Deliverable D56 (D7.7)
"Guidelines for intellectual property rights (IPR) management"

RI-URBANS

Research Infrastructures Services Reinforcing Air Quality Monitoring Capacities in European Urban & Industrial Areas (GA n. 101036245)

By
NOA

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Deliverable D56 (D7.7) "Guidelines for IPR management"

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Acronym	Term Description
IP	Intellectual Property
IPR	Intellectual Property Rights
RPO	Research Performing Organization
FAIR	Findable, Accessible, Interoperable, Reusable
GA	Grant Agreement
CA	Consortium Agreement
OS	Open Science
OA	Open Access
RI	Research Infrastructures
NRT	Near Real Time
AQMN	Air Quality Monitoring Network
AQMS	Air Quality Monitoring Services

1. About this document

This document aims to introduce the aspect of Intellectual Property (IP) Rights (IPR) to the RI-URBANS partners, assuming a difference range of previous experience on handling such issues. Its main purpose is to present the opportunities that proper IPR management can provide for research, innovation, protection and the further development and improvement of the results of this project. Issues such as ownership, transfer of knowledge and joint ventures can be solved by the instruments IPR provide. A significant part of the document explains how IPR can be generally used as an innovation and sustainability accelerator and facilitator, providing information on the existing frameworks and directives that act as enablers. The required tools and processes that must be followed and the value they provide are explained, as well as the proper time frame every action has to be taken to ensure no issues appear at a later stage, both during the project implementation and the post project exploitation phases. Finally, specific guidelines are laid on how the IPR management of RI-URBANS can be conducted in order to maximize the speed and security of the results' exploitation. It is noted that IPR strategies and values from the ACTRIS infrastructure management has been intensively driving the contents and concepts of this document.

This is a public document that will be distributed to all RI-URBANS partners for their use and submitted to European Commission as a RI-URBANS deliverable D56 (D7.7). This document can be downloaded at https://riurbans.eu/work-package-7/#deliverables-wp7

2. Introduction to intellectual property rights (IPR)

Intellectual property is a category of intangible creations of the human mind and intellect. The difficulty of applying ownership to something intangible and indivisible presents a challenge for law and law makers. In addition, issues are also initiated in the attempt to protect such creations. Intellectual property law was formulated to help the iterators protect, share and monetize their creations, allow others to benefit from them, use them and reshape them, as well as prevent copying and transforming them for malicious purposes. Intellectual property rights refer to the legal power given to the owner or creator of such intellectual creation to protect the invention or creation with an exclusive right to attain value or utilize such creation over a given period of time. Intellectual labor associated with innovation and the creation of intangible assets (like knowledge, knowhow, frameworks, and data) needs tools like intellectual property rights that act as protection mechanisms, as much as tools to communicate knowledge and transfer it without legal breaches, infringements to ownership rights and safely disseminate or give access to such assets to anyone that can use them to promote innovation.

2.1 Glossary

Results and Foreground

The IP rules of Horizon 2020 are built on the proven regulations of FP7. There are however some changes with an impact on the implementation and IP management of projects in Horizon 2020. The main differences concern changes and specifications with regard to terminology. For instance, whereas results generated within the project were formally called "foreground", in Horizon 2020 the term "results" is now used. Additional modifications are related to matters concerning exploitation, dissemination (open access), ownership and access rights as well as protection and licensing of IP (Source: https://www.horizon-europe.gouv.fr/sites/default/files/2021-12/h2020---your-guide-to-ip-in-h2020-5146.pdf).

According to RI-URBAN's Grant Agreement (GA, p. 45): 'Results' means any (tangible or intangible) output of the action such as data, knowledge or information — whatever its form or nature, whether it can be protected or not — that is generated in the action, as well as any rights attached to it, including intellectual property rights.

Foreground data

Foreground data are any data generated, created, extracted or analyzed and processed under a defined and proposed act, work, contract or subcontract, license and agreement.

Background data

Background data are any data of any type or kind that were produced outside of a defined and proposed agreement, contract, proposal etc. Such background data may include any modifications, derivatives to previously conceived, designed, developed, and resultant revisions to software, processes, qualification data, and manufacturing plans.

According to the GA (p. 44): 'Background' means any data, know-how or information — whatever its form or nature (tangible or intangible), including any rights such as intellectual property rights — that: (a) is held by the beneficiaries before they acceded to the Agreement, and (b) is needed to implement the action or exploit the results.

Foreground IPR

Foreground IPR is any kind of Intellectual property rights created by any of the activities of a defined framework, proposal, project, joint alliance suggestion, joint ownership agreement, etc.

Fair and reasonable conditions

Fair and reasonable conditions mean appropriate conditions including possible financial terms (market conditions or other) taking into account the specific circumstances of the request for access, for example the actual or potential value of the foreground or background concerned and/or the scope, duration or other characteristics of the use envisaged.

2.2 Rights and obligations related to background and results

The rights and obligations of all beneficiaries and the right to access to every other participant's background and results creates an innovation promoting ecosystem, fostering new collaborations and advancing research and technology. Those rights and obligations create a set of rules that dictate the relationship between beneficiaries, that when appropriately handled can remove barriers and create new innovative collaborations. The following segment displays the rules set from the GA regarding access to background and results.

2.2.1 Rights and obligations related to background

Agreement on background

The beneficiaries must identify and agree (in writing) on the background for the action ('agreement on background').

Access rights to background

'Access rights' means rights to use results or background under the terms and conditions laid down in this Agreement.

Exercise of access rights

To exercise access rights, this must first be requested in writing. Unless agreed otherwise, access rights do not include the right to sub-license.

Access rights for other beneficiaries, for implementing their own tasks under the action

The beneficiaries must give each other access — on a royalty-free basis — to background needed to implement their own tasks under the action, unless the beneficiary that holds the background has — before acceding to the Agreement:

(a) informed the other beneficiaries that access to its background is subject to legal restrictions or limits, including those imposed by the rights of third parties (including personnel), or

(b) agreed with the other beneficiaries that access would not be on a royalty-free basis.

Access rights for other beneficiaries, for exploiting their own results

The beneficiaries must give each other access — under fair and reasonable conditions — to background needed for exploiting their own results, unless the beneficiary that holds the background has — before acceding to the Agreement — informed the other beneficiaries that access to its background is subject to legal restrictions or limits, including those imposed by the rights of third parties (including personnel).

'Fair and reasonable' conditions

Describes appropriate conditions, including possible financial terms or royalty-free conditions, taking into account the specific circumstances of the request for access, for example the actual or potential value of the results or background to which access is requested and/or the scope, duration or other characteristics of the exploitation envisaged.

Access rights for affiliated entities

Unless otherwise agreed in the consortium agreement, access to background must also be given — under fair and reasonable conditions (see above; Article 25.3) and unless it is subject to legal restrictions or limits, including those imposed by the rights of third parties (including personnel) — to affiliated entities 20 established in an EU Member State or 'associated country' 21, if this is needed to exploit the results generated by the beneficiaries to which they are affiliated. Unless agreed otherwise (see above; Article 25.1), the affiliated entity concerned must make the request directly to the beneficiary that holds the background.

Access rights for third parties

Not applicable

2.2.2 Rights and Obligations related to results

Ownership by the beneficiary that generates the results

Results are owned by the beneficiary that generates them. Joint ownership will take place when several beneficiaries own the results. Two or more beneficiaries' own results jointly if:

(a) they have jointly generated them, and

(b) it is not possible to:

(bi) establish the respective contribution of each beneficiary, or

(bii) separate them for the purpose of applying for, obtaining or maintaining their protection.

The joint owners must agree (in writing) on the allocation and terms of exercise of their joint ownership ('joint ownership agreement'), to ensure compliance with their obligations under this Agreement.

Unless otherwise agreed in the joint ownership agreement, each joint owner may grant non-exclusive licenses to third parties to exploit jointly owned results (without any right to sub-license), if the other joint owners are given:

(a) at least 45 days advance notice, and

(b) fair and reasonable compensation.

Once the results have been generated, joint owners may agree (in writing) to apply another regime than joint ownership (such as, for instance, transfer to a single owner with access rights for the others).

Rights of third parties (including personnel)

If third parties (including personnel) may claim rights to the results, the beneficiary concerned must ensure that it complies with its obligations under the Agreement.

If a third party generates results, the beneficiary concerned must obtain all necessary rights (transfer, licenses or other) from the third party, in order to be able to respect its obligations as if those results were generated by the beneficiary itself.

If obtaining the rights is impossible, the beneficiary must refrain from using the third party to generate the results.

Agency ownership, to protect results

The Agency may — with the consent of the beneficiary concerned — assume ownership of results to protect them, if a beneficiary intends — up to four years after the period set out in Article 3— to disseminate its results without protecting them, except in any of the following cases:

(a) the lack of protection is because protecting the results is not possible, reasonable or justified (given the circumstances),

(b) the lack of protection is because there is a lack of potential for commercial or industrial exploitation, or

(c) the beneficiary intends to transfer the results to another beneficiary or third party established in an EU Member State or associated country, which will protect them.

If the Agency decides to assume ownership, it will formally notify the beneficiary concerned within 45 days of receiving notification. No dissemination relating to these results may take place before the end of this period or, if the Agency takes a positive decision, until it has taken the necessary steps to protect the results.

The Agency may — with the consent of the beneficiary concerned — assume ownership of results to protect them, if a beneficiary intends — up to four years after the period set out in Article 3 — to stop protecting them or not to seek an extension of protection, except in any of the following cases:

(a) the protection is stopped because of a lack of potential for commercial or industrial exploitation, or

(b) an extension would not be justified given the circumstances.

A beneficiary that intends to stop protecting results or not seek an extension must — unless any of the cases above under Points (a) or (b) applies — formally notify the Agency at least 60 days before the protection lapses or its extension is no longer possible and at the same time inform it of any reasons for refusing consent. The beneficiary may refuse consent only if it can show that its legitimate interests would suffer significant harm.

If the Agency decides to assume ownership, it will formally notify the beneficiary concerned within 45 days of receiving notification.

Protection of results

Obligation to protect the results: Each beneficiary must examine the possibility of protecting its results and must adequately protect them — for an appropriate period and with appropriate territorial coverage if:

> (a) the results can reasonably be expected to be commercially or industrially exploited, or

> (b) protecting them is possible, reasonable and justified (given the circumstances).

When deciding on protection, the beneficiary must consider its own legitimate interests and the legitimate interests (especially commercial) of the other beneficiaries.

Agency ownership, to protect the results

If a beneficiary intends not to protect its results, to stop protecting them or not seek an extension of protection, the Agency may assume ownership to ensure their (continued) protection.

Information on EU funding

Applications for protection of results (including patent applications) filed by or on behalf of a beneficiary must — unless the Agency requests or agrees otherwise or unless it is impossible — include the following: "The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101036245".

Exploitation of results

Obligation to exploit the results

Each beneficiary must — up to four years after the period set out in Article 3 — take measures aiming to ensure 'exploitation' of its results (either directly or indirectly, in particular through transfer or licensing; see Article 30) by:

> (a) using them in further research activities (outside the action),

> (b) developing, creating or marketing a product or process,

> (c) creating and providing a service, or

> (d) using them in standardization activities. This does not change the security obligations in Article 37, which still apply.

Results that could contribute to European or international standards

If results are incorporated in a standard, the beneficiary concerned must — unless the Agency requests or agrees otherwise or unless it is impossible — ask the standardization body to include the following statement in (information related to) the standard: "Results incorporated in this standard received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101036245".

Dissemination of results – open access – visibility of EU funding

Obligation to disseminate results

Unless it goes against their legitimate interests, each beneficiary must — as soon as possible — 'disseminate' its results by disclosing them to the public by appropriate means (other than those resulting from protecting or exploiting the results), including in scientific publications (in any medium). This does not change the obligation to protect results, the confidentiality obligations, the security obligations or the obligations to protect personal data, all of which still apply.

A beneficiary that intends to disseminate its results must give advance notice to the other beneficiaries of — unless agreed otherwise — at least 45 days, together with sufficient information on the results it will disseminate. Any other beneficiary may object within — unless agreed otherwise — 30 days of receiving notification, if it can show that its legitimate interests in relation to the results or background would be significantly harmed. In such cases, the dissemination may not take place unless appropriate steps are taken to safeguard these legitimate interests. If a beneficiary intends not to protect its results, it may need to formally notify the Agency before dissemination takes place.

Open access (OA) to scientific publications

Each beneficiary must ensure Open Access (OA, free of charge online access for any user) to all peer-reviewed scientific publications relating to its results. In particular, it must:

(a) As soon as possible and at the latest on publication, deposit a machine-readable electronic copy of the published version or final peer-reviewed manuscript accepted for publication in a repository for scientific publications. Moreover, the beneficiary must aim to deposit at the same time the research data needed to validate the results presented in the deposited scientific publications.

(b) Ensure OA to the deposited publication — via the repository — at the latest:

(bi) on publication, if an electronic version is available for free via the publisher, or

(bii) within six months of publication (twelve months for publications in the social sciences and humanities) in any other case.

(c) Ensure OA — via the repository — to the bibliographic metadata that identify the deposited publication. The bibliographic metadata must be in a standard format and must include all of the following:

(ci) the terms "European Union (EU)" and "Horizon 2020",

(cii) the name of the action, acronym and grant number,

(ciii) the publication date, and length of embargo period if applicable, and

(civ) a persistent identifier.

The following peer-reviewed scientific publications requirements are needed:

(a) Immediate OA through trusted repository (at the latest at the time of publication).
(b) Publications licensed under Creative Commons (CC) with 'BY' (or equivalent), with 'CC BY'-Non-Commercial/Non-Derivate Works' (CC BY NC/ND) (or equivalent) allowed for long-text formats.
(c) Information provided via the repository about any research output, tool, or instrument needed to validate the conclusions of a publication.
(d) Beneficiaries/authors must retain sufficient IPR to comply with their OA requirements.
(e) Metadata licensed under CC0 (no copyright reserved) or equivalent, in line with 'Findable, Accessible, Interoperable, Reusable' (FAIR) principles (particularly machine actionable),
(f) Product Information Documents (PIDs), publication, authors, if possible, their organizations and the grant.
(g) Only publication fees (if any) in full OA venues for peer-reviewed scientific publications are eligible for reimbursement.

Open access to research data

(a) Regarding the digital research data generated in the action ('data'), the beneficiaries must: (a) deposit in a research data repository and take measures to make it possible for third parties to access, mine, exploit, reproduce and disseminate — free of charge for any user — the following:

(ai) the data, including associated metadata, needed to validate the results presented in scientific publications, as soon as possible

(aii) not applicable

(aiii) other data, including associated metadata, as specified and within the deadlines laid down in the 'data management plan'

(b) Provide information — via the repository — about tools and instruments at the disposal of the beneficiaries and necessary for validating the results (and — where possible — provide the tools and instruments themselves). This does not change the obligation to protect results, the confidentiality obligations, the security obligations or the obligations to protect personal data, all of which still apply. As an exception, the beneficiaries do not have to ensure open access to specific parts of their research data under points (ai) and (aiii), if the achievement of the action's main objective would be jeopardized by making those specific parts of the research data openly accessible. In this case, the data management plan must contain the reasons for not giving access.

Research data should shift toward **Research Data Management (RDM)** and follow the following directions

(a) Emphasis shifts from open research data to RDM.
(b) No opting out of RDM. Projects generating research data MUST manage their data responsibly and in line with FAIR principles.
(c) Open access to research data 'as open as possible as closed as necessary', i.e. there can be exceptions to open access to research data.
(d) Establish and regularly update a Data Management Plan (DMP).
(e) Deposit data in a trusted repository and provide open access through it.
(f) Deposit and OA as soon as possible and per DMP.
(g) For some actions, additional obligation to deposit in a repository that is federated under European Open Science Cloud (EOSC).
(h) CC BY or CC0 (or equivalent) license required to open data.
(i) Exceptions to open access (duly justified in the DMP; legitimate interests or constraints).
(j) Information via the repository about any other research output or any other tools and instruments needed to re-use or validate the data.
(k) Metadata requirements same as for publications (i.e. CC0 and PIDs).
(l) Costs for RDM (for example data storage, processing and preservation) are eligible.

