FUTURISTIC BEEHIVES FOR A SMART METROPOLIS

Deliverable D7.2

Dissemination and exploitation plan

Lead Beneficiary	UBER
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Dissemination Level	PU
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DELIVERABLE SUMMARY SHEET

Project number	824069
Project Acronym	HIVEOPOLIS
Title	FUTURISTIC BEEHIVES FOR A SMART METROPOLIS
Deliverable No	D7.2
Due Date	Project month M6
Delivery Date	30.09.19
Name	Dissemination and exploitation plan
Description	This deliverable contains a detailed roadmap for all planned scientific and public dissemination activities, as well as a plan to target exploitation activities. First dissemination activities already started in the first six months of the project are presented. The plan will be regularly updated and adapted during the course of the project.
Lead Beneficiary	UBER
Partners contributed	UNIGRAZ, EPFL, FUB, ULB, BST, LLU, UBER
Dissemination Level	Public

Introduction

Purpose and scope of the document

This deliverable presents the dissemination and exploitation plan of the project HIVEOPOLIS, which aims at ensuring the maximum visibility and impact of the project's progress, results and developments.

Overview of the document

This deliverable provides a roadmap for all scientific ("Living technology" book, conferences, publication in scientific journals) and public (website, smartphone app, expeditions and interviews in fairs, museums, TV and social networks) dissemination activities, as well as an exploitation plan. It will be regularly updated and adapted during the course of the project.

Chapter 1: Dissemination plan

1.1 Dissemination strategy

In the project we plan for a substantial and wide-reaching campaign to maximize the impact of our results. We plan to specifically address selected communities with distinct activities/efforts (see sec 1.2), some of them happening multiple times. We devised 16 communication channels to be serving the public with information on our project, each of them handled by a specific „channel manager“ (sec 1.1.1). Besides that, we address many selected scientific conferences (sec 1.3.2) and industry fairs (sec 1.3.3), in addition to the scientific and general public publications (sec 1.3.1).

1.1.1 Roles and responsibilities

We organize communication to/with specific groups of interest (Public, Scientific, Industry) through a set of communication/dissemination channels. Each channel has a responsible “channel manager”, whose responsibilities are to monitor channel activities, self-evaluate and to optimize channel efficiency (e.g. attractiveness to stakeholders). The dedicated dissemination channels and managers are:

- website (P,S,I; UNIGRAZ),
- community forming platforms (P,S; UNIGRAZ),
- scientific publications (S; ULB),
- open-access publications S;UBER),
- conferences (S; UBER),
- topic-related community (S,I; LLU),
- workshops (S;FUB),
- open-source hardware (S,I; EPFL),
- open-source software (S,I; UBER),
- open data (P,S,I; UBER);
- video production (P; UNIGRAZ),
- general media publication (P; UNIGRAZ),
- summer school (S,I; FUB),
- exhibition at industry fairs (I; BST),
- exhibition at museums/festivals (P; FUB),
- small-scale printware (P,S,I; LLU).

1.1.2 Targeted stakeholders for communication

We will address several stakeholder communities. Our resonance will be monitored by Partner UNIGRAZ (community and stakeholder manager). We will use community-building tools to bind stakeholders to our dissemination activities and to receive valuable feedback.

The targeted stakeholder groups are:

- beekeepers (from hobbyist to industrial)/farmers,
- environmentalists,
- Makers (including programmers),
- educators.

1.2 Bio-hybrid socialisation: Forming goal-oriented communities and community-strengthening activities within HIVEOPOLIS

We dedicated a special work package to perform community-forming processes within the project to:

- Improve the interaction amongst various stakeholders involved in ecological, societal and agricultural issues;
- Strengthen the teaching community in ecological, biological and technological disciplines;
- Strengthen the ties between beekeepers ranging from on-hive hobby beekeepers up to professional or even industrial beekeepers (incl. a mobile app (user interface) as a community-interaction and -forming tool);
- Strengthen efforts against social exclusion and isolation by developing local communities around collectively owned (maybe simplified, thus cheap) HIVEOPOLIS systems;
- Increase interest of female students and young researchers in STEM research by introducing them to bio-hybrid living technologies (including at summer schools);
- Anchor the community of “living technologies engineers and stakeholders” by writing a foundational scientific book named “LIVING TECHNOLOGIES”.

