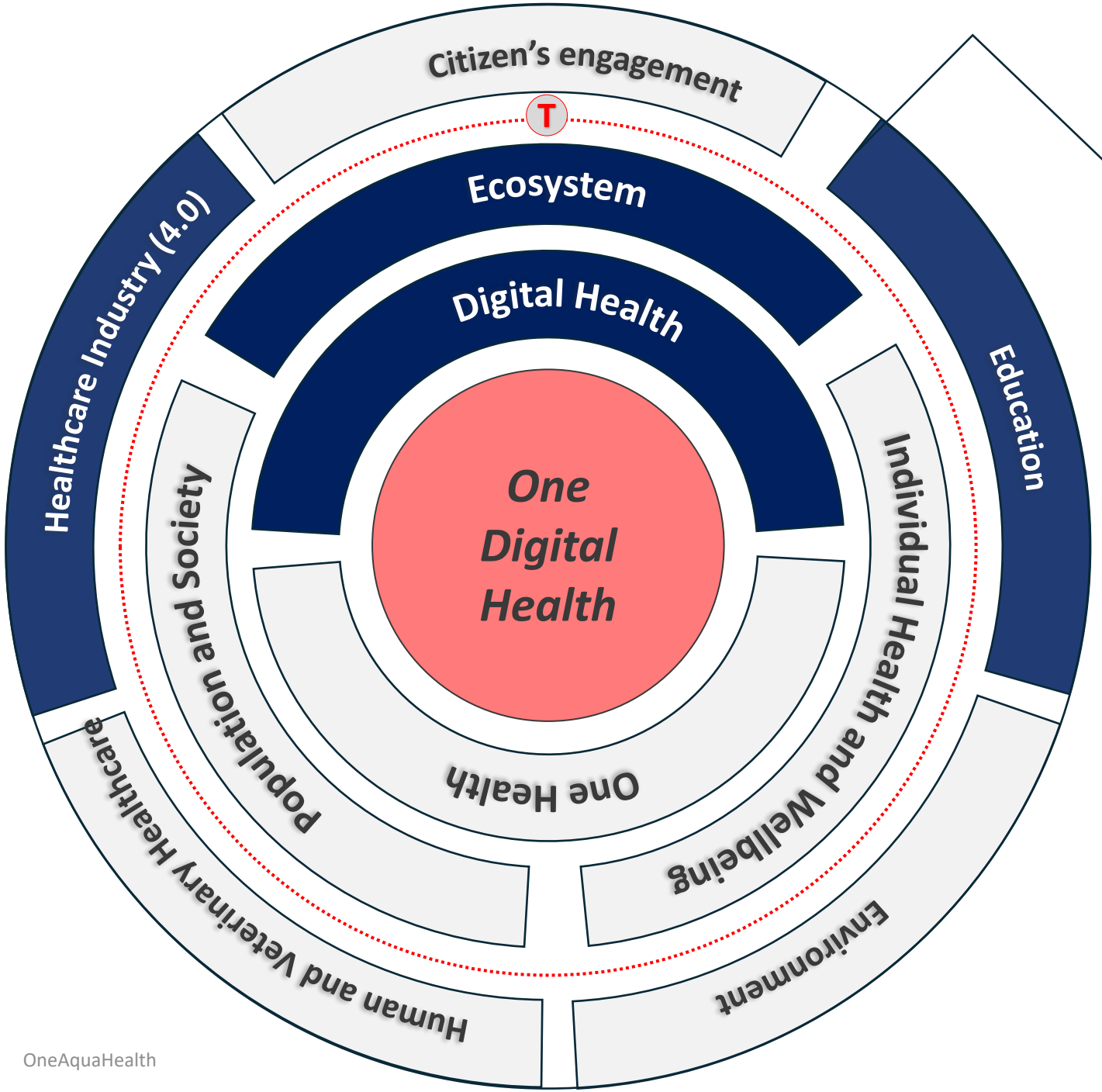


Pillar: *Accidental & Emergency Informatics (A&EI) Integration*

Scope: Embedding acute real-time hazard informatics and situational awareness into public safety networks.