Transfer and licensing of results

Transfer of ownership

Each beneficiary may transfer ownership of its results. It must however ensure that its obligations under Articles 26.2, 26.4, 27, 28, 29, 30 and 31 of the GA also apply to the new owner and that this owner has the obligation to pass them on in any subsequent transfer. This does not change the security obligations, which still apply.

Unless agreed otherwise (in writing) for specifically identified third parties or unless impossible under applicable EU and national laws on mergers and acquisitions, a beneficiary that intends to transfer ownership of results must

give at least 45 days advance notice (or less if agreed in writing) to the other beneficiaries that still have (or still may request) access rights to the results. This notification must include sufficient information on the new owner to enable any beneficiary concerned to assess the effects on its access rights.

Unless agreed otherwise (in writing) for specifically identified third parties, any other beneficiary may object within 30 days of receiving notification (or less if agreed in writing), if it can show that the transfer would adversely affect its access rights. In this case, the transfer may not take place until agreement has been reached between the beneficiaries concerned.

Granting licenses

Each beneficiary may grant licenses to its results (or otherwise give the right to exploit them), if:

> (a) this does not impede the access rights, and

> (b) not applicable.

In addition to Points (a) and (b), exclusive licenses for results may be granted only if all the other beneficiaries concerned have waived their access rights. This does not change the dissemination obligations or security obligations, which still apply.

Agency right to object to transfers or licensing

Not applicable.

Access rights to results

Exercise of access rights — Waiving of access rights — No sub-licensing

The conditions set out in Article 25.1 apply. The obligations set out in this Article do not change the security obligations in Article 37, which still apply.

Access rights for other beneficiaries, for implementing their own tasks under the action

The beneficiaries must give each other access — on a royalty-free basis — to results needed for implementing their own tasks.

Access rights for other beneficiaries, for exploiting their own results

The beneficiaries must give each other — under fair and reasonable conditions — access to results needed for exploiting their own results. Requests for access may be made — unless agreed otherwise — up to one year after the period set out in Article 3.

Access rights of affiliated entities

Unless agreed otherwise in the consortium agreement, access to results must also be given — under fair and reasonable conditions (Article 25.3) — to affiliated entities established in an EU Member State or associated country, if this is needed for those entities to exploit the results generated by the beneficiaries to which they are affiliated. Unless agreed otherwise (see above; Article 31.1), the affiliated entity concerned must make any such request directly to the beneficiary that owns the results. Requests for access may be made — unless agreed otherwise — up to one year after the period set out in Article 3. 31.5.

Access rights for the EU institutions, bodies, offices or agencies and EU Member States

The beneficiaries must give access to their results — on a royalty-free basis — to EU institutions, bodies, offices or agencies, for developing, implementing or monitoring EU policies or programmes. Such access rights are limited to non-commercial and non-competitive use. This does not change the right to use any material, document or information received from the beneficiaries for communication and publicizing activities

Access rights for third parties

Not applicable.

2.3 Access rights requests

In order for any party to request access to any IP right, there are several rules and procedures that need to be followed that accept or deny those requests. While the GA provisions in setting those rules, during the duration of the project, additional access rights may be granted (for background or exploitation). The access rights provisioned in the GA are not automatically granted for every partner, they must be formally requested in writing, specifying the scope of the request and the intended purpose of use of the access rights.

The segment below details how access rights can be requested and the possible limitations in restricting access.

Access rights to any party foreground and background required to carry out the project:

The project may have requested and been granted access to rights that are essential to foreground identification and rights to use for the results activities. If those access rights are not provided as they must, some activities may be delayed or impossible without effort. In addition, if access is prohibited, the workarounds are extremely daunting and costly (ex. If access to a necessary software or hardware is prohibited, the workaround is to invest in R & D to create an alternative).

Access rights to background for other third parties:

What is defined as background can be written down in an agreement and be. It is possible to partly allow availability to only some elements of the background or to specifically exclude specific elements for specific reasons. It should also be clearly specified if the granting of access to the rights includes the right to further sublicense to third parties (unless the owner of background or foreground disallows to do so). This clarification reduces legal uncertainties for the participants.

Do access rights give the right to sub-license? The granting of access rights does not automatically include the right to sublicense (not even to parent/affiliate companies of consortium members), unless the stated owners of the foreground or background allow so through a contract agreement.

Can exclusive access rights be given to other third parties? In terms of providing access to other third parties, the owner of any foreground and background is entitled to grant some exclusive rights to it in the form of an exclusive license, unless stated otherwise by the Contract Agreement (CA) or if third-party rights are used as background with restricted access for the foreground or background in question.

Access rights for implementation of the project:

Access rights for any participant's work can be requested by any other participants, if required for the completion of a project, only until the end of the project and the final deliverable. If there are any conditions to acquiring such work (royalties, terms and conditions) it is discussed by and covered in the CA.

Access rights for use purposes:

Access rights for use purposes (i.e. in further research or for exploitation) may be requested by a participant only if it needs them for using its own foreground resulting from the project. Access rights for use purposes may be requested by a participant only if it needs them for using its own foreground resulting from the project. In all other situations, appropriate access rights may be freely negotiated, but there is no requirement to grant them

Access rights for affiliates:

If an affiliate of a participant requires any access to background and foreground of another participant, he is granted access only if it is needed to be used as its own foreground.

Conditions for access rights:

Access to rights is foreseen by the GA and specifies if there are conditions for accessing data. Conditions that don't involve financial and monetary compensations are "Access for Fair and reasonable conditions" or royalty free. Conditions that involve financial compensations usually use currency to acquire access to specific or all rights (background and foreground) concerned. This transaction can take place on a single, one-time payment, on assigning royalties' payments or any other condition (or combination of conditions) that satisfies both parties. It is of utmost importance for the concerned parties to define a clear method, amount, date and conditions of a payment, and to take under consideration the fact that such deals for access rights may not immediately have a significant payoff and value will/can be attained in the long term.

3. The value of IPR in research

3.1 Policies influencing RI-URBANS

Some of the expected outcomes and impacts from RI-URBANS are "The development of synergies among research infrastructures in different disciplinary areas, including social sciences, and improved, optimized and harmonized research services to address Green Deal objectives will foster economies of scale and improved use of scientific resources across Europe and beyond…Users, both from the scientific and industrial community, will benefit from integrated and efficient access to the best research infrastructures as well as from advanced research services addressing their specific needs. … RI-URBANS will foster the development of new skills and a new generation of researchers ready to optimally exploit the most advanced and essential instruments and resources for research and innovation addressing Green Deal challenges … and efficient curation, preservation and provision of access to data in line with FAIR principles" (GA p.172). In order for those synergies to be successful for the creation of an ecosystem that enables collaboration between RI-URBANS and urban Air Quality Monitoring Stations (AQMNs), enables integrated and efficient access to other RIs and researchers, it is imperative that there are some common directives and policies that are to be followed. Those policies, coming from key actors in the implementation of the work program or research directives, play an important role in how the access to any potential background and data is handled as much as on how the results can be shared and exploited. The segment below summarizes the most important policies under which RI-URBANS operates.

3.1.1 Open science and open access

Open science represents a new approach to the scientific process based on cooperative work and new ways of diffusing knowledge by using digital technologies and new collaborative tools (European Commission, 2016b:33). The Organization for Economic Co-operation and Development (OECD) defines OS as: "to make the primary outputs of publicly funded research results – publications and the research data – publicly accessible in digital format with no or minimal restriction" (OECD, 2015:7), but it is more than that. Open Science is about extending the principles

of openness to the whole research cycle, fostering sharing and collaboration as early as possible thus entailing a systemic change to the way science and research is done" (Figure 1) (https://www.fosteropenscience.eu/content/what-open-science-introduction).

Open science has become a policy priority for the European Commission and the standard method of working under its research and innovation funding programs as it improves the quality, efficiency and responsiveness of research.

When researchers share knowledge and data as early as possible in the research process with all relevant actors it helps diffuse the latest knowledge. And when partners from across academia, industry, public authorities and citizen groups are invited to participate in the research and innovation process, creativity and trust in science increases and that co-design process leads to better understanding of the problems that need to be solved and thus to better solutions.

That is why the Commission requires beneficiaries of research and innovation funding to make their publications available in OA and make their data as open as possible and as closed as necessary. It recognizes and rewards the participation of citizens and end users.
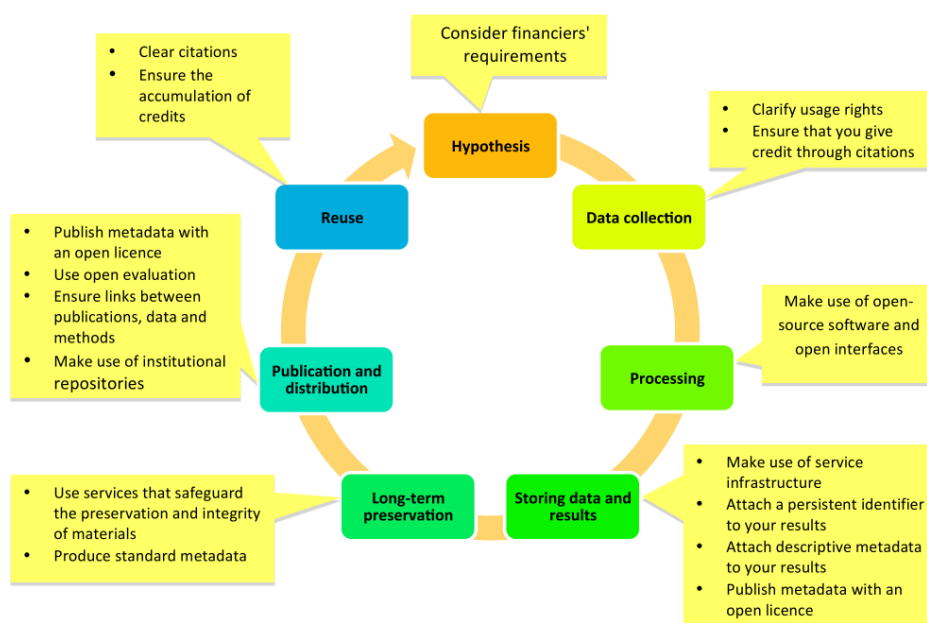

Figure 1. Promoting openness at different stages of the research process (Open Science and Research Initiative, 2014).

Open Science acts as an umbrella encompassing a number of movements that aim to remove barriers and increase accessibility in research, as shown in Figure 2.
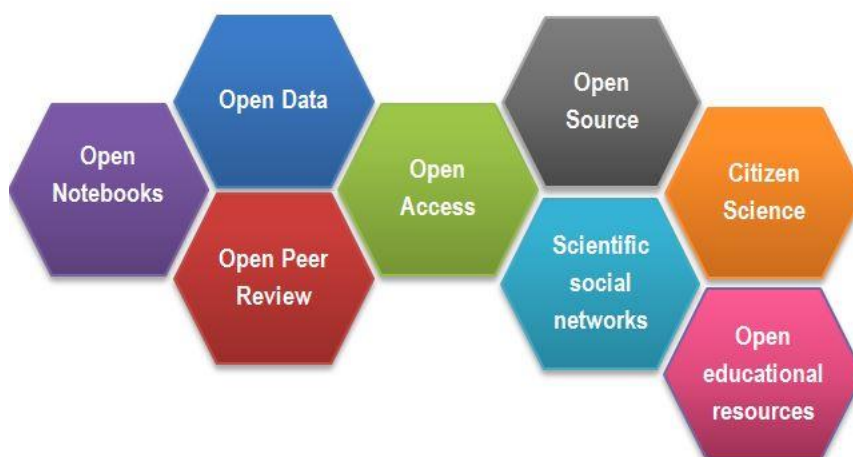

Figure 2.Open Science facets as a beehive.

"Open access is a broad international movement that seeks to grant free and open online access to academic information, such as publications and data. A publication is defined 'open access' when there are no financial, legal or technical barriers to accessing it - that is to say when anyone can read, download, copy, distribute, print, search for and search within the information, or use it in education or in any other way within the legal agreements.

Open access is a publishing model for scholarly communication that makes research information available to readers at no cost, as opposed to the traditional subscription model in which readers have access to scholarly information by paying a subscription (usually via libraries).

One of the most important advantages of open access is that it increases the visibility and reuse of academic research results. There is also criticism, and the aspect of quality deserves extra effort. "

(Source: https://www.openaccess.nl/en/what-is-open-access)

Open Science is a much broader term that encompasses OA in its processes. The research and every dissemination process of OS require the OA aspect to be included, as much as dissemination networks for research and scholarly articles, Open data portals and databases and citizen science or open-source projects.

3.1.2 FAIR data principles

Data sharing enables scientific and research acceleration by allowing the creation of new collaborations, the easier transfer of knowledge and by promoting openness. In research, digital assets are proven valuable and essential tools. The FAIR data principles (https://www.go-fair.org/fair-principles/), published in 2016 are a set of guiding pillars to promote the reusability of digital assets. Each principle describes its purpose and provides guidelines to enable the "FAIRification" process they describe. The principles heavily emphasize on harmonized data, metadata and infrastructure modules and structuring, so that machines and computational systems are easily able to discover and share them.

The first step in (re)using data is to find them. Making your data **Findable** both for humans and computers, paves the way to easier collaboration between peers and towards transparency.

F1. (Meta)data are assigned a globally unique and persistent identifier.

F2. Data are described with rich metadata (defined by R1 below).

F3. Metadata clearly and explicitly include the identifier of the data they describe.

F4. (Meta)data are registered or indexed in a searchable resource.

The second step is to make the data **Accessible**. Once the data are discovered, they have to be clear on how they can be accessed, possibly including authentication and authorization.

A1. (Meta)data are retrievable by their identifier using a standardized communications protocol.

A1.1 The protocol is open, free, and universally implementable.

A1.2 The protocol allows for an authentication and authorization procedure, where necessary.

A2. Metadata are accessible, even when the data are no longer available.

The findable and now accessible data usually need to be mixed and used among other data or machine-language applications. This points to the need that the data need to be **Interoperable**. Interoperability enables better integration to analysis, processing methods, faster inputs and harmonized outputs.

I1. (Meta)data use a formal, accessible, shared, and broadly applicable language for knowledge representation.

I2. (Meta)data use vocabularies that follow FAIR principles.

I3. (Meta)data include qualified references to other (meta)data.

The final goal of the FAIR Principles is to improve the **Reuse** of the aforementioned data. FAIR data should be well described and listed so they can be easily mixed and combined while containing their initial metadata and attributes.

R1. (Meta)data are richly described with a plurality of accurate and relevant attributes.

R1.1. (Meta)data are released with a clear and accessible data usage license.

R1.2. (Meta)data are associated with detailed provenance.

R1.3. (Meta)data meet domain-relevant community standards.

In order to FAIRify your data according to the principles, the GO FAIR Initiative provides 7 steps that have to be followed:

Retrieve non-FAIR data

The first step is access to the data that will be FAIRified.

Analyze the retrieved data

Examine the content and the structure of the data according to the field the dataset is used for. Proper understanding leads to better identification and analysis.

Define the semantic model

Define a 'semantic model' for the dataset, which describes the meaning of entities and relations in the dataset accurately, unambiguously, and in a computer-actionable way. Depending on the dataset, defining a proper

semantic model may require a significant effort, even for experienced data modelers. A good semantic model should represent a consensus view in a particular domain, for a particular purpose. Therefore, it is good practice to search for existing models. Semantic models often contain multiple terms from existing ontologies and vocabularies. A vocabulary is a computer-readable file that captures terms, their URIs, and descriptions. An ontology can be roughly described as a vocabulary with hierarchies, meaningful relations among concepts, and their constraints. These conceptual models allow us to classify our data models and data items using the provided terms, concepts, and conceptual structures.

