Partner UGOE cooperates formally with INTEL using their LOIHI neuro-chip and is, thus, familiar with the general complexity of parallel, neuromorphic engineering, which is beneficial in the context of the optical implementations in ADOPD.

Partners IFISC-EBD/CSIC have worked extensively in the last years on big data and complex spatiotemporal metrics, as well as in co-evolutionary processes shaping resource-consumer interaction networks allowing linking WP1 with WP2. Partners EAWAG and TARTU complement each other in network approaches. They will build eco-evolutionary process-based deep learning networks for causal knowledge discovery allowing linking WP2 with WP3.

Partner TUG is also completely familiar with abstract neural models allowing linking WP1 with WP4, as needed. Furthermore, UGOE, IFISC-UIB/CSIC, and TUG have led or participated in other integration efforts in EU-projects (FP6: DRIVSCO, FP7: ACAT, FP7: PHOCUS, H2020: Plan4Act, SYNCH, HBP).

ROBHOOT is a science-enabled multi-feature technology designed with a highly modular structure. Modularity allows to gain module functionality while maintaining cross-functional features among the different parts to produce a science-enabled interdisciplinary technology (Figure 1, WP one to three and milestones one to three, red, green and blue, respectively): Data knowledge discovery's team requires skills in evolutionary biology, evolutionary computation, computer science and the physics of complex systems (Section 3.1.1, Table 3.2a). ROBHOOT v.1.0 work mixes expertise in semantic algorithms, evolutionary computation algorithms and multilayer network metrics to create novel evolutionary-biology inspired ontology annotations along heterogeneous data-sources into one data knowledge discovery. EBD-CSIC team takes care of data knowledge graphs introducing novel evolutionary semantic algorithms to decipher ontologies and interactions among many data-sources (D1.1, Tables 3.1a-c). IFISC-CSIC team focuses on multilayer network modularity, community detection and decentralization metrics for pattern detection in data knowledge discovery (D1.2, Tables 3.1a-c). All teams in WP1 will join efforts to merge evolutionary semantic algorithms, multilayer network metrics, automation, reproducibility and visualization to produce the data knowledge discovery graph for the sustainability of the Seas case study (D1.6, Tables 3.1a-c). ROBHOOT v.2.0's team composed by EAWAG, and TARTU ULIKOOL and will merge eco-evolutionary biology-inspired networks to deep learning networks, the "Evolutionary biology-inspired AI algorithms" approach (D2.1 and D2.2, Box 1, Table 3.1a-c and Figure 1, green). The overall goal of this milestone is to connect evolutionary biology mechanisms to deep learning networks to generate a causal knowledge discovery technology to make patterns interpretable (Deliverable D2.2, Section 3.1.2, Table 3.2.a-c and Figure 3). The team for this milestone add inter-module complementarity expertise to ROBHOOT v.1.0's team: Now the skills focus on data-scientists trained in deep learning networks and evolutionary biologists with expertise in evolutionary ecology theory and evolutionary-inspired networks (section 3.1.2 and Figure 1, green). Milestone two generates a causal knowledge discovery for the sustainability of the Seas containing 9 million entries, 1612 species using around 11 sampling methods and more than 15 countries (D2.6, Figures 1, green). Interdisciplinarity in ROBHOOT is achieved not only at the intra-module development stage, but also at the inter-module stage where causal knowledge discovery and evolutionary biology-inspired AI algorithms might form the basis for the interdisciplinarity breakthrough ideas reflected in the highly complementarity skills of the consortium. The first two modules in ROBHOOT contain researchers from Estonia, Spain and Switzerland.

The ROBHOOT consortium wants to advance the rapidly evolving digital ecosystem by making cooperative discovery a fundamental feature of it. For this purpose, a science-enabled data and causal knowledge discovery technology is not enough if they stay isolated from a discovery technology embedded in large-scale networks. To discover novel scenarios for ecosystem sustainability, Discovery in federated networks should learn to learn from heterogeneous data-sources in the context of evolutionary neural biology-inspired algorithms. To achieve scalability for the discovery in federated networks, eco-evolutionary dyamics and neural-inspired protocols in federated networks is the excellency feature of ROBHOOT v.3.0 (section 3.1.3). ROBHOOT v.3.0's team composed by SRC and UNIGRAZ, develop eco-evolutionary dynamics scenarios for ecosystem sustainability and neural biology-inspired