In the remainder of this section we give an overview about how we want to boost and support those specific emerging communities.

- **Young researchers in the field of bio-hybrid living technologies, especially targeting females to increase their interest in STEM**
    - We will anchor the “living technology community” by writing a book on the science we perform here, but also about the work of consortium members in other projects in this field and by invited key scientists in the field outside of the consortium.
    - To support the dissemination of our project’s ideas and results and to introduce people outside of the consortium to our technologies, we plan to organize two summer schools over the course of the project, targeting students and young researchers in the field of bio-hybrid living technologies, with special emphasis on attracting female participants to increase their interest in STEM disciplines and research.
    - We will manage a library of open-access publications on our project website to keep them accessible for the public. When legally allowed, we will upload our publications to open-access websites and favour open-access journals and similar publication channels. We will keep project developments

(software, hardware) open-source. We will use standard platforms (sourceforge, github) or our project website for keeping the access open.

- **The emerging "maker" communities**
  - HIVEOPOLIS, as a bio-hybrid physical entity, occupies tinkerers and inventors who produce material that is inherently transformative. The Maker movement, of which HIVEOPOLIS is a part, encompasses the characteristics of the latest industrial movement defined as "Industry 4.0". The design and making principles of HIVEOPOLIS parts, especially the below mentioned hardware-software and prototyping-manufacturing (organismic augmentation), are being established with a goal of bridging the gap between hobbyist DIY (do-it-yourself) Makers and the larger industrial producers.
    We define the specific group of Makers as the Web generation, who bring online networking culture to the process of creating. Thus, we form a decentralised collaborative platform of creating, sharing and manufacturing. This formation process starts with using already-existing sharing platforms like : instructables.com, thingiverse.com, github.com, helping to bring together makers, programmers, and other community members.
    During the first year of the project, we have already begun to position ourselves and the shareable developments in HIVEOPOLIS within maker, hacker and designer oriented events. The biological design and material investigations have already been presented at the Vienna Maker Faire'19, RESPOND Festival - Planet, Earth and Technology in Copenhagen, Danish Engineers Association. In Copenhagen, we collaborated within Copenhagen Maker and held a one-day workshop during the "Kids Maker Day" in that period.

    Two workshops are planned to appeal and potentially merge three main subgroups of "Makers" that engage with digital tools, designing onscreen and outputting to desktop fabrication machines. The below described activities depend on the planned "open-hardware" and "distributable design" development.

    1) "Bio-fabrication for Outdoor Beehives" : OLGA (The Open Bio-lab Graz, REALRAUM) or Plant Sciences, Lichenology/Mycology UNI GRAZ, Botanical Garden

    2) "Passive Solutions for Climate Regulation in Building / Beehive Skins" MAKERTHON at the Fabrication Laboratory, Innovation and Industrial Management, Technical University of Graz

    Besides these high-visibility workshops to be organised in Graz, further outreach activities are planned to engage with local Maker communities, for instance by partner EPFL in Lausanne (e.g. Haquarium, a biology-focused maker community) and by partners UBER+FUB in Berlin (e.g. fablab, xhain).