Make data linkable

The non-FAIR data can be transformed into linkable data by applying the semantic model defined in step 3. Currently, this is done using Semantic Web and Linked Data technologies. This step promotes interoperability and reuse, facilitating the integration of the data with other types of data and systems. However, the user should evaluate the feasibility of this step for the given data. It is a sensible thing to do for many types of data (e.g., structured data), but it may not be relevant for other types (e.g., the pixels or audio elements in images, audio data, and videos). Of course, the annotations about the images, audio, and video (e.g., data about identified regions of images, or about parts of an audio file) could very well be made linkable.

Assign license

Although license information is part of the metadata, we have incorporated the license assignment as a separate step in the "FAIRification" process to highlight its importance. The absence of an explicit license may prevent others from re-using data, even if the data is intended to be open access.

Define metadata for the dataset

As explained by many of the FAIR principles, proper and rich metadata support all aspects of FAIR. (Read the GO FAIR recommendation for metadata.)

Deploy FAIR data resource

Deploy or publish the FAIRified data, together with relevant metadata and a license, so that the metadata can be indexed by search engines and the data can be accessed, even if authentication and authorization are required.

FAIR data does not mean **Open** data. The FAIR Principles, while inspired by Open Science, do not tackle the openness of the data. This is up to the discretion of the data owner. "FAIRification" is a process for "for accessing discovered data; a requirement to openly and richly describe the context within which those data were generated, to enable evaluation of its utility; to explicitly define the conditions under which they may be reused; and to provide clear instructions on how they should be cited when reused". That does not explicitly mean that the data should be Free or Open. FAIR data are required to be provided under a preferably machine-readable license, that enables total transparency on the equal collaboration of different stakeholders in a great spectrum of sectors.

3.1.3 Horizon principles

Open science in Horizon

Open Science became the standard research conducting method of the European Commission and every project under it as its principles focus on improving the effectiveness, reach and quality of the research itself. Stakeholders like Research Performing Organizations (RPOs) and Research Infrastructures (RIs), industry and public authorities are able to work together and innovate in collaboration under those principles that make research as open as possible. The European Commission requires every partner associated with research and innovation that is granted funding to provide open access to the research data to maximize their usage and possible exploitation. The EU OS policy specifically has the following ambitions:

(a) Open Data from projects that are in line with the FAIR Principles and adhere to the integrity and reproducibility standards of research results.
(b) Use of the European Open Science Cloud, a virtual environment that enables storage, shareability, processing and reuse of digital assets of the results (publications, data, software, algorithms, frameworks, etc).
(c) The creation of new indicators to complement existing ones, capable of doing justice to the OS practices and trends EU is going towards to.
(d) Promote education, training, innovation and tackling of challenges and through OS.
(e) Rewarding research and researchers engaging in OS activities, and citizens engaging in citizen science.

Expected results from the implementation of OS practices in Horizon are:

(a) Improved overall capacities within the European Research Area to conduct open science and implement it as a modus operandi of modern science.
(b) Development and consolidation of the European OS Cloud.
(c) Establishment of open repositories for research objects from Horizon projects.
(d) Improved reproducibility of results and minimized duplication of effort.
(e) Increased trust of society in science.
(f) Better and more societal engagement in research and innovation.
(g) Consolidation of the Open Research Europe publishing platform.
(h) Increased openness, quality and performance of the EU research and innovation system.

(Source: https://op.europa.eu/en/publication-detail/-/publication/9570017e-cd82-11eb-ac72-01aa75ed71a1)

Horizon programs, as a part of the European Commission, actively promote OS with clear rulesets and directives to enforce Open Science Principles. Being able to properly managing and protecting your knowledge and know-how should be an integral part of the overall management of a project that emphasizes on openness and transparency, otherwise you will not be able to:

(a) Disclose your knowledge and ideas safely.
(b) Prove the ownership.
(c) Profit from commercial exploitation.
(d) Prevent or discourage its unauthorized use by others.

Open access in Horizon

Under Horizon 2020, OA was defined as the obligation for beneficiaries to ensure "open, free-of-charge access to the end-user" to peer-reviewed scientific publications relating to their results. Open access refers to the practice of providing online access to scientific information that is free of charge to the end-user and reusable. 'Scientific' refers to all academic disciplines. In the context of research and innovation, 'scientific information' can mean:

(a) peer-reviewed scientific research articles (published in scholarly journals), or

(b) research data (data underlying publications, curated data and/or raw data).

The HORIZON 2020 Online manual, as shown in Figure 3, specifically directs members to:

(a) All projects receiving Horizon 2020 funding are required to **make sure that any peer-reviewed journal article they publish is openly accessible**, free of charge.
(b) As for **open access to research data** the Commission is currently running a flexible pilot on open access to research data, which has recently been **extended** to cover all thematic areas of Horizon 2020, thus realizing the Commission's ambition of "open research data per default", but allowing for opt-outs for some datasets,

for instance in cases of IPR protection, personal data or national security issues. Projects that do not opt-out must develop a **data management plan** outlining how data is generated, curated and made accessible, within 6 months of starting work.
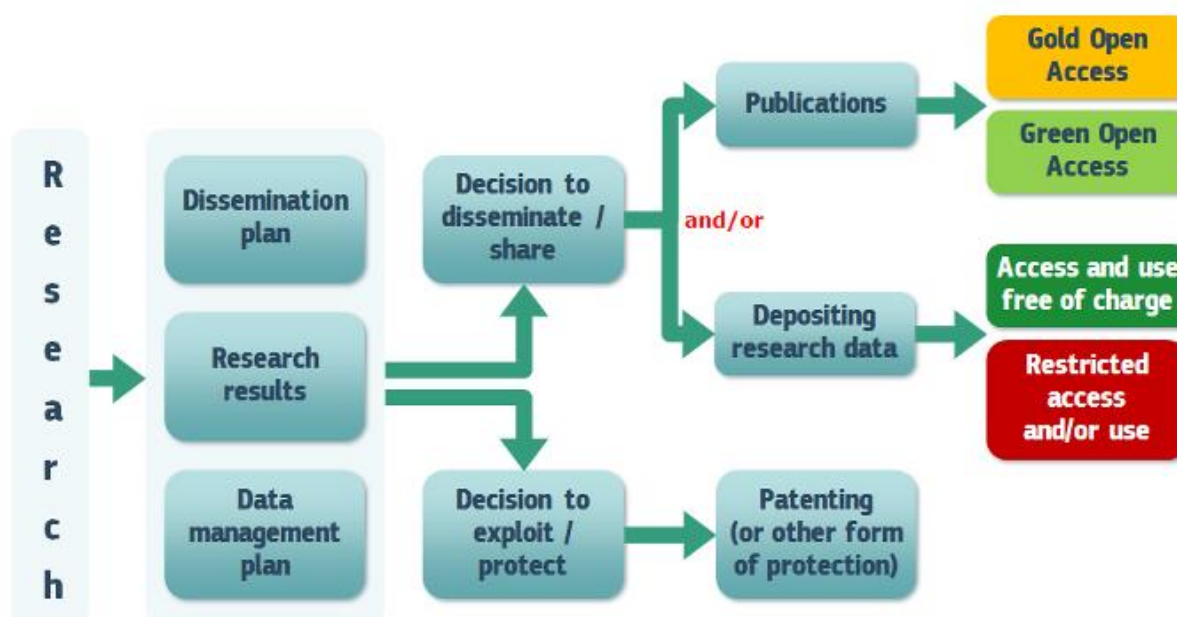
Figure 3. Open access flow chart.

Open data in Horizon

In Horizon, Open Data means open access to research data, and refers to the right to access and reuse digital research data under the terms and conditions set out in the GA.

Research data refers to information, in particular facts or numbers, collected to be examined and considered as a basis for reasoning, discussion, or calculation.

In a research context, examples of data include statistics, results of experiments, measurements, observations resulting from fieldwork, survey results, interview recordings and images. The focus is on research data that is available in digital form.

(Source: https://ec.europa.eu/research/participants/docs/h2020-funding-guide/cross-cutting-issues/open-access-data-management/open-access_en.htm)

Open Access to publications and data in Horizon 2020 aims to:

    (a) build on previous research results (improved quality of results),
    (b) encourage collaboration and avoid duplication of effort (greater efficiency),
    (c) speed up innovation (faster progress to market means faster growth),
    (d) involve citizens and society (improved transparency of the scientific process).

(Source: https://ec.europa.eu/research/participants/docs/h2020-funding-guide/cross-cutting-issues/open-access-data-management/open-access_en.htm)

3.1.4 GEOSS data sharing and management principles

Group on Earth Observations (GEO) is a partnership of more than 100 national governments and in excess of 100 participating organizations that envisions a future where decisions and actions for the benefit of humankind are informed by coordinated, comprehensive and sustained Earth observations. GEO is a unique global network connecting government institutions, academic and research institutions, data providers, businesses, engineers, scientists and experts to create innovative solutions to global challenges at a time of exponential data growth, human development and climate change that transcend national and disciplinary boundaries. The unprecedented global collaboration of experts helps identify gaps and reduce duplication in the areas of sustainable development and sound environmental management.

As GEO moves further down the path towards providing its members and participating organizations with the best evidence-based information from Earth observations possible, an Open Knowledge approach supports this ambition and the GEO Vision.

*"*We, the Group on Earth Observations (GEO), advocate the adoption of Open Knowledge to create a commons environment that is transparent, diverse, collaborative, timely and sustainable with respect to addressing societal challenges through the application of Earth observations" (Source: GEO Open Knowledge Statement).

GEO also endorses "Full and open access to Earth observation data, information and knowledge is crucial for humanity as it faces unprecedented social, economic and environmental challenges" (Mexico City Ministerial Declaration, November 2015)

GEO promotes Open Knowledge mainly through the following two principle sets:

GEOSS data sharing principles

"GEOSS 10-year Implementation Plan (2005) stated that "The societal benefits of Earth observations cannot be achieved without data sharing" and adopted the following GEOSS data sharing principles:

1. There will be Full and Open exchange of data, metadata, and products shared within GEOSS, recognizing relevant international instruments and national policies and legislation

2. All shared data, metadata and products will be made available with minimum time delay and at minimum cost.

3. All shared data, metadata and products being free of charge or no more than the cost of reproduction will be encouraged for research & education.

The principles were adopted in order to promote the implementation of full and open exchange of data, metadata and products in accordance with the GEOSS Data Sharing Principles, and thus to realize its vision and potential. The full and open exchange of data called for in the data sharing principles should apply to GEOSS data, metadata and products even after such shared information is disseminated to users. Users need to be able to integrate, reuse, and re-disseminate the shared information with minimal restrictions in order to achieve maximum results in the GEOSS societal benefit areas.

●   For GEOSS to realize its vision and potential, it is essential to promote the full and open exchange of data, metadata and products in accordance with the data sharing principles.

●   GEO should encourage governmental, public-sector organizations to register and provide robust and well understood data, metadata and products in the GEOSS, without any reuse or re-dissemination restrictions on this data and information.

- To meet the full range of user needs identified as priorities by GEO, private-sector or hybrid public-private systems, or public-sector organizations that are partly publicly funded, should be encouraged to contribute at least a useful subset of their data and products on a full and open basis, with minimum restrictions as to reuse and/or re-dissemination.

- Attribution requirements should include recognition of all significant data sources or authors, as well as the GEOSS component that enabled access to and delivery of the data"

*(*Source: https://www.isprs.org/proceedings/xxxviii/part8/pdf/GEO15_20100326220730.pdf)

GEOSS data management principles

In order to maximize the value and benefit from data sharing, GEO laid out five headings under which the data and information of different kinds and origins can be easily discovered, accessible, usable, preserved and curated. Thus, different data can be comparable and compatible, easily integratable and usable in order to accelerate application development for tools for decision support, risk analysis and health monitoring. (Source: https://www.earthobservations.org/documents/dswg/201504_data_management_principles_long_final.pdf)

Discoverability

Data management principle-1. Data and all associated metadata will be discoverable through catalogs and search engines, and data access and use conditions, including licenses, will be clearly indicated.

Accessibility

Data management principle-2. Data will be accessible via online services, including, at minimum, direct download but preferably user-customizable services for visualization and computation.

Usability

Data management principle-3. Data will be structured using encodings that are widely accepted in the target user community and aligned with organizational needs and observing methods, with preference given to non-proprietary international standards.

Data management principle-4. Data will be comprehensively documented, including all elements necessary to access, use, understand, and process, preferably via formal structured metadata based on international or community-approved standards. To the extent possible, data will also be described in peer-reviewed publications referenced in the metadata record.

Data management principle-5. Data will include provenance metadata indicating the origin and processing history of raw observations and derived products, to ensure full traceability of the product chain.

Data management principle-6. Data will be quality-controlled and the results of quality control shall be indicated in metadata; data made available in advance of quality control will be flagged in metadata as unchecked.

Preservation

Data management principle-7. Data will be protected from loss and preserved for future use; preservation planning will be for the long term and include guidelines for loss prevention, retention schedules, and disposal or transfer procedures.

Data management principle-8. Data and associated metadata held in data management systems will be periodically verified to ensure integrity, authenticity and readability.

Curation

Data management principle-9. Data will be managed to perform corrections and updates in accordance with reviews, and to enable reprocessing as appropriate; where applicable this shall follow established and agreed procedures.

Data management principle-10. Data will be assigned appropriate persistent, resolvable identifiers to enable documents to cite the data on which they are based and to enable data providers to receive acknowledgement of use of their data.

It was stated in the "Overview of GEOSS Data Sharing Principles and Implementation" that a change to business model transitions won't take place unless leaders of countries are convinced of the benefits of open data sharing. So in the attempt to move towards open data sharing, the principles aspire to help access to be as open as possible and as closed as necessary (as mentioned in the Horizon OS Principles). In order to do so, recommendations were laid for members and projects:

(a) To develop national (or organizational) data policies that are in accordance with the GEOSS Data Sharing Principles.
(b) To exert leadership to establish necessary coordinating mechanisms to implement the GEOSS Data Sharing Principles, monitor data sharing progress and provide feedback to GEO.
(c) To maximize the number of datasets shared as GEOSS Data. CORE in accordance with the GEOSS Data Management Principles.
(d) To explore and enable business model changes for data generation in the public sector.
(e) To promote the benefits of open data sharing, share your best practices or lessons learned with the entire GEO community.

It is important to have a clear understanding of the underlying frameworks that surround RI-URBANS, their policies and logic behind decisions. The promotion of knowledge through transparency, FAIR data principles, quality and long term curation in tandem with the nature of the project, aiming to provide new solutions for health and air quality related issues, paves the road for the results of RI-URBANS to adopt the same directives, principles, values and methods.

3.2 The importance and value of an IPR conscious approach in research

It is established that intellectual labor associated with RPOs and innovation providers needs to be elevated higher due to the value the society derives from it. The Environmental Sciences Thematic Working Group (2010) states that: "RIs should be accompanied by a service unit in order to maintain efficient knowledge exchange, maximum accessibility and data interoperability, and to keep up with scientific and technical developments. Scientific service centers and hubs are integral parts of multidisciplinary and cross-sectoral environmental RIs. Distributed RIs in particular need to have a clear hub, together with well-structured links and virtual connections to partners, who may be located far away from each other in Europe. The local partners may have different roles, responsibilities, and consequently different investment shares for the RI. The scientific service center has a central role and challenge in coordinating the research activities, and in management, legal, and IPR issues. …. Typically, in environmental research there is a need to integrate data from different sources to understand complex systems. Environmental sciences require harmonization of methods and standards for data, common e-science tools and formal arrangements to promote a coherent management of on-line research data and access policy across Europe."

"The effective linking of open science practices to innovation and business models requires careful consideration of issues such as Intellectual Property Rights (IPR), licensing agreements, interoperability and reuse of data."

(Source: https://ec.europa.eu/info/research-and-innovation/strategy/strategy-2020-2024/our-digital-future/open-science_en)

IPR are being used to boost innovation, growth, business development and revenue generation. As a consequence, RPOs are constantly developing and perfecting new strategies to manage their IP rights. In order to stay ahead of the curve, IPR management has evolved from a defensive mechanism to protect ownership to a complicated and sophisticated asset management mechanism, capable of increasing added value.