doi: 10.1055/s-0043-1768742

ODH – BMHI - NLP
Steering Wheel Overlay



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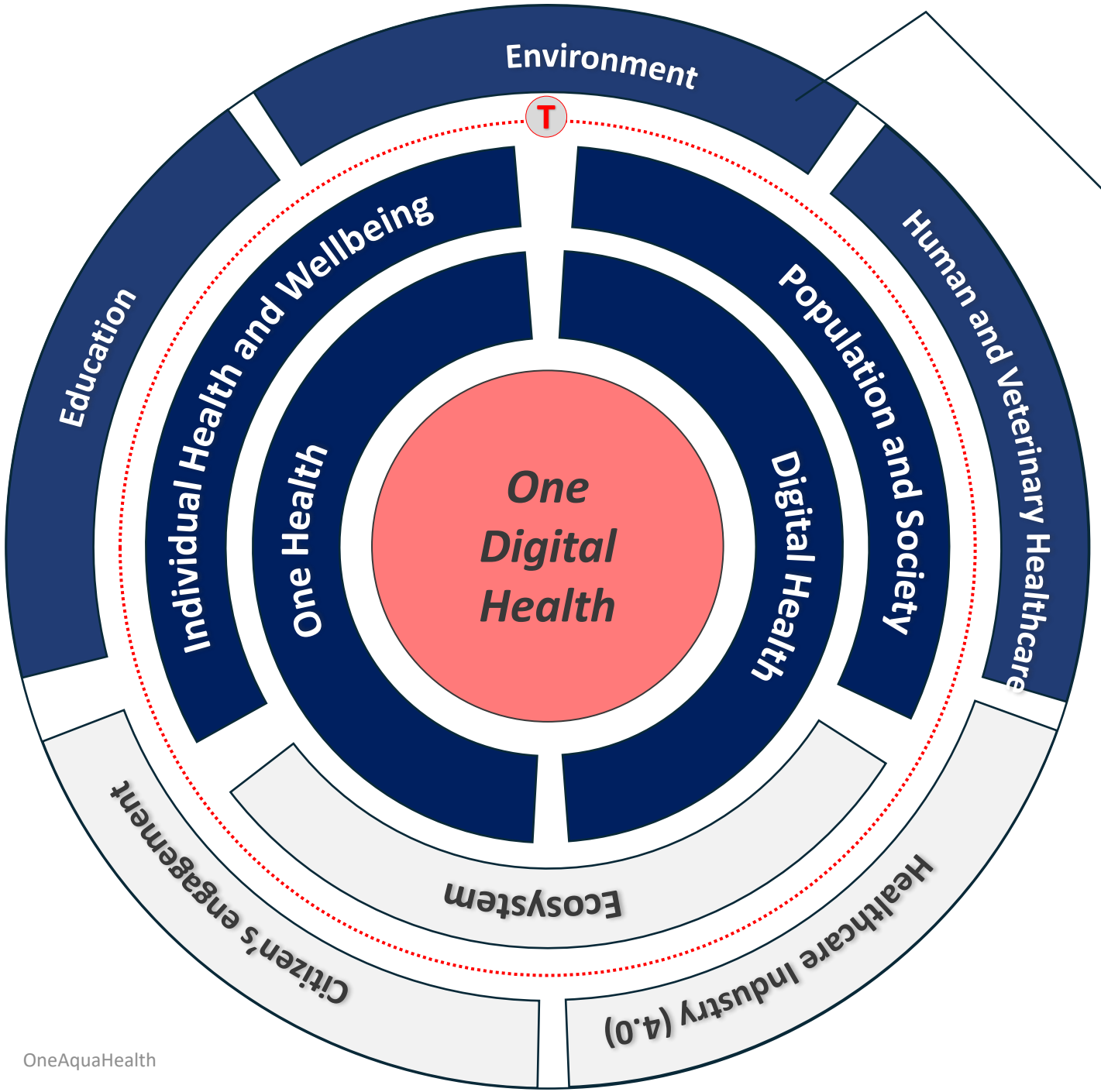
Pillar: *FAIR Data Maturity Model (FDMM) Expansion*