- **Non-professional & semi-professional beekeepers**
  (This includes people interested in honey bees, urban & lifestyle beekeepers, and part-time beekeepers or beebreeders, respectively)
  - We will produce a professional HIVEOPOLIS movie and broadcast it on Youtube, universities' web pages, the web page of Pollenity, the HIVEOPOLIS webpage, and on social media.
  - We will further improve and constantly update our website, twitter, and instagram account to address people which, at present, are only moderately interested in honey bees, nature, or architecture.
  - We will publish reports accessible to the general public on HIVEOPOLIS in national beekeepers journals.
  - We will conduct surveys in beekeepers journals, at conferences (printed version), or online, for example, to find out which kind of technology would be useful for beekeepers.
  - We will establish two best-practice HIVEOPOLIS beehives, one maintained by a beekeepers club in a rural area, one in an urban area (see also Sec 1.2.1). To do so, we will run a workshop for the members of both beekeepers clubs in order to teach them the correct use of sensors and non-trivial, specific beekeeping techniques necessary for a HIVEOPOLIS hive. We will be in close contact with both clubs throughout the experiments and test the applicability of newly invented HIVEOPOLIS features in a real-world experiment.
  - We plan to present a HIVEOPOLIS beehive at certain times of the year, for example at the national day of science or at the national honeybee day.

- **Professional beekeepers and farmers (leaders & decision makers, influencers)**
  - We will present HIVEOPOLIS at the international, annual beekeepers exhibition in Graz, hosted by the ÖEIB, and the annual beekeepers exhibition in Donaueschingen, hosted by the DBIB. Both international, two-day exhibitions are hosted by professional beekeepers organisations and attended by approximately 2000 visitors per day. Additionally, we will present this project at international conferences such as EurBEE, APIMONDIA, or the Kongress deutschsprachiger Imker. Although these exhibitions are mainly visited by professional beekeepers, many hobby beekeepers, part-time beekeepers, professional beebreeders, and honeybee scientists visit them as well.
  - We will test some of our newly developed sensors for the applicability in professional apiaries. To do so we will be in close contact with volunteer professional beekeepers.
  - We will contact a farmers organisation in order to test a model that predicts the optimal number and distribution of honey bee hives in areas of crop depending on honey bee pollination (e.g., apple bloom).

- **Ecologists**
  - We will provide access to ecology-relevant data (open-data) and participate in relevant ecological conferences (e.g., ISIE-ISSST; International Conference on Ecology, Ecosystems & climate Change, IUSSI)

- **Teachers and school children**
    - The ubiquity of bees in everyday life and popular culture provide an excellent conduit to share key topics from our research with younger audiences, ranging from the challenges faced by bees from pesticides, environmental change, and parasites to sustainability and solutions that community action and technology can bring.

      There are some exciting opportunities to deeply connect directly with our research: the access to real-time information from within colonies and the environment at a wider scale, or the flow of information both from human-centric sources (e.g., pollen forecasts) and from honeybees (e.g. current foraging hotspots) are examples that can be communicated as part of education at the crossroads of ecology, biology, sustainability and technology. We plan to develop education material for use by teachers of basic education (approx ages 5-16), working with the schools of the Vaud canton. In our department we have expertise in using technology -- and scientific/computational/technological thinking -- within the development teaching programs and we also have significant experience in transferring this knowledge to teachers through training courses.

1.2.1 Best practice project “Community Beehive”

By the third year of the project a HIVEOPOLIS beehive should be maintained by a community in an urban and a rural area. This “best practice” project aims to provide local communities with a new place of interaction. It will allow participating stakeholders to collectively manage a HIVEOPOLIS colony together, strengthen neighboring bonds, facilitate social interactions, and actively steer against social exclusion and isolation. This is because beekeeping should bring together people of all ages, genders, and religions or cultures, respectively, to pursue one common goal and to cooperate in a constructive way. We aim to compare the behaviour of honey bees in HIVEOPOLIS hives in an urban area to the behaviour in a rural area. Also, we want to test newly developed equipment in best practice hives and constantly improve it until the final version of a HIVEOPOLIS bee hive. A best practice hive is the ideal way to test our material in a real-world situation.

1.3 Dissemination and Communication Activities

This section describes activities that aim to communicate our project concepts and results, for scientific, public, and industrial groups of interest. Where there are overlaps between these groups (e.g. the website), the activity is described under the primary target group.