(Source: https://ec.europa.eu/research/participants/docs/h2020-funding-guide/grants/grant-management/dissemination-of-results_en.htm)

3.3 Types of IP

As mentioned above, intellectual property can take many forms as it entails every imaginary creation the human mind can conceive. Although those created assets are intangible, some of them hold greater value than many physical assets. The limitless differentiations of mental creations led to the categorization of those intangible assets based on various criteria. "The World International Property Organization (WIPO), a global forum for intellectual property development of a balanced and effective international IP system that enables innovation and creativity for the benefit of all", was a key player on categorizing those assets. Some of the most common and useful IPR types with their definitions and usage are listed below, as defined by WIPO.

3.3.1 Patents

A patent is an exclusive right granted for an invention, which is a product or a process that provides, in general, a new way of doing something, or offers a new technical solution to a problem. To get a patent, technical information about the invention must be disclosed to the public in a patent application. In principle, the patent owner has the exclusive right to prevent or stop others from commercially exploiting the patented invention. In other words, patent protection means that the invention cannot be commercially made, used, distributed, imported or sold by others without the patent owner's consent. Patents are territorial rights. In general, the exclusive rights are only applicable in the country or region in which a patent has been filed and granted, in accordance with the law of that country or region. The protection is granted for a limited period, generally 20 years from the filing date of the application.

3.3.2 Utility patent or utility model

In some countries, a utility model system provides protection of so-called "minor inventions" through a system similar to the patent system. Recognizing that minor improvements of existing products, which does not fulfill the patentability requirements, may have an important role in a local innovation system, utility models protect such inventions through granting an exclusive right, which allows the right holder to prevent others from commercially using the protected invention, without his authorization, for a limited period of time. In general, compared with patents, utility model systems require compliance with less stringent requirements (for example, lower level of inventive step), have simpler procedures and offer shorter term of protection. Designed primarily to respond to the needs of local innovators, requirements and procedures for obtaining protection and the duration of protection vary from one country to another. The main differences between utility models and patents are the following:

(a) The requirements for acquiring utility models are less stringent than for patents. While the requirement of "novelty" is always to be met, albeit some countries only on a local level, that of "inventive step" or "non-obviousness" may be lower or absent altogether. In practice, protection for utility models is often sought for innovations of a rather incremental character which may not meet the patentability criteria.
(b) The term of protection for utility models is shorter than for patents, and varies from country to country (usually between 6 and 15 years).

(c) In most countries, patent offices do not examine utility model applications as to substance prior to registration. This means that the registration process is often simpler and faster, sometimes taking six months or less.

(d) Fees for obtaining and maintaining utility models are cheaper.

(e) In some countries, utility model protection can only be obtained for certain fields of technology, such as mechanical devices and apparatus, and only for products but not for processes. Be sure to see if the country's law regarding model protection for processes is in line with the project's general strategy. (Source: https://www.wipo.int/patents/en/)

3.3.3 Trademarks

A trademark is a sign capable of distinguishing the goods or services of one enterprise from those of other enterprises. Trademarks are protected by intellectual property rights. At the national/regional level, trademark protection can be obtained through registration, by filing an application for registration with the national/regional trademark office and paying the required fees. At the international level, you have two options: either you can file a trademark application with the trademark office of each country in which you are seeking protection, or you can use WIPO's Madrid System. In principle, a trademark registration will confer an exclusive right to the use of the registered trademark. This implies that the trademark can be exclusively used by its owner, or licensed to another party for use in return for payment. Registration provides legal certainty and reinforces the position of the right holder, for example, in case of litigation. The term of trademark registration can vary, but is usually ten years. It can be renewed indefinitely on payment of additional fees. Trademark rights are private rights and protection is enforced through court orders. A word or a combination of words, letters, and numerals can perfectly constitute a trademark. But trademarks may also consist of drawings, symbols, three-dimensional features such as the shape and packaging of goods, non-visible signs such as sounds or fragrances, or color shades used as distinguishing features. The possibilities are almost limitless.

(Source: https://www.wipo.int/trademarks/en/ , https://www.wipo.int/reference/en/branddb/)

3.3.4 Trade secrets

Trade secrets are IPR on confidential information which may be sold or licensed. In general, to qualify as a trade secret, the information must be:

(a) commercially valuable because it is secret,

(b) be known only to a limited group of persons, and

(c) be subject to reasonable steps taken by the rightful holder of the information to keep it secret, including the use of confidentiality agreements for business partners and employees.

The unauthorized acquisition, use or disclosure of such secret information in a manner contrary to honest commercial practices by others is regarded as an unfair practice and a violation of the trade secret protection. In general, any confidential business information which provides an enterprise a competitive edge and is unknown to others may be protected as a trade secret. Trade secrets encompass both technical information, such as information concerning manufacturing processes, pharmaceutical test data, designs and drawings of computer programs, and commercial information, such as distribution methods, list of suppliers and clients, and advertising strategies. A trade secret may be also made up of a combination of elements, each of which by itself is in the public domain, but where the combination, which is kept secret, provides a competitive advantage. Other examples of information that may be protected by trade secrets include financial information, formulas and recipes and **source codes**. Depending on the legal system, the legal protection of business secrets forms part of the general concept of protection against unfair competition or is based on specific provisions or case law on the protection of confidential information.

While a final determination of whether trade secret protection is violated or not depends on the circumstances of each individual case, in general, unfair practices in respect of secret information include industrial or commercial espionage, breach of contract and breach of confidence.

A trade secret owner, however, cannot stop others from using the same technical or commercial information, if they acquired or developed such information independently by themselves through their own R&D, reverse engineering or marketing analysis, etc. Since trade secrets are not made public, unlike patents, they do not provide "defensive" protection, as being prior art. For example, if a specific process of producing Compound X has been protected by a trade secret, someone else can obtain a patent or a utility model on the same invention, if the inventor arrived at that invention independently.

Companies should take preventive measures to protect trade secrets against theft or misappropriation, including:

(a) Non-disclosure agreement (NDA): employees and business partners should sign a non-disclosure agreement that prevents them from disclosing a company's confidential information.
(b) Non-compete agreement (NCA): employers should ask employees, contractors and consultants to sign a non-compete agreement to prevent them from entering in competition when their employment/service agreement ends.
(c) Robust IT security infrastructure.
(d) Controlling the accessibility of important documents.

(Source: https://www.wipo.int/tradesecrets/en/)

3.3.5 Copyrights

Copyright (or author's right) is a legal term used to describe the rights that creators have over their literary and artistic works. Works covered by copyright range from books, music, paintings, sculpture, and films, to computer programs, databases, advertisements, maps, and technical drawings. Exhaustive lists of works covered by copyright are usually not to be found in legislation. Nonetheless, broadly speaking, works commonly protected by copyright throughout the world include:

(a) literary works such as novels, poems, plays, reference works, newspaper articles,
(b) computer programs, databases,
(c) films, musical compositions, and choreography,
(d) artistic works such as paintings, drawings, photographs, and sculpture,
(e) architecture, and
(f) advertisements, maps, and technical drawings.

Copyright protection extends only to expressions, and not to ideas, procedures, methods of operation or mathematical concepts as such. Copyright may or may not be available for a number of objects such as titles, slogans, or logos, depending on whether they contain sufficient authorship. There are two types of rights under copyright:

(a) economic rights, which allow the rights owner to derive financial reward from the use of their works by others, and
(b) moral rights, which protect the non-economic interests of the author.

Most copyright laws state that the rights owner has the economic right to authorize or prevent certain uses in relation to a work or, in some cases, to receive remuneration for the use of their work (such as through collective management). The economic rights owner of a work can prohibit or authorize:

(a) its reproduction in various forms, such as printed publication or sound recording,

(b) its public performance, such as in a play or musical work,

(c) its recording, for example, in the form of compact discs or DVDs,

(d) its broadcasting, by radio, cable or satellite,

(e) its translation into other languages, and

(f) its adaptation, such as a novel into a film screenplay.

Examples of widely recognized moral rights include the right to claim authorship of a work and the right to oppose changes to a work that could harm the creator's reputation. In the majority of countries, and according to the Berne Convention, copyright protection is obtained automatically without the need for registration or other formalities. Most countries nonetheless have a system in place to allow for the voluntary registration of works. Such voluntary registration systems can help solve disputes over ownership or creation, as well as facilitate financial transactions, sales, and the assignment and/or transfer of rights.

(Source: https://www.wipo.int/copyright/en/)

3.3.6 Industrial designs

In a legal sense, an industrial design or design patent constitutes the ornamental aspect of an article.

An industrial design may consist of three dimensional features, such as the shape of an article, or two dimensional features, such as patterns, lines or color. In principle, the owner of a registered industrial design or of a design patent has the right to prevent third parties from making, selling or importing articles bearing or embodying a design which is a copy, or substantially a copy, of the protected design, when such acts are undertaken for commercial purposes.

Industrial designs are applied to a wide variety of products of industry and handicraft items: from packages and containers to furnishing and household goods, from lighting equipment to jewelry, and from electronic devices to textiles. Industrial designs may also be relevant to graphic symbols, graphical user interfaces (GUI), and logos. In most countries, an industrial design needs to be registered in order to be protected under industrial design law as a "registered design". In some countries, industrial designs are protected under patent law as "design patents".

Industrial design laws in some countries grant – without registration – time- and scope limited protection to so-called "unregistered industrial designs". Depending on the particular national law and the kind of design, industrial designs may also be protected as works of art under copyright law.

(Source: https://www.wipo.int/reference/en/designdb/ , https://www3.wipo.int/designdb/en/)

3.3.7 Data and data management plans

A "database" is defined as "a collection of independent works, data or other materials which are:

(a) arranged in a systematic or methodical way; and

(b) individually accessible by electronic or other means".

Databases can be protected by copyright and/or by database rights. To be protected by copyright, the database must be "original" in that the arrangement or selection of the contents is the result of the author's intellectual creation. In contrast, to qualify for database rights, the database does not require "originality" but there must have been a substantial investment in obtaining, verifying or presenting the contents of the database. The owner of the database right is the person who takes the risk of obtaining, verifying and assembling the contents of the database.

The lifespan of data, as intangible, able to be "consumed" many times assets, often have a bigger lifespan than the research initiatives or sources they are derived from. After the projects end, research may still be done using the data or follow up projects using the data may be created. During a project lifespan, it is essential to provide good

organization, structure and documentation for the data provided in order to increase the ease of access and use after the projects end. Good data management, organization, preservation, curation, plans and principles, lead to increased value to the total lifespan of the data, resulting in more opportunities for research and innovation.

(Source: https://mbmcommercial.co.uk/images/Assets/Content/Guides/Identifying--Protecting-IPR-Published.pdf)

If you have a database that is digitally accessible, you have the ability to protect:

(a) The content it entails, with the use of the Sui Generis right.
(b) The structure it is formed upon, with copyrighting it.

If the database fulfills both previous requirements, it can be protected for both.

"If your database is an original intellectual creation, you can protect it through copyright, which guarantees you exclusive rights to reproduce, adapt, distribute the database or any variation of it. With copyright, you protect the structure of your database and not its content.

Sui generis protection: If the structure of your database is not an original creation, you can still protect its content under the sui generis right. To benefit from the sui generis database right, you or the maker of the database must be EU nationals or residents in the EU. To obtain sui generis protection you need to prove that you have made a substantial investment (financial, material and/or human) in either, obtaining, the verification or the presentation of the database content. The sui generis database right protects the content of your database. You or the maker of the database can prevent the extraction and/or reuse of the whole or a substantial part of the database's content. When you create the database and it meets the requirements for the sui generis protection, you are automatically granted this protection for 15 years, starting either from the creation date or from when the database was first made publicly available."

(Source: https://europa.eu/youreurope/business/running-business/intellectual-property/database-protection/index_en.htm)

3.4 Open access vs licensed

Open access increases visibility and the use of research results and enables access for other researchers to build upon, examine and generate knowledge from. Simply enabling access to the data though, often proves to be counterproductive. The complicated legal status and rights of access and use at any context often are different for a number of stakeholders and require intensive research and resources to answer the simple question: Can they be used or not? Here comes the value of the use of licenses, which provide a way to act as a legal instrument for an owner or rights holder to permit specific actions on any ownership that otherwise would be illegal and would be infringing the rights held on the ownership. This legal instrument is essential to ease the transition of the results to any commercialized, industrialized, marketised and monetized product, service or framework at near-market levels.

Although the use of licenses is new to many users (research communities, networks, data providers etc) it should not be seen as a barrier but as the means to clarify the access and use of the available data, and how to acknowledge/attribute the contributors, while not restricting the use.

The results of RI-URBANS may or may not be enhanced by local, regional and national data through the Open Government Data portals that keep amassing open data at a national level. It is important to acknowledge that proper licensing, open access terms and conditions and vision towards collaboration through research or data sharing can insert the results of RI-URBANS on the ecosystem of providing value through new services and products

while safely and correctly using the vast resources of Open data portals and data providers. In order for this interconnectivity to be legal and safely protected, the services of IPR are called upon.

The following segment details how IPR can be used as a tool to protect, strengthen and widen the project and the results possibilities, increasing the innovation capabilities and allowing new market exploitation strategies or the creation of new service tools that bring the power of AQMNs and the knowledge they provide to decision makers.

3.5 Intellectual property protection and innovation

As the age of digital transformation advances the "knowledge economy", there is a transition from value gained from material and tangible assets to intangible ones, like data, software and IPR. Those intangible assets become a new form of pathways that lead to monetary rewards, socioeconomic growth, innovation acceleration and new transfer knowledge capabilities for research, business endeavors and increased added value in crucial sectors like health, justice and education. Intellectual property rights act as a protection measure for the majority of those intangible assets.

On the other hand, IPR by itself has transformed into a currency and value system, regarding the fact that there are small companies that are sustainable and growing only by managing the value of their intellectual properties. By safely protecting those assets, not only an organization avoids legal conflicts, rights infringements and their illegal uses, but also increases its total value, sustainability, usefulness and social & research impact. Securing the rights of the results can lead to:

Monetisation and economy

It is a common trend that growing and developing communities in sectors that depend on IPR are a significant part of the growth itself, in terms of the value they provide to the whole economy. Employment provided, tax revenues and ecosystem importance show a healthy, growing "player" that can regularly lead to investments, collaborations, sustainability opportunities via further licensing and knowledge (or technology) transfers from more developed countries. Proper protection of the assets also enables further and safer development of products and services, generating more income and thus increasing their market and societal value and importance. Finally, SMEs heavily rely on attaining value through IPR, increasing their income, employment and total value to the local communities.

Innovation

By the established sustainability and with the growing, local economic value that proper IPR management provides, it is a natural aftermath that innovation is promoted. The safe dissemination of any results allows clearer expression for their value through research and licensing. This safety also allows the innovative nature of the results to be able to faster and more effectively benefit the society, both directly and indirectly. Having new products or services allows innovation to reach faster to the community level, offers more and probably better choices and tackles many of society's new needs that require innovation to be better fulfilled.

Research and development

Due to the negative effect that illegal copying and/or free riding tends to have on innovative services and products, it's a common occurrence that there is low incentive to engage in R&D. The fear of heavily investing on a creation and not appropriately being able to get reimbursed for it, deters Research and Development. IPR and protection methods provide incentives to increase such initiatives in the form of giving the proper ownership rights to the proper owners and granting economic safety incentives in the form of legal intervention when rights are disputed.

The health-related nature of results of RI-URBANS, the transfiguration and modification processes that will take place in order to increase the value of analyzing air quality, heavily depend on existing tools and data sources that are used to feed many of the results. With IP protection of foreground, background and third-party rights, in

addition to clearly defined access rights and ownership, IPR becomes a valuable ally in the attempt to dilute the results effects and value as much as to provide tools that benefit the society, while safely using existing intellectual property, tools, data and datasets or creations. In every project, the team needs to decide the most suitable IP type for their assets (patent, copyright, etc.) and proceed securing them in coordination with the project coordinators. Note: Applications for protection of results must be filed according to the [Information on EU funding segment](#).