Scope: Enforcing machine-actionable data-sharing standards to drive automated, AI-ready data governance.

doi: 10.3233/SHTI251544

ODH – BMHI - NLP
Steering Wheel Overlay

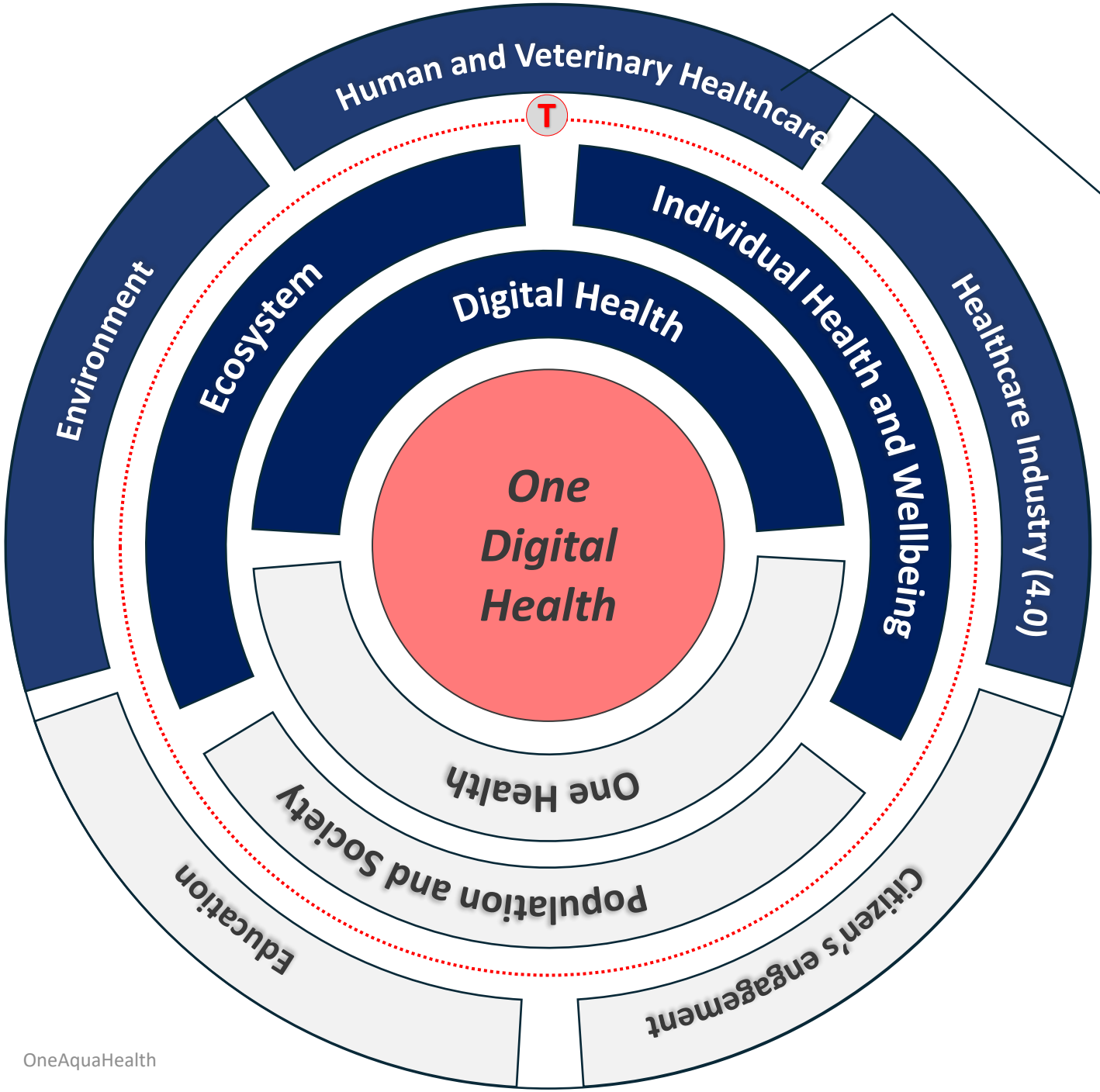


Pillar: *Next-Gen Indicators*

Scope: Leveraging Large Language Models (LLMs) to synthesize hidden connections between nature and health.