1.3.1 Scientific dissemination

Targeted scientific journals

We will target: (1) high-ranking peer-reviewed journals of broad readership: Science, Nature, PLOS Computational Biology, PLOS One, Proc. Royal Society, PNAS, Royal Society Interface;
And (2) journals in various specialised fields where we make detailed contributions:

a) Robotics (e.g. Science Robotics, J. Intelligent Control & Systems, Robotics & Biomimetics, Frontiers in Robotics and AI) since modulation of various behaviours within the bee colony, via robotic and other mechatronic actuators is crucial to our project mission.
b) Bee biology (e.g. Apidologie, J Apicultural Res., Insect Science, Insectes Sociaux) since our project involves significant efforts in fundamental bee science, addressing questions regarding bee health, the brood development cycle and life-history, and social behaviours.
c) Collective/Swarm systems (Adaptive Behavior, Swarm Intelligence, Robotics & Biomimetics), since our project investigates behaviours made by collectives, including decision-making.
d) Complex systems (Complexity, Artificial Life), which aims to identify fundamental features or patterns in complex systems, and is thereby in important source of novel thoughts to be brought in from other disciplines.
e) Instrumentation (MDPI Sensors, Measurement Science and Technology, Computers and Electronics in Agriculture) since the level to which we instrument beehives, a system with stakeholders from science to agriculture to the general public, will deliver advances beyond the state of the art.
f) Applications of agricultural instrumentation and software (e.g. Biosystems Engineering, BJMC (Baltic journal of modern computing)) to showcase developments within these important stakeholder communities.

Targeted scientific conferences

We aim to present HIVEOPOLIS to several scientific communities at conferences. Specific examples include:

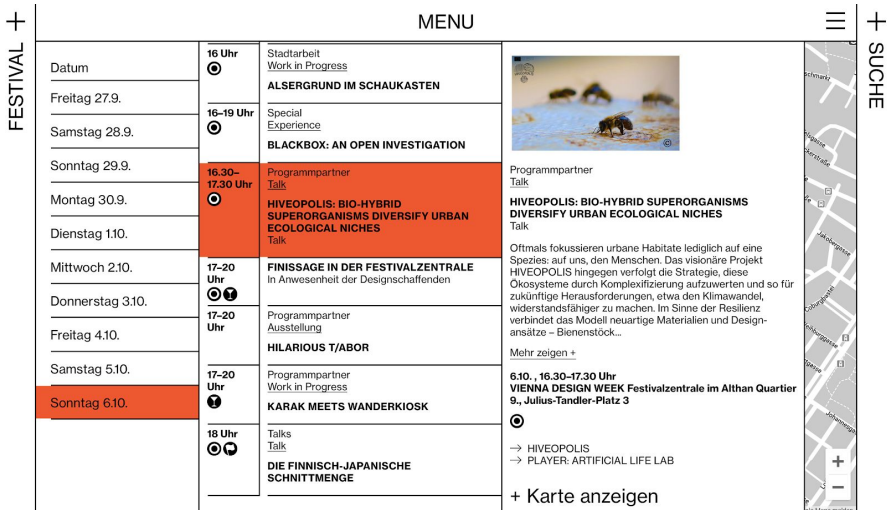
a) The international, biannual Apimondia (2021 in Russia) which is a conference connecting applied honey bee science with professional beekeeping and beekeeping industry.
b) Bio-hybrid systems, such as Living Machines, Artificial Life, SASO.
c) Robotics and engineering advances, e.g. ICRA, IROS.
d) Biosystems Engineering (BSE), Tartu, Estonia. The Biosystems Engineering conference is organised by Estonian University of Life Sciences. It aims to become the leading annual conference in Baltic region in fields related to traditional and modern engineering techniques and technical solutions applied to biological systems.