3.6 Intellectual property rights management stages

The process of securing the rights, ownership and access is a dynamic process and needs to be managed throughout the evolution of the results. This IPR management process can protect and solve conflicts that may occur from new inceptions and inventions from all around the world and is a constant procedure that is better to be handled preemptively than when a conflict occurs. An IPR management process can be split into three phases, according to the "life stage" of the project. It is a process that usually begins at the proposal stage (i.e. statement of background IPR), continues in the first steps of the implementation stage and follows up after its end and towards commercialization or new research initiatives, following the results and their exploitation. The stages will be discussed in the segment below in order to provide insights, aid the completion of the current phase and the preparation of the next while avoiding pitfalls.

3.6.1 Proposal stage

During the CA, key IP focal points, like background or envisioned foreground targets and goals are discussed, tailored and modified to be presented to the GA by the consortium. This is the optimal time for a draft roadmap of the IPR management procedure that will define the exploitation plan on the development and post-project stage, and will converge towards beneficial synergies and alliances between partners by introducing suitable new ones to the project's needs.

This stage needs to pinpoint and agree upon the IP plans and arrangements to be made upon partners, and have partners explore and discuss issues and aspects of the project like how access rights should be shared, how ownership and knowledge management will be handled, dissemination and protection of results and use of background or third-party rights. Careful planning during this stage will create the first preliminary version of the IPR Vision of the project.

3.6.2 Implementation stage

During this stage, the IP planning undergoes multiple changes, mostly derived from better understanding of the project's value as a service, product, research item, etc, as well as ensuring that all partners share common understanding of the process and its implications. This is a normal phenomenon as the planning is not set on stone/concrete after initial completion; it undergoes changes to better fit the strategy of the best exploitation of the project results. Important IP issues that need to be handled at this stage is:

(a) IP mapping: All IP pieces and types for every (potential) asset have to be identified and mapped in such a way that a full IP portfolio will be created and shared among members & partners. This mapping may differ from the initial as it may introduce new assets that were deemed necessary to be used or to be granted access for during the more practical and less theoretical development stage the project is undergoing during this phase.

(b) Securing the foreground and third-party rights and requirements: Access rights from and to partners regarding the exploitation of any kind of results has to be specified and be contracted,

(c) Communication and dissemination to stakeholders: This is the ideal stage to communicate the results of prototypes and pilots to stakeholders, key players in the air quality monitoring and health sectors and local authorities that can adopt the result when completed. All the above and the ways the results will be communicated need to be agreed upon with the partners in collaboration with the DEC plan.

(d) Ownership and protection of the results. The earlier the issues about ownership are fine-tuned and set, the earlier the results can be protected from malicious use and exploitation. This stage envisions and selects the most appropriate defense and protection strategy to then select the best IP protection tool for every (part of) foreground.

Matters that are usually not changeable and important to be properly identified at the early phases of this stage are ownership, exploitation and dissemination of the results, IP protection and identification (background and foreground) and access to every asset required, both tangible and intangible ones.

3.6.3 Post project stage

At the end of the project, a final report with the last version of the IP roadmap and IP handling strategy is necessary. This final version leads to the post-project exploitation of the results, leading to educated and based decisions concerning the commercialization, PR transfer, sustainability, protection and ownership, joint alliances and synergies, as well as a proper handling of every IP asset. In case any asset or IP is clearly intended for monetization, commercialization and in general are going to be exploited for profit, it is essential to:

(a) Prepare the IP strategy for commercialization, exploitation, protection and dissemination. This new strategy may significantly differ from the previous in the subjects of access rights, rights to use, confidentiality issues and licensing choices. Common practices under this category is creation of new spinoffs for/or new internal asset development, sales and transfers of the IPR rights, new joint ventures and agreements with partners that can increase the results reach and potency
(b) Market analysis. Assessment of the value of the asset and its IP, potential market sizes, competitors, business plan formulation, go to market plan, etc. By properly evaluating the IP assets, the negotiation and licensing power increases, increasing demand and pricing.
(c) Risk analysis and management strategy. An important step to minimize dangers, legal disputes, infringements during commercialization.

From this stage onwards, the results can be used in every possible way for more research, new projects, near market service tools and new policy making. This means that while approaching the near-market phase, in each specific task the results might need to be transformed. Access rights, designs, trademarks and copyright will all be (probably) submitted to changes, from the result's phase to every other use they will end up to be used for. That is why it is important as a post-project obligation to handle matters such as confidentiality issues that may come up, keeping up with the obligation to protect the results, handle requests for access rights, valorizing the IP into new forms such as spin offs and new joint ventures.

3.7 Results ownership list

In order to ensure the efficient management of IP it is advisable to adopt a timely process and a flowchart able to identify IP assets, as well as to discuss and agree on their handling and protection. In joint projects with different inputs of components and combination of background and foreground IPR, the exploitation plan's directive can be identified and communicated clearly by the use of a shared use matrix. A common space where every necessary piece of information among stakeholders is portrayed can improve communication between partners and accelerate procedures. This IPR framework needs to include:

(a) exploitable results,
(b) individual exploitation requests or efforts,
(c) IPR repositories, and
(d) IPR background information.

An Excel file is shared as a deliverable that contains a suggested matrix that can be used and tailored for a plethora of assets and categories.

All partners can input their information regarding IP and Foreground on their projects, their suggested IPR protection method and details about stakeholders and the asset itself, so the project coordinators and Dissemination, Exploitation and Communication partners can work together to protect, disseminate and exploit each result safely, while reporting it in the final stages effectively and effortless. The exploitation actions and decisions regarding the result can help identify the best IPR solution and can be used by the DEC Plan as well.

The segment below explains how each cell on the matrix should be filled. The first column displays the contents that should be filled accordingly and the second column provides a description where needed:

Details

IP Name	A suggested name for the IP.
Description	Short description of the IP and its usage (e.g. Our result/IP/solution does ….. to solve the problem of….. with the use of………)
Nature of the result	Hardware, software, framework, methodology
Stakeholders required for implementation	Stakeholders' names and details (institution web page link)
Stakeholders' role in the implementation	Describe the way the stakeholder is contributing to the project. E.g. by providing technical help, acceleration, knowhow, software, hardware provider, management
Stakeholders benefited from implementation	Describe the target group that will be benefited from the result.
Stakeholder's Country	
Background required	Required background like ownership, licensing and rights required for the project's implementation. (Can be none)
Rights to use the foreground	OS, CC, Licensing plan, Not decided. Can be filled with the expected rights form, and be finalized when the project is completed.
Third party rights	All third-party rights including license, general rights, ownership, etc., like Libraries, toolkits, online platforms,
Stage of implementation	Pilot, trials, development, etc. Depicts the stage of implementation during the first submission on the ownership list.
Urgency/Dependency	High medium low. Higher urgency appropriation when the asset is essential for other partners results and implementations/exploitation. Lower for zero to none dependence on the asset for other partners results.
Completion Date	Completion Month
Next Planned Update	Planned update to the Ownership matrix

Joint ownership directive

Not decided yet	Select one from below
Decided at consortium	
Equal among partners/stakeholders/investors	
Ownership percentage based on work/ contribution/ assets provided	
Ownership percentage based on each partner investment size/ contribution to the budget /expenses	

Access to commercialisation rights

Consent required	Yes/No
License and access rights to use results	Yes/No
Conditionally restrictive without royalty fees	Yes/No
Conditionally restrictive with royalty fees	Yes/No
Unrestricted and without royalty fees	Yes/No
Unrestricted with royalty fees	Yes/No

Protection, curation and maintenance obligations and cost

Partner(s) responsible for Management of Protection	Partner name(s)
Partner(s) responsible for Management of Curation	
Partner(s) responsible for Management of Maintenance	
Partner responsible for Protection & Protection costs	
Partner responsible for Curation & Curation costs	
Partner responsible for Maintenance & Maintenance costs	
Shared cost for processes	Please write shared cost distribution

Final stage changes to licensing or transfer of rights

License type and licensee party name	Fill in accordingly in case a licensing occurs
Transfer and new owner party name	Fill in accordingly in case of a transfer or rights

Individual exploitation on the IP

Yes/No	
Partner name	Fill in If Yes
Exploitation plan	Roadmap and way the IP will be individually exploited
Member that conducts the exploitation country	Country of the member/party pursuing exploitation
Exploitation terms & conditions	Agreed rules for the individual exploitation

3.8 Intellectual property rights vision

By formulating the exploitation plan and in conjunction with the IPR strategy, there can be a clear vision on how the results may and can be used. As mentioned above, value can not only be attained by the use of the results, but at the proper IPR management of the results as well. By licensing access or use rights, the results may enter or create new markets that were not compatible or suitable before, provides monetary and economic benefits to the owners ,enables the steering of the technology/innovation/products/services derived from the results towards a path that the owner deems suitable and beneficial for its evolution or application while enabling interoperability for further research, building upon and further exploitation that is probably out of the owners' scope. (in this case, every partner and collaborator, either declared as such by the Grant agreement or from further Joint agreements, is specified as an owner).

This vision of the future state of the results can heavily influence the direction that will be followed. In order to provide maximum applicability, a friendly approach and preference to picking open source, not heavily restricting licensing is highly suggested. The interoperability, freedom to use or operate and knowledge transfer nature of

Open source licensing models heavily benefit the research community and the society. Another suggestion is to take under consideration the rising trends in this specific sector of service and the type of licensing that takes place. Other projects, businesses or research units with similar projects and the licensing strategies they prefer need to be thoroughly examined in order to provide insight and understanding to why their selected method is the appropriate and most suitable one. Common licensing practices in the same sector can reform competitive relationships into synergies by pointing out similarities, added value and interoperability potential, while simultaneously avoiding to create barriers for collaborators. This visionary process is detrimental to the exploitation of the results and with proper strategic thinking, decision making and thorough mapping of the ecosystem, and can heavily contribute to maximize the extent in which the results can be beneficial and properly used, without inconveniences and legal issues. The final output of this process is to be able to tread through the exploitation plan while having a clear provision for how IPR of exploitable (or not) results can be used and evolved through any means after the end of the project.

3.9 Intellectual property rights background research

A part of IPR focuses on the Post Project life phase to ensure a safe and effective transition to the exploitation stages of the results, either for further research, commercialization or joint venture agreements and collaborations. A thorough and in-depth search for similar projects, IP Rights and restrictions, is mandatory in order to avoid conflict on the subjects of rights to use, potential infringements, freedom to operate and commercialization. The search is aimed to identify every relevant and similar IP right, both in effect and in pending approval applications, in every regional group, and needs to be concluded before the start of the project, as a CA task. By identifying the current state of the art and ensuring there is no infringement from any of the partners to third parties or a position to any third party to infringing a partners claim on any rights, the exploitation plan and IPR strategy can be finally implemented. Every barrier and threat has been identified and strategies to handle problems can be now formulated to overcome them and smoothly transition to the project's end and exploitation.

However, as a project's life span can take several years to conclude and begin the exploitation phase of the results, it is essential to regularly perform a search even after the initial, bigger scale IPR research to ensure no problems arise with the appearance of similar IPR filings and applications that were filed after the initial research. This step complements the initial IPR research to enable convenience and effectiveness in the exploitation of the results by avoiding legal conflicts that usually take long to settle and may prevent the further use of the results until settled.

3.10   Intellectual property rights model agreement

It is a common occurrence for a result to have been developed by a joint collaboration of different partners. Such a collaboration of over two partners aiding to the development of a result may create difficulties to specifically distinguish how each partner has invested or contributed to the completion of the project. This is often handled by the GA with general rules to avoid conflict at any stage. However, the partners often find the clarification of how much the joint ownership amounts for each partner difficult. In order to avoid such uncertainties on the terms of ownership, partners utilize an internal IPR Agreement that enables both partners to discuss and finalize common terms for IPR related subjects on the result, such as exploitation, terms and conditions, shares, exploitation and use rights, commercialization rights, management, protection, terms of use/dissemination/confidentiality rules, etc.

Thus, instead of using a general natured agreement, it may prove beneficial to compile and agree upon a tailored agreement form between the specific partners that are up for collaboration. This way, more light is shed on each stakeholder's needs and the agreement formed increases value for all sides while avoiding future conflicts.

This model agreement should be directed by the general vision and the exploitation plans. As such, it is important to make decisions that are future proof and can be flexible to overcome potential barriers and also don't create

barriers by themselves (limiting access to future licensees, preventing collaborations and reducing or requiring revisions on the terms of already established licenses).

As granted by the CA, individual partner exploitation can also be pursued by any partner or collaborator if there is interest in the project results. Those exploitation initiatives and strategies are to be reported to the consortium, to be agreed upon and not interfere with any existing agreements. The individual's profile details, role, previous experience and partnership details need to be reported, the market/sector where the exploitation will occur and the value proposition of the new approach that will be followed in this new venture.

3.11   Public emergency provisions

The disastrous COVID-19 pandemic has enabled the scientific community to accelerate the sharing and transfer speed of scientific knowledge. There was a great need to not only quickly create new solutions to protect human lives but to also legally increase the reach of those solutions to face the pandemic. So in the wake of the COVID-19 crisis, the Public Emergency Provisions clause was created. This new provision "allows quick access to important R&I results in a public emergency. The granting authority (Commission, executive agency or Joint Undertaking) will be able to request beneficiaries to grant non-exclusive licenses to their results. The licensing would have to be done under fair and reasonable conditions to legal entities that need the results to address the public emergency and commit to rapidly and broadly exploit the resulting products and services at fair and reasonable conditions.

To allow for a rapid response, the public emergency provision will be dormant in the grant agreements concluded under Horizon. It will only be triggered if Europe's security, public order or public health cannot be protected by a less restrictive measure. Public emergencies could cover events such as pandemic diseases (like Covid-19), terrorist attacks, hacking, earthquakes, tsunamis, Chemical Biological Radioactive Nuclear (CBRN) events, e.g. novel and highly fatal infectious agents or biological or chemical toxins, as well as those from resulting cascading risks. This measure is part of the Union's efforts to strengthen its resilience and preparedness." (Source: https://ec.europa.eu/info/news/access-research-results-and-ip-public-emergency-2021-jun-03_en)

The reasoning behind this new provision is clear, and the clause is initially dormant and only activated in the face of a public emergency or a serious threat to the EU to act as a rapid response counter measure to any such threat.

Even though the public emergency provision is a clause that is included in the Horizon Europe GAs and not set as an obligation in the H2020 framework that RI-URBANS is under, it is important to take it into serious consideration due to the public health and epidemiology extensions that lie in the core of this project.

3.12   Exploitation plan & IPR

Proper IP management provides exclusivity over the exploitation of intangible and tangible assets and can provide added value to the total asset portfolio that is elevated to more than the sum of its parts. Such assets can be used to improve value, become a source of income or increase the competitiveness of existing products/services/tools, can be a source of publications and knowledge amassment or can be distributed to third parties by thoroughly transporting the ownership or rights for use (sale, license, joint ventures and collaborations/alliances). Some can become the basis for new research, activities, products or services.

Having every asset and result IP protected enables the Exploitation plan to plot their course towards exploitation while not losing time and momentum on legal and ownership issues. Those results often need to be exploited together due to the nature of the invention, creation and functionality. A common example is software and hardware, where individually are not functional but through their interoperability they provide solutions.

Results and their interoperability or necessity in the use and function of another result often create associations. Those associations create **bundles** of use, making the value proposition of the results clear. Key elements required

for those bundles are: The reason and purpose of using the results, how they can be used (which is explained in more detail in the business plan) and the required assets and resources to create a "standardized" use of the bundle (for example hardware use + user actions + data source + internet access = service = value). Other important factors that need to be identified and listed during this process are the rights of use/license to any background needed, the owner and the agreement between each party.