TBP (IMIA Yearbook)

ODH – BMHI - NLP
Steering Wheel Overlay



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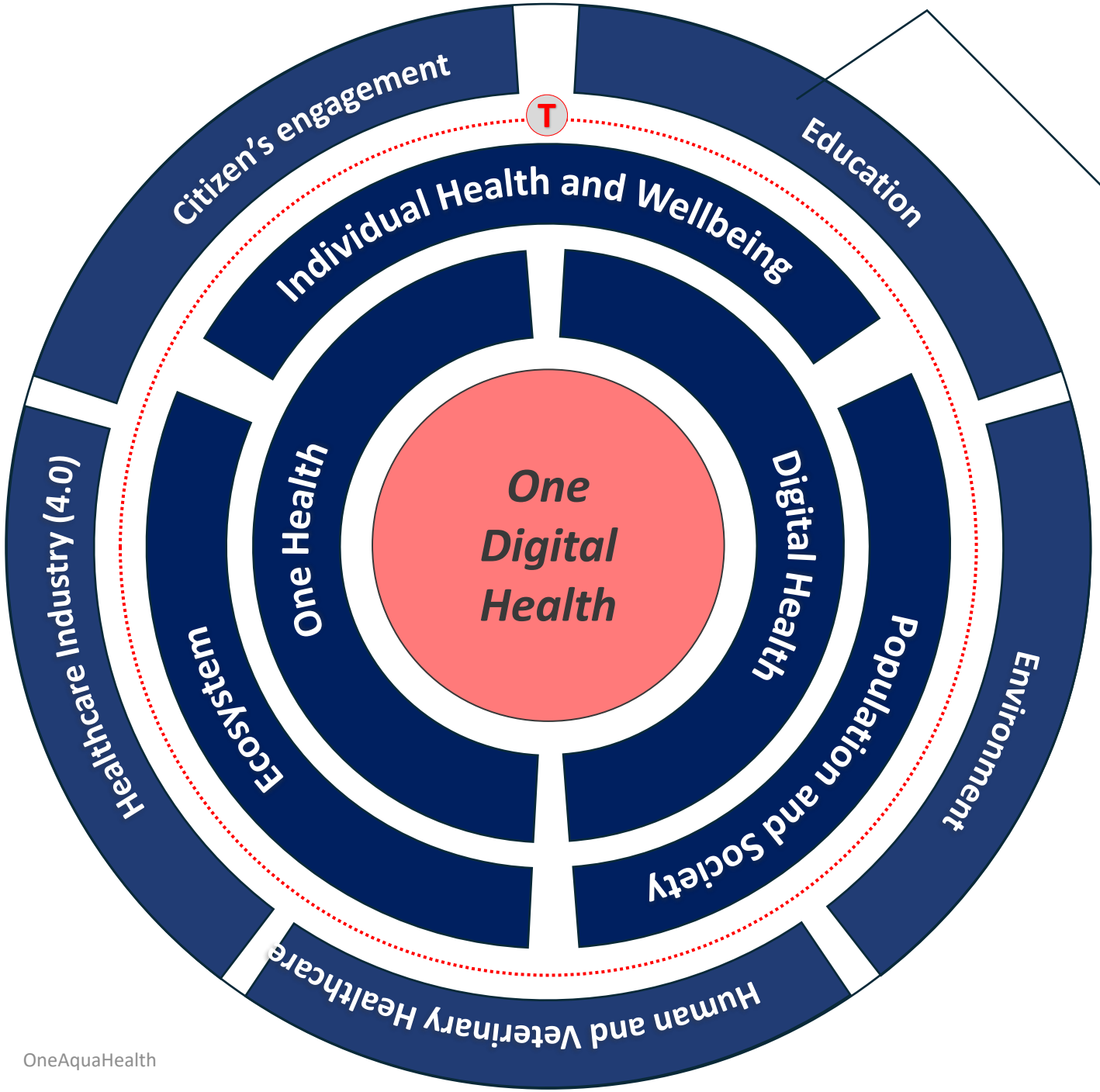
Pillar: *LinkAll Reference Architecture*