1.3.2 Public dissemination

The wider public is informed by our website, by frequent events in social media and by making frequent press releases (1 PR-release & 1 PR-event/partner/year). Appearances in art- and science-festivals and museums are also in our public dissemination plan.

Targeted exhibitions

- **Vienna Design Week 2019**
  The first two hive prototypes will be part of the curated exhibition in Festival Headquarters, Vienna Design Week'19 from 26.09.2019 to 6.10.2019. Vienna Design Week is Austria's largest curated design festival that reaches more than 40,000 visitors every year since 2007. As part of the creation of HIVEOPOLIS hives, we focus on biocompatible novel materials that are engineered and manufactured to perform specific functions. During this event, we will demonstrate how we use the large scale 3d printing methods to produce alternative beehive enclosures that are lightweight, with high insulation properties, bio-compostable, durable and visually bespoke. We use experimental composites to 3d print sufficient substrates for growing mycelium (vegetative part of common mushroom) as an insulation and mechanical enhancing agent.



- **Distributed Design Market Platform - RESPOND FESTIVAL**
  The early material and design prototypes of Hiveopolis have been exhibited during the The Respond Festival, organised by the Danish Engineers´ Association, IDA, Copenhagen on June 6-8. The headline festival Distributed Design Market Platform - EU (https://distributeddesign.eu/) and Copenhagen Maker were part of the event with 10 different designs (one of which is HIVEOPOLIS) showcasing the concepts of distributed design and local manufacturing.

- **Scientific Night**
  Scientific Night is an event for the general public in Latvia for popularisation of science (part of the Marie-Curie action "European Researcher's Night")

Website

The dedicated HIVEOPOLIS website - www.hiveopolis.eu - will play multiple roles as a communication resource to promote the project, its objectives and partnership and a channel to update interested parties on progress, results and outcomes. The regularly updated website is informative and visually attractive and links to the project's Twitter and Instagram accounts. A regularly updated press & media section will provide informative and publishable material for science communication to the public. Furthermore and a repository of published results and specific public deliverables will be provided over the course of the project.

Newsletter

A short newsletter with updates from every partner will be produced periodically (min. 2 times per year) and uploaded to the project website. The newsletter will also include information about recent publications as well as upcoming events and workshops.

Social media

Social networking is part of the project's communication and community-forming strategy by connecting with the public and creating a dialogue with potential stakeholders and communities.

Twitter (https://twitter.com/hiveopolis) will be used to share project results with expert communities and inform about project events such as conferences and workshops, and disseminate the results.

HIVEOPOLIS involves a variety of visually and graphically valuable byproducts during the project. During this run-time of 5 years, we aim to form and participate in several communities other than scientific groups. We use **Instagram** (https://www.instagram.com/hiveopolis_project/) as a social media platform to share the visuals and to make the process more accessible to the public. With this visual sharing platform, we can easily and rapidly reach and generate target audience such as urban beekeepers, teachers, hobbyist beekeepers, makers, nature-enthusiasts, tech-geeks, etc..

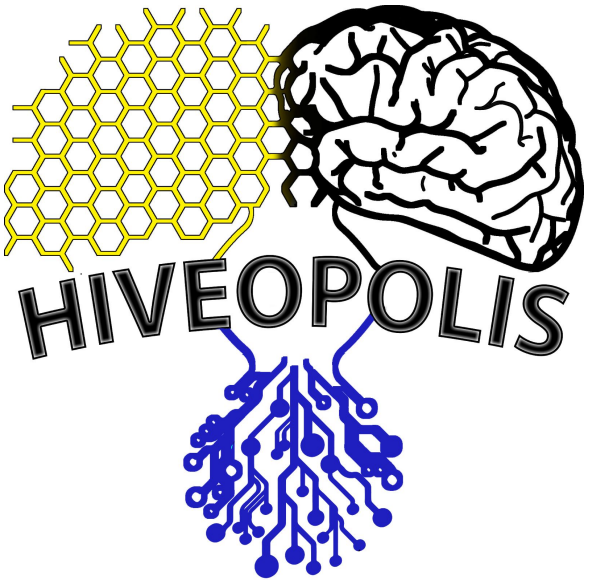
1.3.3 Industrial dissemination plan

We have specifically- allocated funds to support industry outreach activities. We will have 2-3 such events within our project to specifically address industry. In addition, partners will actively approach industry representatives in their domain and organize bilateral workshops to discuss joint future cooperation. We plan to publish in specific media of this community.