Useful categories can be:

(a) Methodology, framework, operational knowledge, use cases, similar projects.
(b) Software, repositories, background, prototyping.
(c) Data management plans, data sources, APIs, repositories, analytics & Dashboards.
(d) Rules and requirements of use, guidelines on use, laws and regulations on use, trial and validation results, use case scenarios and feedback, community acceptance and feedback, operation standards, environmental and sustainability outputs.
(e) Business plans, exploitation strategy models, IPR management plans, project roadmaps.
(f) Requirements (specific under each category and general).

The bundles section can be found on the second page of the Excel file accompanying this and presented as a deliverable.

3.13   Post project exploitation

After the project's completion there is the GA Obligation for the exploitation of the results that pushes participation parties towards the exploitation of their new innovative results. This urges to proceed the use, development and improvement of the results to cover societal needs, act as new research material or create a near market level service.

In order for the obligation to be fulfilled, RPOs have a set of alternatives on how they will pursue exploitation. As mentioned before, IPR management creates new possibilities in the exploitation process. In the segment below, there will be an analysis on how IPR can be used for additional value in each alternative possible.

3.13.1 Commercialisation

By utilizing the opportunities that IPR can provide, there are many ways to exploit the results of the project. Bringing those results near a market level can create new services and tools to be utilized in any market needed. The commercialization options that IPR can provide for the results are:

Spin-off

The exploitation of academic science, research results and technological breakthroughs by firms, entrepreneurs and academics can create tremendous value for the economy. Global powerhouse companies have their origin in academic labs and research organizations. This is realized by a relatively new type of company named a spin-off.

An (academic) spin off or spin out is a company formed by research that has the capacity and capabilities to grow into a sustainable and valuable business opportunity. This company enables the commercialization of any research material or result and allows the exploitation of any IPR arising from the research. The spin off involves a minimum of two parties in its foundation, the **founders** themselves, that usually are the ones that spearheaded the research initiatives, and the university or organization that enabled the research to take place. Additional members can be investors, SMEs or OEMS (Original Equipment Manufacturer).

The foundation of a spin off revolves around the registered IPR (patents, designs, licenses, trademarks, industrial designs) that may have stemmed out of the research and several unregistered rights the founders may own, such

as copyrights, software, academic journals, etc. During the formation of the spin off, negotiation processes define the ownership of such IPR, that occur between the universities or research organizations and the founders. This is where the degree of ownership is set in stone, where usually the prime owner becomes the institution, with a bigger ownership percentage. This means that usually, any new IPRs generated during the life cycle of the spin off, is owned by the institution/organization. Usually, the negotiation takes place between the founders and the IP commercialization departments of the founding institution (Technology Licensing Offices, University Business Departments)

The spin-off company creation allows a more dedicated research and exploitation initiative from the founding party, significantly more oriented towards sustainability and commercialization than ever before in the life phase of the research. Important factors that have to be taken under consideration during the spin off creation process are:

(a) Distribution of the rights between the founding institution and the founders. Usually, the rights the founding institution retains may act as limiting factors to how the IPRs can be used or exploited by the spin off or any partners. Limitations may include geographical, sublicensing, protection and dissemination restrictions, reducing the total maximum value the spin off can have.

(b) Ownership. Any IPR relevant need to have their background access licensed and correctly assigned in order to properly be able to transfer the rights to the spin-off company.

(c) Responsibility on IPR issues. Issues like protection, access rights to the IP, exploitation and dissemination and usage rights require management and the clear assignment of the party that is responsible for each and every one of them.

(d) Partner conditions: Investors, SMEs, OEMs, research units or any type of partner may set conditions on the spin off that have to be taken under serious consideration and handled before the creation of the company. Usually, the need for a strategic partnership is essential to the sustainable evolution of the spin off and a collaboration that breaks apart can have a great impact on the company itself or its initial formation. Example: if any investors take shares of the new spin off, the control the owners have on the company is reduced. Partners often share their connections and their experience in the market, and many times are as essential as the IP itself.

(e) Timing and future plans: Timing is a "make or break" factor that may elevate or sink any business opportunities. A proper timing, roadmap planning, and quick-to-take-action approach can create more space in the markets, lead to faster sustainability options and increase the image and standing of the company itself. IPR protection, regulatory approval (where necessary) and ownership transfer issues usually slow spin offs significantly and cause the loss of momentum. With proper planning ahead, those issues can have their required action times minimized.

The forming of a spin off inadvertently increases risk, requires more management and experience in the field or market, probably requires a starting capital to be used and is heavily reliant on the terms and conditions of the contract between the founders and the universities. That risk may be mitigated through the efforts of the European Commission's funding opportunities for spin offs, through the [Fast Track to Innovation (FTI) Programme](#) for innovation ideas that need a push to enter the market. On a local level, incubators and accelerators can also improve the value propositions, market approach and business models of spin offs, enabling the injection of experience and business approach to the research natured background the company usually has. The mindset shift from academics and research to business is quite hard, and spin offs appreciate the conjunction of minds from both worlds. In addition, research and markets move with different rhythms and speeds, making it hard to quickly accelerate reaction and progress times.

Licensing

A useful tool that protects intellectual property and allows its commercialization and dissemination is licensing. Licensing is one of the most common forms of creating additional value from IPRs. A license acts as a legal contract that allows or restricts use and access to any type of Intellectual property. In contrast to the spin off and the many delicate handlings and time investment it may bring, a licensing agreement allows the use of any IP or technology to a requesting party, allowing the exploitation from their part. This is the most popular and sustainable way of commercializing IPR, without the requirement of significant capital and time investment.

Basic Elements of the License

A licensing agreement is a legal contract between two parties, known as the licensor and the licensee. In a typical licensing agreement, the licensor grants the licensee the right to produce and sell goods, apply a brand name or trademark, or use patented technology owned by the licensor. In exchange, the licensee submits to a series of conditions regarding the use of the property licensed and agrees to make payments known as royalties. The agreement allows the licensee to use and earn revenue from the property of the licensor. There are no limitations on what kind or type of ownership can be licensed from one party to another and the most usual examples are data, software, intellectual property, technology and artistic designs and assets. The licensed subject can also be know-how, knowledge or frameworks that have importance in the innovative processes of any party to create new processes, devices or products (formulae, operating methods, construction & assembly methods). Also information itself can be licensed, not as strictly formulated as frameworks. For example, a licensor can license sales or customer data, management advice and procedures or marketing strategies. An inventor can license development methods, device construction "walkthroughs", etc.

Effective copyright licenses all share certain common features. At a minimum, it is necessary to define the copyright works and rights subject to the license, the territories in which the license applies, the term of the license and the consideration (such as a royalty) for the license.

The most difficult issue in copyright licenses is defining the copyright property that is the subject of the license. Questions to be considered are: how broad a scope of rights the licensor owns, what rights does the licensee require, what rights should it seek, and what rights is the licensor prepared to grant. The parties' economic bargaining positions frequently determine who gets what, and who controls the drafting of the agreement. Simply identifying and describing the licensed property and understanding the legal limitations, strengths and weaknesses of the parties' respective positions vis-a-vis such properties can be daunting. Copyrights are also limited by external factors and substantive law. Indeed, licensing copyrights is most effectively accomplished with an understanding of what rights are needed to achieve the intended business goal. Depending on local law, copyright may be treated as being virtually infinitely divisible. It is therefore imperative that the precise boundaries of the rights being licensed be defined. Failure to do so could result in disaster–either an interpretation that more rights have been conveyed than was intended (in the extreme case, the entire copyright), or that fewer rights were conveyed than intended. A vitally important consideration for both parties to the license is the necessity to account for future, as yet unknown, technological developments. Much litigation has been concerned with the use of a licensed copyright work in a medium unknown when the license was executed. To the degree that the future can be anticipated, it should be taken into account. Licenses very frequently resort to catch all phrases such as "in any medium now known or later developed." Again, it is up to the parties to define such terms as precisely as possible to avoid future controversy over what was intended, and to know how local law interprets such provisions. (Source:[https://www.wipo.int/edocs/pubdocs/en/copyright/897/wipo_pub_897.pdf)](https://www.wipo.int/edocs/pubdocs/en/copyright/897/wipo_pub_897.pdf)

"Because of the legal ground they must cover, some licensing agreements are fairly lengthy and complex documents. But most such agreements cover the same basic points. These include the scope of the agreement, including exclusivity or territorial restrictions; financial aspects including required advances, royalty rates, and how

royalties are calculated; guarantees of minimum sales; time schedules involving "to market" dates, length of contract, and renewal options; the lessor's rights of monitoring and quality control, including procedures to be followed; minimum inventories required to be maintained; finally, returns and allowances.

One of the most important elements of a licensing agreement covers the financial arrangement. Payments from the licensee to the licensor usually take the form of guaranteed minimum payments and royalties on sales. Royalties typically are defined as a percentage of sales or a payment per unit, depending on the specific property involved and the licensee's level of experience and sophistication. In some cases, licensors use guarantees as the basis for renewing a licensing agreement. If the licensee meets the minimum sales figures, the contract is renewed; otherwise, the licensor has the option of discontinuing the relationship.

The licensing agreement also establishes the time frame of the deal. Many licensors insist upon a strict market release date for products licensed to outside manufacturers. After all, it is not in the licensor's best interest to grant a license to a company that never markets the product. The licensing agreement will also include provisions about the length of the contract, renewal options, and termination conditions.

Most licensing agreements also address the issue of quality. For example, the licensor may insert conditions in the contract requiring the licensee to provide prototypes of the product, mockups of the packaging, and even occasional samples throughout the term of the contract. Of course, the best form of quality control is usually achieved before the fact—by carefully checking the reputation of the licensee. Another common quality-related provision in licensing agreements involves the method for disposal of unsold merchandise. If items remaining in inventory are sold as cheap knockoffs, it can hurt the reputation of the licensor in the marketplace.

Another common element of licensing agreements covers which party maintains control of copyrights, patents, or trademarks. Many contracts also include a provision about territorial rights, or who manages distribution in various parts of the country or the world. In addition to the various clauses inserted into agreements to protect the licensor, some licensees may add their own requirements. They may insist on a guarantee that the licensor owns the rights to the property, for example, or they may insert a clause prohibiting the licensor from competing directly with the licensed property in certain markets."

(Source*: https://www.encyclopedia.com/entrepreneurs/encyclopedias-almanacs-transcripts-and-maps/licensing-agreements)

Note: Licenses for data, metadata, databases (and software) are different and can be protected/licensed differently. Intellectual property is protected by the law of copyright. In Europe, databases are also protected by the "Sui generis" right that grants the maker of any database a property right to prevent any unauthorized reproduction, distribution, reuse, … of substantial parts of the database.

Licensing's importance to RI-URBANS

Licensing provides a sustainable way for the results of the project to create solutions and be exploited at a market or near-market service level. Proper licensing methods of the project's results and background enable a faster and effective evolution of the results to an acute and valuable solution, whilst not restricting innovation, acting accordingly to the EU OA principles and transferring and curating the results for future use or funding. Licensing also enables the way for new collaboration network to be created, enabling innovation previously not available to flourish, sharing the results with the proper key players and that can maximize the exploitable effects of the results by using one of the alternative IPR option transfer methods (as shown in Figure 4), while protecting the ownership and rights of the licensees and properly benefiting them.
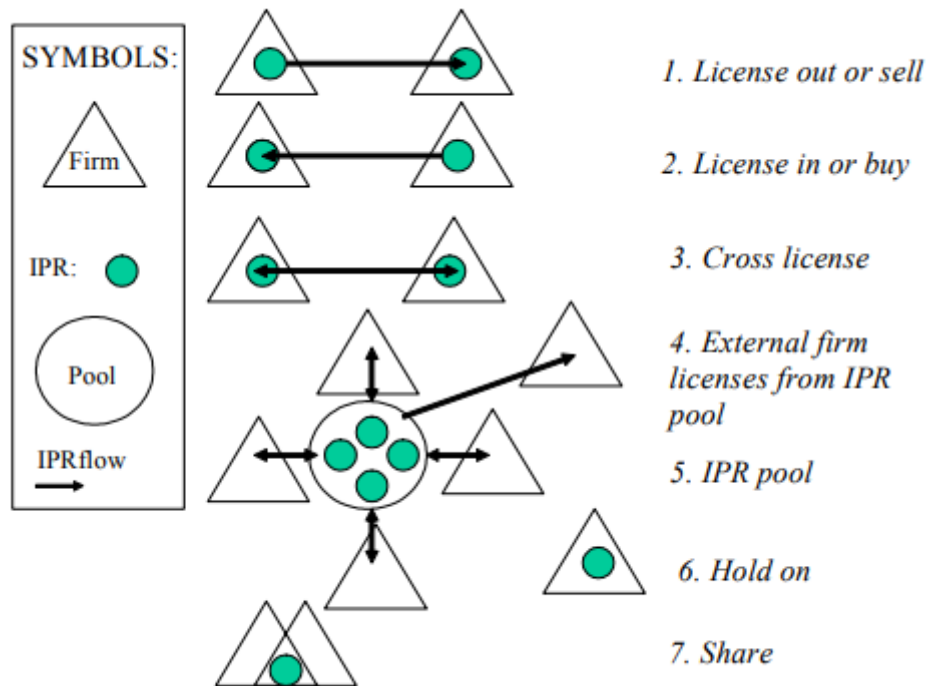
Figure 4. Alternative IPR options and flow.
(Source: http://www7.bbk.ac.uk/innovation/publications/dime/docs/WP15-IPR.pdf)

When to consider licensing/selling

Licensing	Selling
Increase future value and benefits through royalties and fees	When there is potential loss of all future earnings (due to no exploitation capabilities, etc)
Low-cost entry to new markets	When there is no interest in further development and commercialization
Increased marketing reach (through exposure, recognition, strategic alliances)	Sell where there is no alternative or the price is worth it

Benefit list for licensors/licensees

Licensors	Licensee
Monetary gains (revenue gain)	Lower cost than developing (no need for R&D)
New partnerships and alliances	New and fast market ventures

Access to new/more markets and business expansions	Access to technology and know-how that may be state of the art
Infringers become collaborators/partners	Safety from infringement disputes
Simultaneous use by many/on many products	Possibility of creating innovative/standardized products/services

Advantages and disadvantages of licensing

Advantages: The licensing agreement is extremely time, cost and workload-wise efficient as discussed above. When done correctly, the contract gives a great amount of control over every asset, securing it for use to any market by any party while protecting its ownership and avoiding costly and time-consuming legal battles. The agreement itself provides security to all parties concerned regarding the time period the licensing is valid. This way, a stable foundation for the exploitation is created, with clear rules and terms both for the upkeep of the contract as much as the terms and conditions that must be upheld upon breaking the contract or not fulfilling the contract's terms (from each side). The contract also clearly specifies how the licensed subject will be used, providing the security that it cannot be legally used in any other way or form other than the decided ones, and providing as much clarity as possible on the exploitation methods of the subject.

Licensing is also commonly used when there is no intention of involvement in manufacturing from the owners, enabling the manufacturing of the asset to be handled by another party. This often happens to solve distribution situations as well (specifically for hardware where there is no such capacity or capability). A final advantage of a licensing to a "big player" is the increased reputation and networking this collaboration can bring to the licensee. Working together with great companies, RPOs and policymakers can create favorable social and negotiation opportunities.

Disadvantages: When licensing procedures take place (initiative from the licensor) to quickly and desperately enter a specific market, proper and thorough research needs to be conducted for the party that will become the licensee. A binding contract with a partner with different ideals, exploitation directions, ethical differences or legal issues can put the licensor at risk. Any scandal, bad handling and use of the licensed subject or improper marketing and marketization can harm the image of the licensor and reduce external trust towards both parties. Finally, in any licensing negotiation, until the terms are set and the licensing is fulfilled, the relationship between partners is a highly competitive one. Each party tries to benefit as much as possible from the contract, which can mean that it can be on the behalf of the other party. Again, important research on what the terms can and may be requested from the other party is important and should always be taken into consideration before proceeding to negotiation.