Scope: A resilient cloud-edge topology managing distributed IoT telemetry with integrated FAIR compliance.

doi: 10.1177/14604582251383803

ODH – BMHI - NLP
Steering Wheel Overlay



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Pillar: *ODH-Unified Terminology*

Scope: Establishing a unified, cross-lingual terminology backbone to bridge multidisciplinary vocabularies.

doi: 10.3233/SHTI240719

ODH – BMHI - NLP
Steering Wheel Overlay

The One Digital Health Ecosystem

A Unified Terminology for ODH within OAH

A Unified Terminology for ODH within OAH

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- An effective combination of what underscored so far – DOs, FAIR Data Maturity Model, ODH Intervention as story/use case – demands for a shared language → a ***Unified Terminology***;
- The work on the ontological framework is already up and running

- ***Data Sources***
  - *ODH-SW, Healthcare terminologies (MeSH, NCIt, LOINC)*
  - *IEEE terminology*
  - *Relevant scientific literature*
  - *Domain experts*
- ***Inclusion Criteria***
  - *Alignment with ODH-SW framework*
  - *Comprehensiveness*
  - *Unambiguousness and precision*
- ***Curation Process***
  - *Continuous review and normalization*
  - *Domain expert evaluation*
  - *Version tracking*
  - *Alignment with HeTOP terminologies*
- ***Benefits***
  - *FAIR principles compliance*
  - *Enriched T&Cs*

Bauberg H, Nehama D, Blinder C, Davidman R, Cohen E, Tamburis O, Darmoni SJ, Grosjean J, Benis A. **Initiating a One Digital Health Unified Terminology (ODH-UT) to Facilitate Community Expansion**. *Stud Health Technol Inform*. 2024 Aug 22;316:1569-1573. doi: 10.3233/SHTI240719. PMID: 39176507

A Unified Terminology for ODH within OAH

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ODH component	Synonym(s)	Definition
ODH component	**Synonym(s)**	**Definition**
ODH component	**Synonym(s)**	**Definition**
Citizen's Engagement	*Public Participation; Community Involvement.*	The involvement of individuals in health-related decision-making processes fosters collaboration between healthcare providers and the public.
Education	*Literacy; Knowledge; Learning; Dissemination.*	Education promotes awareness, understanding, and acquisition of information and knowledge, empowering individuals, and communities to make informed decisions.
Environment monitoring	*Environmental Factors; Surroundings monitoring; Ecological indicators tracking.*	Surveillance of the external surroundings that impact health, including biological, chemical, physical, social, and cultural elements.
Human and veterinary healthcare	*Delivery of health care; Medical Care; Animal Health Services.*	Human and veterinary healthcare rely on all aspects of providing and distributing health services to a patient population (human or animal).
Healthcare Industry (4.0)	*Healthcare Industry; Digital Transformation in Health.*	The Healthcare Industry (4.0) integrates advanced technologies like artificial intelligence, big data, and IoT into healthcare systems to improve efficiency and patient outcomes.

A Unified Terminology for ODH within OAH

OneAquaHealth

- An effective combination of what underscored so far – DOs, FAIR Data Maturity Model, ODH Intervention as story/use case) demands for a shared language → a ***Unified Terminology***

Importance of ODH-UT

A unified terminology like ODH-UT is critical to better **communication** and **collaboration** in the One Health and Digital Health domains.

Benefits of ODH-UT

It can **improve patient outcomes, monitoring, and decision-making** across healthcare and environmental applications.