1.4 Dissemination Channels

1.4.1 Visual identity of HIVEOPOLIS

Logo



1.4.2 Acknowledgement of EU funding

The formal communication and dissemination of the project and the results will display the EU emblem

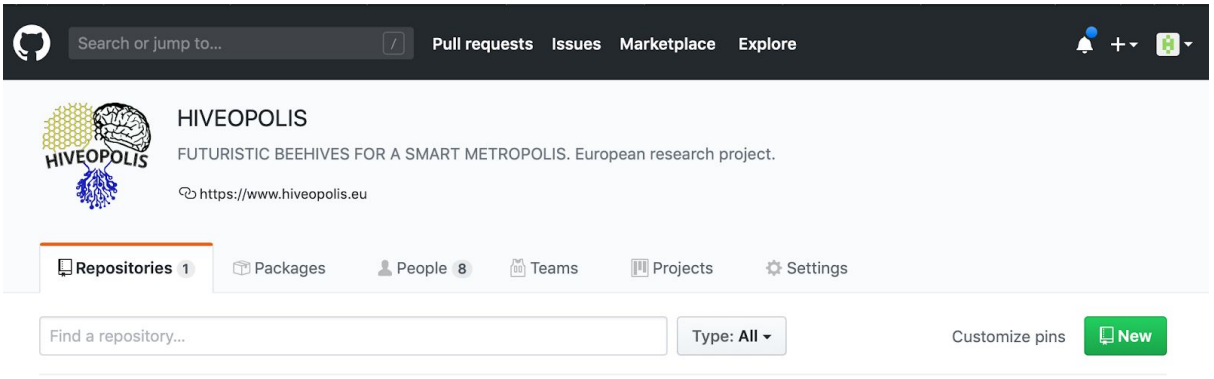
and include the following text:

"This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824069."

1.5 Open X

1.5.1 Open access/open source

We manage a library of open access publications on our project website to keep them accessible for the public. When legally allowed, we upload our publications to open access websites and favour open access journals and similar publication channels. We will keep project developments (software, hardware) open source wherever possible. We use standard platforms (sourceforge, github (https://github.com/hiveopolis)) or our project website for keeping the access open. We will curate a community on zenodo to collect papers, code products when they reach maturity, and datasets, or links to these resources where the original source cannot be included in this repository (https://zenodo.org/communities/hiveopolis).



1.5.2 Open data plan

Our project will perform an “open data publication plan”: Partner UBER is the responsible “open data channel manager” and thus will select data sets of special broader interest collected in our experiments. We will publish them in an “open-data” section of the project website. These data sets will be checked for privacy issues, packaged and documented in standard formats. We plan to publish some data sets of special interest as “data papers”, e.g. in the journals “Int. J of Robotics Research”, “Ecology”, “Data in Brief” or “Scientific data”. The channel manager will also provide sample analysis and some analysis/filtering tools using an open-source standard tool, like R or a python notebook. This storage and open-access to data is also in line with the European Parliament’s & Council’s INSPIRE directive. More details can be found in the Data Management Plan (Deliverable D7.1).

1.6 Timeline of actions

This timeline of actions for dissemination shows the timing of specific actions during the project. Actions in the near future are more detailed and will be updated with future versions of this Dissemination Plan.