Data Licensing

For the reuse of an entire database or specific data from that database, it is necessary to establish use and access rights and terms for potential other users. A way to legally set such aforementioned rules is to license under the Open Data Commons licenses (http://opendatacommons.org), a combination of contracts and copyright that is tailored to be used on data projects. The Open Data Commons licenses are:

(a) The Open Database License (ODC-ODBL) which is the most restrictive of the three ODC Licenses. Any (subsequent) use of the database needs to provide attribution to the source of the database/data and every new use/service/product made of the aforementioned must be distributed with the same use terms. Also, the

unrestricted access to the new use/service/product is mandatory and has to be always accessible after the licensing.

(b) Attribution License (ODC-BY) in which users are free to use any material from the database and recreate it into new uses/services/products. It is mandatory to provide attribution to the source of the data used and/or the database itself.

(c) Public Domain Dedication Licensing (PDDL) that frees the database and all its data to the public, deeming it free to use from anyone to any use they need. No requirements or attributions needed.

Another way to license databases and data is through the Creative Commons (CC) licenses. While CC is a library of licenses, 2 of them complement the licensing of data and databases. Those are:

(a) CC0 (CC Zero). The CC0 is used by a Database owner to essentially "forfeit" their claims of ownership on the database, making it practically public and free to use, exactly like the ODC PDDL.

(b) CC BY: This license allows re-users to distribute, remix, adapt, and build upon the material in any medium or format, so long as attribution is given to the creator. The license allows for commercial use.

(c) CC BY-NC: This license allows re-users to distribute, remix, adapt, and build upon the material in any medium or format for noncommercial purposes only, and only so long as attribution is given to the creator.

(Source: https://intellectual-property-helpdesk.ec.europa.eu/news-events/news/open-access-obligations-horizon-europe-what-are-cc-licences-2021-11-15_en, https://creativecommons.org/publicdomain/mark/1.0/)

Note: Licensing your work in CC BY does not mean that you (or your organization) will lose the copyright over it. It does not mean that your work will end up in the public domain. It does not mean that you are not allowed to commercialize your work. What it does mean is that you will have to grant others permission to share it and adapt it too while this can clash with your interests as copyright holder, this is NOT incompatible with the possibility for you to exploit your work commercially.

Remember that licensing your work under CC BY (or any kind of license) entails that you should have the right to do so in the first place, meaning that you own the copyright over your work or at least that you have retained sufficient rights to be able to license them and fulfill your OA obligations.

Software Licensing

Software is also acknowledged as intellectual property and can (and should) be protected under ownership and copyright laws. The default acknowledged owner of software is the creator that can use it accordingly with full control over it (copy, distribute, alter, license). For the easiest distribution of any type of software, and the avoidance of the creation of several complex ownership problems that can prevent any use until solved, several sets of licenses have been created. Those sets of licenses that all meet a certain set of conditions can be designated as Open-source licensing. An open-source license must:

(a) grant the licensee the right to distribute the program themselves, including the right to charge money for it,

(b) grant access to the program's source code,

(c) grant the right to modify the program,

(d) grant the right to distribute modified versions of the program,

(e) allow use of the program by all persons or groups in all fields of endeavor,

(f) apply to everyone who receives the program, without the need for any additional agreements,

(g) apply to the program it licenses, whether the program is obtained as part of a group of programs, or on its own,

(h) allow distribution with any other software,

(i) allow distribution in any form.

3.13.2. Horizon results platform

The Commission recently created the Horizon Results Platform (HRP), a matchmaking tool allowing you to publish your Key Exploitable Results to promote them vis-à-vis your targeted audiences – investors, stakeholders, policy makers, potential business partners, etc. The HRP is part of the Funding and Tenders (F&T) Portal. The Funding and Tenders Portal is the single-entry point (Single Electronic Data Interchange Area) for participants in all funding programs and tenders managed by the European Commission where applicants can use the Portal to identify relevant collaboration opportunities, find project partners, submit proposals, and view past and ongoing EU-funded projects.

The F&T page provides a search bar that directs applicants or interested members to research active calls and proposals through filters (time period, funding state, project/program type, categorization). All calls are published here and can be a great point on identifying new research and innovation proposals for further collaboration and funding. The portal contains information on past and running Horizon Projects via the "Projects and Results" tool, with details like success rates, program type, engaged partners, etc.

Another valuable tool is the "Partner Search" tool provided by the web portal that enables users to search for potential partners via various filtering methods (country, topic, expertise provided/required). Additionally, the tool enables the publication of any partner search request, completed and explained with details by the party conducting the request. Such a collaborative tool can accelerate innovation and research, while providing a funding opportunity to jump start any new project or continue any previously concluded one.

Finally, any partner with expertise in any field can apply to act as an assistant in the evaluation of grant applications, projects and tenders or to provide guidance and assistance (advisory or hands on) in the preparation and implementation of upcoming projects. The "Work as an expert" tool allows the application as an expert, and enables the collaboration with experts with experience in their field. As an expert, your job includes monitoring projects and contracts, providing advisory services on specific issues when requested upon and evaluating applications and submissions

The HRP focuses on results, not projects. It is free to use and available to any beneficiaries for any submission. In addition, while there is an obligation to exploit any results on a "best efforts" approach, there are cases where no uptake happens after the project. After a year of no uptake from the project's end, the project is also obligated to use the HRP to make any exploitable results visible and accessible for further F&T rounds and exploitation.

An important part of the results themselves is very often data and databases. Making that data FAIR means they are machine readable and actionable, and thus significantly easier to upload and be accessed upon demand, either as a whole dataset or as specific and distinct parts of one. This is a rising issue that the HRP manages to tackle by requesting the "FAIRification" of data during the project's lifetime. The data are curated in the portals, promoting the transparency, security and quality they originally had when submitted.

4. Intellectual property rights guidelines for RI-URBANS

This chapter aims to deliver specific guidelines to the members of RI-URBANS to take strongly into account IPR issues and sustainability options within their results and/or applications. With a proper IPR strategy, each asset can achieve a higher effectiveness of the DEC plan communication and dissemination efforts. The safe and legal promotion of results can now securely take the form of workshop events and stakeholder meetings, probably leading to increased collaboration and the extension of the IPR and exploitation strategies.

4.1 Intellectual property rights management report

In order to keep up with the IPR status of the results and probable changes to similar results that may restrict implementation due to infringements or access to background, it is suggested to use an IPR Management Report as the means to monitor the changes and adapt to how barriers can be overcome.

An IPR Management Report combines the knowledge obtained from the IPR Background Research with the IPR Vision and the Results Ownership List, to provide a distinct roadmap and pathways for proper and holistic IPR management in order to avoid legal issues, protect and exploit the results and properly attribute ownership and access to any parties involved.

The IPR Management Report should be first completed when the most suitable types of IPR for every asset are selected so that it can also be communicated through the DEC plan. It could also be completed at the end of the implementation stage, if there are any changes that came up during the project's lifecycle. It is also suggested to be filled once again, six months from the beginning of the post project phase.

An IPR Management Report should indicatively include:

(a) WP name, collaborating parties, date filled.

(b) Asset list.

(c) Licensing models (if existing) - Decided upon definition of the final project deliverables/targets.

  (ci) Software licensing.

  (cii) Data licensing.

  (ciii) Hardware licensing.

(d) Types of licensing and conditions for each asset.

  (di) Free and Open Source (FOSS).

  (dii) Proprietary.

  (diii) Hybrid.

(e) IPR management process - An outline of the internal process strategy and points, basically a roadmap that communicates to all the partners what your projects' steps are towards the exploitation plan.

  (ei) Background identification - This step is mostly identified in the proposal phases.

  (eii) Foreground identification - Asset identification list with every type of asset, component, software, hardware included.

  (eiii) Needs and restrictions regarding IPR.

(f) Exploitation actions (filled after the second time, only if exploitation actions occur).

(fi) Type of exploitation (commercialization, licensing, transfer).
(fii) Involved parties' details (name, country of origination, party performing activities e.g. industry, manufacturing, etc).

4.2 Result ownership list and bundling

A suggested way of action regarding the ownership list is to have it completed by every partner, and create a matrix that catalogs every result of the project and details on how it should be managed IPR-wise. The access to the results and derivative products can then be protected and IP licensed accordingly, while mapping the stakeholder's interest in them.

After the matrix is completed, there should be a second, additional sharing of the matrix to have each partner pinpoint potential internal collaboration ideas and possibilities, if such exist. The mapping of internal collaboration ideas, potential needs, barriers or commercialization/near-market approaches can be included to further increase the value of the project and create post project collaborations. This matrix can be a great tool when delivered and appropriately exploited by the DEC team.

The second time the matrix should be updated is during the middle of the implementation phase of the project, to ensure that changes have not occurred concerning the background IPR, as mentioned in the IPR background research. It is suggested that partners decide the timing of the next revision of the Result ownership list and include this information in the shared document as an action reminder for both the party involved and the coordination team.

After the complete filling of the result list, an additional document containing every asset can be created. The new document in addition to the bundling list can act as a document that can be shared with stakeholders in any dissemination and communication event, to map their interest in the results and the available pilots or initiatives running. This way the results, their function and added value provided can be clearly communicated to them and by them to further interested parties and can act as a tool for enhancing the impact of DEC activities.

4.3 Intellectual property rights management process

Figure 5 shows a scheme that suggests an IPR roadmap that can be followed upon for the IPR process of any asset in the RI-URBANS project.

It is suggested to have a holistic and thorough examination of every step, even if that may be on the proposal stage. Having the total understanding of the process can accelerate processes and prevent issues. In addition, during implementation stage, it Is also suggested to form a clear image on how the post project stage could and should be to better prepare for it.
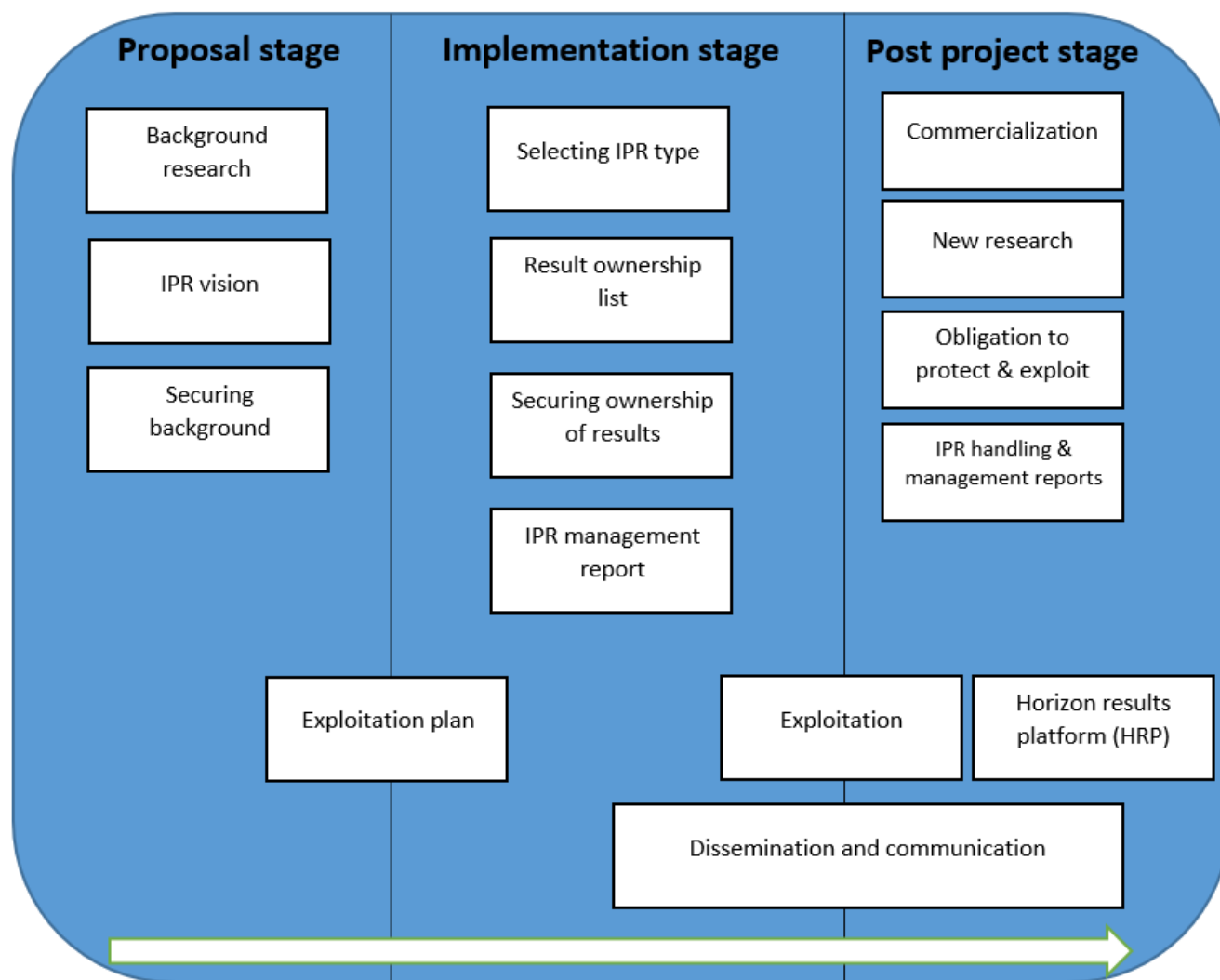
Figure 5. Suggested process-scheme to implement an intellectual property rights (IPR) roadmap for the RI-URBANS project.

4.4 Internal IPR team formation

The creation of an internal IPR team can be considered for projects with many results (hardware, software, etc.) and many different IPs of each category (Figure 6). An internal IPR Team enables the proper and efficient management of IP, knowledge transfer and the bypassing of legal barriers on the results rights and exploitation. The team can also be of valuable assistance in handling the protection, licensing and management of the results. Finally, it helps the project prepare for new exploitation ventures in the post project phase through the fostering of new joint agreement ventures, spin off company creations, handling access and use rights and creating further research or commercial uses for the results. The IPR team can direct an internal call for ideas, business propositions and exploitation model optimizations, increasing the total value of the results. A suggested structure is to create a member that can identify IPR issues and strategies for every asset that requires it and a team assembled of those members to handle them.
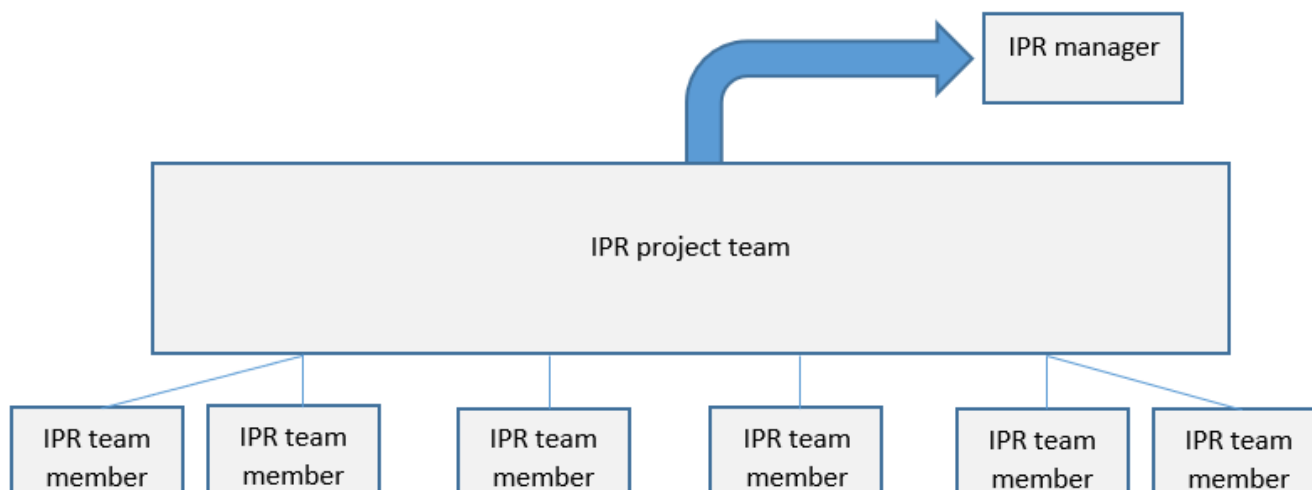
Figure 6. Suggested structure of the intellectual property rights team for the RI-URBANS project.