Implementation Challenges

Successful implementation **requires collaboration** from diverse stakeholders and **ongoing refinement** to stay relevant in a constantly **evolving** field.

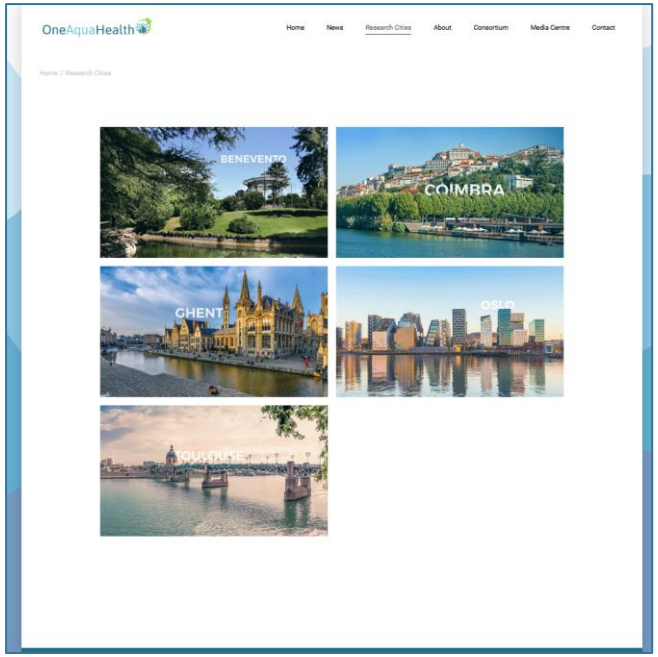
Future Potential

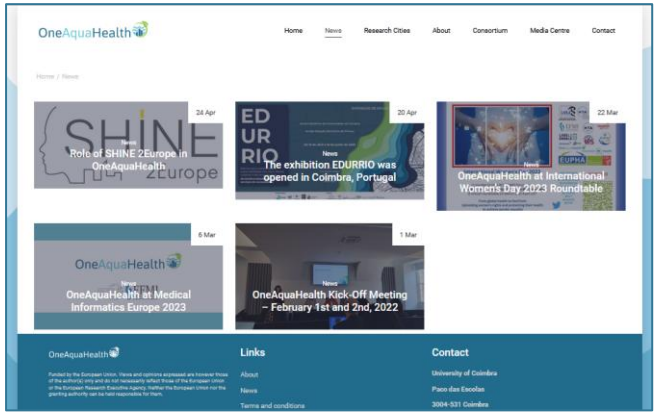
A robust ODH terminology (and domain ontology in the future) **can unlock the potential of digital technologies** to revolutionize healthcare, environmental efforts, and citizen **empowerment**.