Dissemination actions already conducted or started:

Website (see above)
Twitter account (see above)

The following dissemination actions and public deliverables are planned in the coming years:

2019:
Exhibition at Vienna Design Week (Sept/Oct 2019)
D7.1 Data Management Plan (DMP) (M6)
D7.2 Dissemination and exploitation plan (this document, M6)

2020:
Fachtagung des ÖEIB 2020 (Austria, 21.-23.2.2020)
Lange Nacht der Forschung (Austria, 8.5.2020)
Tag des offenen Bienenstocks (Austria, 17.5.2020)
D5.1 Design of the brood nest module (M12)
D3.1 Hive architecture and core design (M16)
Present HIVEOPOLIS at ALIFE 2020 conference (Montreal)
49. Berufsimkertage Donaueschingen (Germany, October 2020)
EurBEE 9 Congress (Serbia, 15.-17.9.2020)
Kongress deutschsprachiger Imker (Südtirol-Italy, 10.-13.9.2020)

2021:
Present HIVEOPOLIS at IROS 2021 (Prague)
APIMONDIA (Russia, 20.-25.9.2021)

2022:
XIX IUSSI International Congress (California, USA)

Chapter 2: Exploitation plan

At this early stage of the project only a rough exploitation strategy can be devised. The exploitation plan will be updated at the later stages. The final result of the project comprises a complex system. The general strategy is to exploit intermediate results like subsystems which can already be integrated into a regular bee hive.

2.1 Exploitation goals

The HIVEOPOLIS consortium has addressed the topic of exploitation ever since the proposal writing phase by outlining the means and channels for exploitation in a general manner. They include but are not limited to: HIVEOPOLIS's communication tools and channels; utilisation and enhancement of the partners' own networks which already involve key stakeholders; possible new exploitation partnerships and the extension of the existing HIVEOPOLIS channels far beyond the end of the project.

Future sustainable and successful exploitation of the results of the HIVEOPOLIS project dictates that outputs created by the work during the project are relevant, usable and identifiable after its successful completion. In order to design and execute a successful exploitation plan, the consortium will conduct intermittent evaluation of the exploitability of the results and outputs during its future general assembly meetings.

Partner EPFL will be attentive to opportunities to exploit technologies and knowledge developed within HIVEOPOLIS, in the context of teaching programs in basic education, where our department is actively involved and has historical experience with such activities. This is partially in the ambit of task 7.5.

2.2 Ownership of the results

The ownership of the results, right and obligations of the partners within the HIVEOPOLIS consortium are discussed in the Grant Agreement (GA) under article 28.

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 standardisation activities.

Art. 25.3 of the GA describes access rights for other beneficiaries for exploiting their own results. Access must be given under fair and reasonable conditions to background needed for exploiting of own results unless the beneficiary that holds the background has informed other beneficiaries that access to its background is subject to legal restrictions.

2.3 Patenting

The HIVEOPOLIS consortium will intermittently evaluate all possibilities for intellectual protection of results as well as potential spin-offs, patents, trade marks and publications. Following the dissemination plan, each partner will have a clear indication of when a certain collective within the consortium will publish any particular paper and so, prior to this event, a patent evaluation will be performed by BST as a SME partner. BST will closely follow to pinpoint any patentable portion of the IP before any information about it is published. Being an active entity in the beekeeping industry and interacting with beekeepers of all levels described in 1.2 (Bio-hybrid socialisation), BST will have an accurate indication of what part of the IP generated by all partners is a viable spin-off or patentable technology with an actual economic value. This will ensure that the maximisation of the environmental and societal impact the consortium will reach and help promote the research produced during the HIVEOPOLIS project beyond the “state-of-the-art”.

Plan:

1. Identify a real life use case for a particular technology.
2. Ensure that partners have not already published any results or background leading to the innovation.
3. Conduct a “patent infringement” analysis to protect the consortium from future litigation.
4. Form a workgroup of all individuals and partners who have contributed in the development of the underlying technology.
5. Evaluate any potential barriers proposed by partners’ internal policies.
6. Organise the patent documentation.
7. Commence filing of the patent (preferably with EU LaunchPad service).