Intellectual property rights team member: Each individual partner with an IPR asset can assign an IPR team member. This person becomes a central contact point that is responsible for collecting and communicating every IPR related information of the partner to the IPR manager (see below). The closer look and understanding of the asset development enables the transfer of the proper information to the IPR team, thus increasing the value of the information transferred and enabling the IPR team to accelerate the project IPR management actions and bring closure to them. The member can also be responsible for creating internal calls for new ideas regarding the asset, filling the IPR management reports and result ownership list listings for their asset(s).

Intellectual property rights project team: This team composed of the IPR team members, acts as a think and work tank that handles IPR issues, is provided with training and involved in the creation of workshops (see below training – workshops). The team works as the "IPR backbone" of RI-URBANS, always creating opportunities for more effective exploitation options and proper ownership, protection and distribution of the asset(s). With the close view on their assets, they are the most well equipped to pinpoint and map the necessary information for the asset(s) IPR handling.

Intellectual property rights manager: Intellectual property managers act as a central focal point for the internal IPR team, that is tasked with keeping in track with the innovation, the implementation of the IPR strategy, assistance with the exploitation plan and becoming a beacon that can communicate and disseminate essential parts of each project to foster collaborations while avoiding legal issues. The existence of such a role improves the internal communication and acceleration of IP related issues, as much as enables increased innovation touches with the IPR team members as a liaison between projects, due to his holistic and horizontal view on the partners' projects. The IPR manager works closely with the DEC plan execution team to formulate and enforce exploitation strategies effectively. The IPR manager is selected amongst the IPR project team members to provide coordination, and plays an important role in utilizing tools, assets and external help to valorize the IPR of the assets and create accelerated exploitation processes.

4.5 Training - workshops

After each IPR team member has imported their assets on the result ownership list, partners can use the help of the European Intellectual Property Rights Helpdesk to validate their decisions and have their questions answered. "The European IP Helpdesk supports European SMEs and research teams involved in cross-border business and/or

EU-funded research activities manage, disseminate and valorize their IP. Offering a broad range of informative material, a Helpline service for direct IP support as well as on-site and online training, our main goal is to support IP capacity building along the full scale of IP practices: from awareness to strategic use and successful exploitation." (Source: https://intellectual-property-helpdesk.ec.europa.eu/regional-helpdesks/european-ip-helpdesk_en).

A workshop event can be planned in advance for several partners that have completed their listings, giving them better insight and training to solve their specific needs. The event can be coordinated by the IPR manager for the member of their team or planned by the project coordinator at standard timings for everyone interested (once per 6 months), to better prepare the partners on more practical and realistic issues that may appear.

Another beneficial workshop event (or set of events) can be planned with OpenAIRE, an organization that helps researchers practice OS and can provide training on how any project's data can be properly modified to be inputted to the European OS cloud.

Those workshop events and training sessions enhance the capabilities of the project members, providing valuable and lasting experience and knowledge that can accompany them for the rest of their research while improving the quality of RI-URBANS and its results.

4.6 Suggestions for additional revenue streams, innovation and research for members of RI-URBANS

RI-URBANS aim to increase the value of AQMS that complements existing ones in urban environments, creates expertise in the urban air quality and pollution monitoring field, and by utilizing, designing, creating and testing new service tools from RIs, they tackle a problem that is urgent and essential to be tackled. This process to reinforce collaboration between RIs and monitoring networks and stations can be furtherly exploited by the members or through the results for increased added value in sustainability, research and innovation matters.

4.6.1 Sustainability options

The members of the project can be included in various activities to increase the number and establish lasting revenue streams (mid and post project). There are several propositions for increasing the sustainability channels, such as:

(a) **Advisory:** Advisory is essential and can be used upon AQMN, handling IPR issues, promoting innovation on the sector, bringing NRT data that can enrich decision and policy making and creating networks between AQMS and RIs in new projects. Mentoring key players in the private or government sectors can improve innovation and enable accelerated procedures for trials or pilots.

(b) **Training:** Parts of the RI-URBANS focus on training new and experienced personnel and researchers on new techniques and operational standards, or training frameworks and methods. This training initiative is invaluable to new projects and is often deemed necessary, so exploiting it can provide a revenue channel for individual researchers or as an institutional approach with learning and training material, workshops and webinars.

(c) **Post project collaborations**: RPOs involved can act as facilitators or matchmakers between key players in the ecosystem, leading to innovation, technology, co-design and partnership accelerators. The RPO can be inclued as a partner to provide additional services as mentioned above.

4.6.2 Innovation and research initiatives

Engagement with RPOs and RIs related to RI-URBANS increases the added value provided in innovative activities and research initiatives. Members, partners and stakeholder collaboration increases the value of RI-URBANS to more than the sum of its parts. SMEs, OEMs, RIs, governments, industry and local authorities working with members

of RI-URBANS have access to its members' scientific knowledge and experience and can be benefited in the following:

(a) **Matchmaking and new collaboration forming:** The large ecosystem the RI-URBANS network operates in has value that additional members can be presented with and be positive to be included in. The pilots, infrastructure, training material, data, and results in general can lead new interested parties or stakeholders to express collaboration interest so they can be included in, enrich and gain value from such an ecosystem. Access to such an ecosystem increases the reach of the network itself while improving the collaboration between all members, which in turn leads to further increase of the network's value, in a cascading manner.

(b) **Scientific excellence**: Skills, knowhow, scientific experience, expertise and quality of work can entice and assure new research partners of the value of any innovative activity that any partner member of the project can induce to new research initiatives.

4.7 Licensing

4.7.1 Before licensing

Before you apply a CC license or CC0 to your work, there are some important things to consider the following:

(a) The licenses and CC0 cannot be revoked. This means once you apply a CC license to your material, anyone who receives it may rely on that license for as long as the material is protected by copyright, even if you later stop distributing it.
(b) You must own or control copyright in the work.
(c) Only the copyright holder or someone with express permission from the copyright holder can apply a CC license or CC0 to a copyrighted work.
(d) If you created a work in the scope of your job, you may not be the holder of the copyright.

How to apply a CC license or CC0 to your work?

CC-licensing your work is simple. All you have to do is choose the CC license that suits your needs and then communicate this choice in a way that will be clear to people who come across your work. As part of this communication, you should include a link to the license you've chosen. This can be as simple as a bit of text stating and linking to the license in a copyright notice, like this: *© 2019. This work is licensed under a* CC BY 4.0 license, or as complex as embedding the license information on your website using the HTML code associated with the particular license. Use the Creative Commons License Chooser to get the relevant HTML code.

Things to check before:

(a) Similar IP ownership and existing or relevant licenses.

(b) Legal validity of the aspiring licensing method and rules.

(c) Third party claims and rights to use

(d) Market research, relevant markets, protected markets (cannot be reached even with licensing).

(e) Licensee's reputation, market share, exploitation capabilities, negotiation expectations.

(f) R&D on relevant technology and projects.

(g) Intent to allow sublicensing.

After deciding to license, the first and greatest focus must be on protecting the IP rights that were licensed by clear and beneficial rule setting between partners. A proper party selected for a licensing can be extremely beneficial in

terms of speed (faster procedures, less problems to manage), value and recognition. So, in the selection process, global markets should be searched and assessed thoroughly in order to find the most competitive and thus appropriate partner. After a good partner is selected, the license must be tailored to benefit the partner in ways they prefer, keeping him close and preserving the security and control of the asset(s). The license must have a fair compensation agreement from both parties and be written and approved by the proper procedures. Key scopes that have to be properly identified in the license itself is the exclusivity rights, scope of use rights, area of operations (national/abroad, access to sublicense or sublicense other assets using the licensed asset, royalty sizes). Confidentiality issues as much as terms of the general agreement (termination rules, early termination conditions, breach conditions, post termination rules and obligations). That concludes the licensing procedure, but the aftermath management of license/es remains from the side of the licensee.

Any licensing other than PDDL or CC0 may cause problems and create operational barriers down the line of further subsequent use.

Example: One can use specific data from a hundred databases to create a derivative dataset deriving from those hundreds of sources. If the data needs attribution, this becomes a tedious job, discouraging this way of action. On the contrary, if the access to the data/database and the rights to use it in any way was as unrestricted as possible, this barrier does not exist. So, a good practice among the community has been formed that dictates that it is good to credit each owner and author whose data/database you make an extensive use of, even if it is not mandatory. This way, instead of legally requiring the attribution, a thankful culture is cultivated that serves both the owner and the end user.

4.7.2 Data licensing display

Due to the open sharing principles of the project, it is important to approach IPR as a tool that helps the clarification of access, use rights and restrictions to data, the identification and specification of those restrictions and the proper acknowledgement and attribution to the rightful contributors and owners when the data are going to be used in the future. In order to allow proper usage of any of the data, it is important to provide understandable and specific guidelines on how any request must be made and what is all that necessary information that has to be included by the requestor to properly cite or attribute ownership. The following aspects can be put on a document, web page, etc. that specify requirements for usage.

Data license/license summary:

(a) Freedom to: Share, adapt, reuse….

(b) Under the following terms: Attribution, royalties, no restrictions.

(c) For how long: As long as the license terms are followed, specified time.

(d) How the data need to be cited: PID, DOI, CC, …

(e) Other terms and requirements: FAIR use of data, specific conditions, specific restrictions.

4.8 Stakeholder engagement and innovation -> communication between WP7 and WP6

RI-URBANS results can tremendously increase the attained knowledge of decision makers on health-related issues by providing them with real time, in situ data, enabling them to easily take data driven decisions. In order for this to happen, the awareness on the benefits of this type of work, as well as the potential application areas need to be raised. This needs to be done in a simplified way, easily understandable even to the untrained eyes. By providing an easy understanding as such, it becomes easier for industry and SMEs, users and academics, tech experts and policy makers to engage.

Some of the most important stakeholders that may adopt the results are local and regional authorities, bigger scale government units and ministries. After the adoption, the personnel managing the results will most probably have low to zero understanding about how air quality monitoring networks and relevant indicators about air quality work. An innovative approach is to present the results in a way that provides all necessary information to enforce and strengthen proper decision making, while on the other hand making it simple to understand, explore and utilize the user interface without having any beforehand (scientific) experience. A great and highly functional tool, most appropriate for this scope, is a dashboard. Dashboards become easy to understand, can and must have "How to use" tips and tutorials and can be easily utilized to a great degree without the need to delve into documentation and user journey documents. Thus, by increasing the ease of use, the total addressable market size increases too, accessing users that may previously be reluctant to adopt and learn the results service or tool. The ability to reach and create interest in local authorities is crucial due to the fact that they are essential for the sustainability of the results in the post project phase, as they buy and economically sustain such tools. So it is important to make the result seem easy to use, intuitive and helpful to the final users, the key innovation partners that influence authorities in regional/national levels (SMEs, OEMs, local businesses and local authorities' staff).

Stakeholders or end users can often show interest in the results by themselves and offer collaboration terms. By having a clear and understandable licensing and IPR strategy that can be researched upon by potential collaborators, the image of an innovative and outreaching project that entices communication and collaboration is shown. Also, as mentioned above, having a good IPR strategy can avoid the creation of common barriers (e.g. legal, practical or technical), which becomes a great advantage for any possible collaborator or end user. This leads to effectiveness and promotes the total value of the alliance, leading to a more lucrative and desirable view for the results and the services they provide.

The collaboration of the IPR strategy with the DEC will play a crucial and central role in the project by keeping a fluid communication in order to capture new ideas: internal (among partners) or external (end-users needs, stakeholders and advisors); fostering the co-creation and assimilating the stakeholder knowledge; identifying funding opportunities (either public or private) for the exploitation of the results and the future development of close-to-market products and services; elaborating of the exploitation plan, including the identification of alternative applications, side markets, new business models, potential strategic alliances and exploitation pathways. This way, DEC and IPR act as a dynamic feedback loop to each other, providing new information and creating more opportunities for the other, leading to maximum effectiveness of exploitation.

The outcomes of this collaboration process can be either:

(a) internal: improvements of the technologies, solutions and methods to be implemented in the scope of the project, as a result of the interaction with end-users and stakeholders or by co-creation between the partners, or

(b) external: new innovation opportunities to be explored out of the scope of the project or after the project.

It is suggested that the IPR team members or a workshop event performs an internal call for both internal and external collaboration ideas.

ANNEX 1: Useful resources and links:

IPR helpdesk : A first-line intellectual property (IP) service providing free-of-charge support to help European SMEs and beneficiaries of EU-funded research projects manage their IP in the context of transnational business or EU research and innovation programs.

PCTxs: PCTxs is an internet based marketplace offering technology for sale or license in the form of National Phase patent application rights associated with published PCT International Patent Applications.

PATENTSCOPE from WIPO: The PATENTSCOPE database provides access to international Patent Cooperation Treaty (PCT) applications in full text format on the day of publication, as well as to patent documents of participating national and regional patent offices. The information may be searched by entering keywords, names of applicants, international patent classification and many other search criteria in multiple languages.

WIPO PROOF: WIPO PROOF complements voluntary copyright registration systems by offering creators the possibility of recording and digitally certifying possession of the work. This digitally encrypted proof, which cannot be modified, can certify the existence of the work at a moment in time.

Espacenet: Espacenet is a tool made by the European Patent Office (EPO). The Office's core activity is the search and examination of patent applications and the grant of European patents. We also provide patent information and training services.

OpenAIRE: OpenAIRE aims to ensure a permanent open scholarly communication infrastructure to support European research with training sessions on Openess, FAIRness and on how to transfigure any projects' data suitable to be properly entered to the European Open Science Cloud.

Choose a license: Creative Commons has created a web tool that based on the answers of simple questions, helps users decide the most suitable CC license for their work.

B2 SHARE EUDAT: B2 SHARE EUDAT is a user-friendly, reliable and trustworthy way for researchers, scientific communities and citizen scientists to store, publish and share research data in a FAIR way. B2SHARE is a solution that facilitates research data storage, guarantees long-term persistence of data and allows data, results or ideas to be shared worldwide. B2SHARE supports community domains with metadata extensions, access rules and publishing workflows. EUDAT offers communities and organizations customized instances and/or access to repositories supporting large datasets.

Fast track to innovation (FTI) : FTI is a tool that accelerates the market uptake of ground breaking innovations by providing funding in an open, accessible scheme that nurtures ideas from consortia of innovators of all types and sizes from across Europe. Innovation is fostered when new ideas can emerge and easily translate into socio-economic value, shaping new markets and laying the foundations of a stronger, high-tech industrial base for Europe. Working together, partners with complementary backgrounds, knowledge and skills, in both new and established value-chains, can turn ideas into world-beating products, processes and services that tackle societal challenges. FTI supports actions undertaking innovation from the demonstration stage through to market uptake, including activities such as piloting, test-beds, systems validation in real-world working conditions, validation of business models, pre-normative research, and standard-setting. FTI can act as an acceleration tool during the post project phase, providing momentum to the results towards exploitation.

European open science cloud - EOSC: EOSC is the EU initiative to progress on FAIR principles which has been developed since 2016. According to the official definition the EOSC is the "envisioned federation of research (data) infrastructures that will enable the Web of FAIR Data and Services and help researchers to perform Open Science

and open up and exploit their data, publications and code." The EOSC also acts as a catalogue and marketplace for research data and tools, working as a repository and entry point for researchers.

Innovaccess -Intellectual property portal: The aim and purpose of the website is to serve the needs of SMEs within national and European basis whilst continuing to improve and intensify co-operation amongst each other and with general business support organizations. Innovaccess provides tools to manage, license, valuate your IP assets and find what are the requirements and paperwork that needs to be filled for each EU country to file for a patent, copyright, etc.