Questions & Answers

DISSEMINATION & COMMUNICATION

Open Information Hub | www.oneaquahealth.eu





Scan Me

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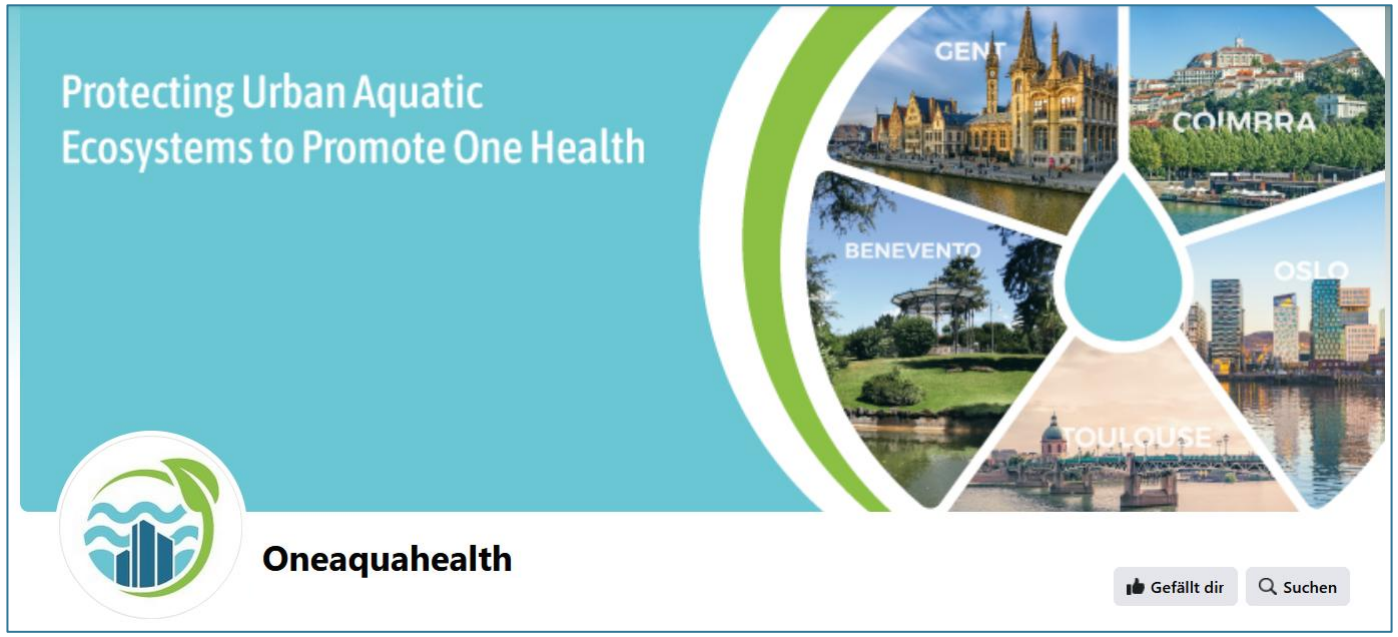

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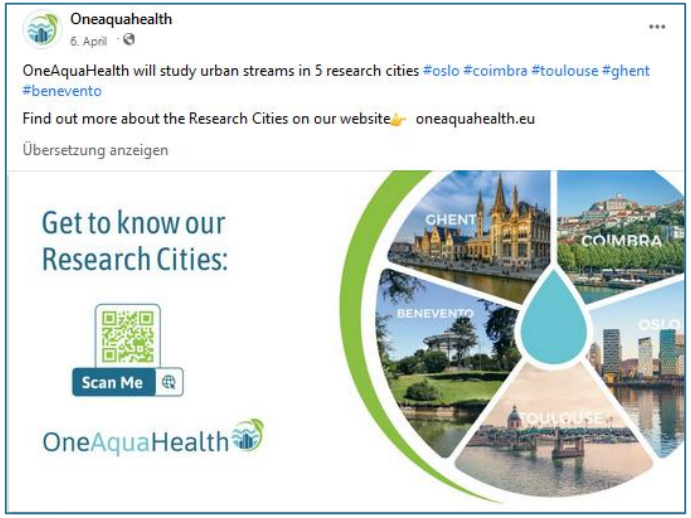

DISSEMINATION & COMMUNICATION

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LinkedIn account|https://www.linkedin.com/company/oneaquahealth/

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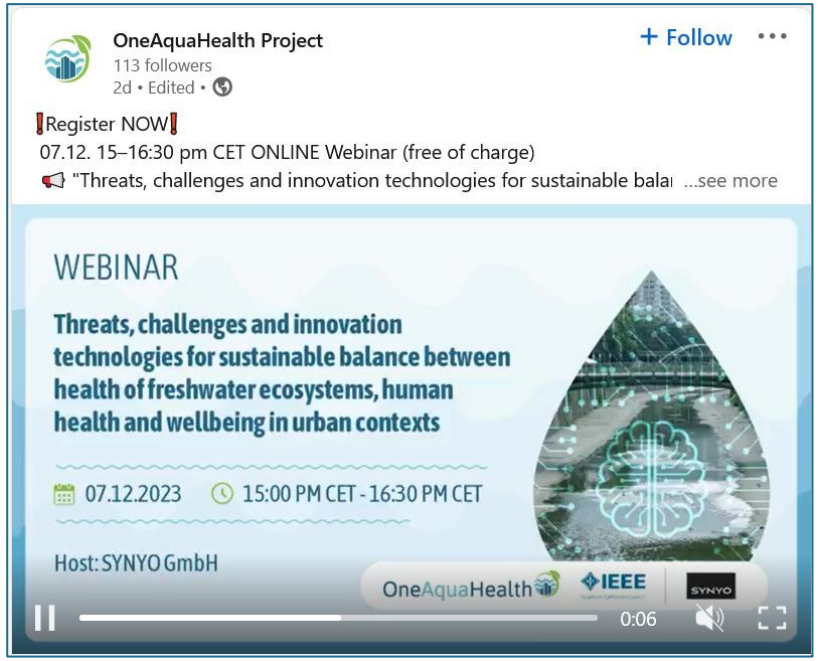

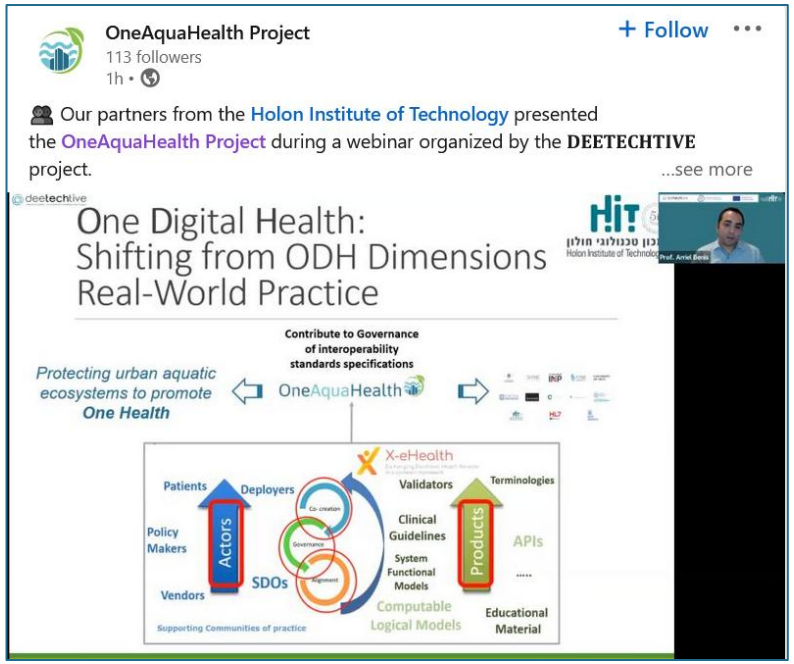

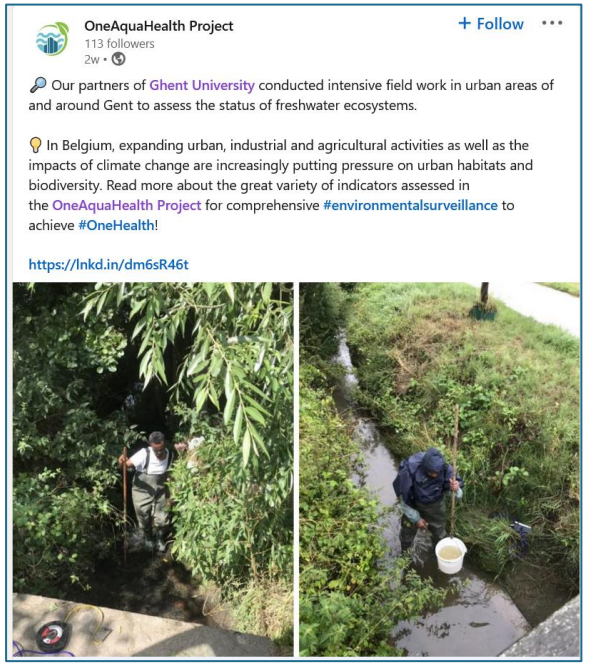

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