



**RESEARCH - TECHNOLOGY - INNOVATION  
FOR SUSTAINABLE GROWTH**

**Additive Manufacturing: Shaping the future  
of production**

The incredible potential of 3D printing in the modern technological reality, the expertise of CERTH and the problem of mass production





## Contents

- 2** | “WE WILL GO ON OFFERING SOLUTIONS FOR A MORE SUSTAINABLE AND DEMOCRATIC ENERGY FUTURE THROUGH THE NEW GENERATION MICROGRIDS“
- 5** | ADDITIVE MANUFACTURING: SHAPING THE FUTURE OF PRODUCTION
- 9** | MAKING TRANSPORT INFRASTRUCTURE MORE SUSTAINABLE FOR BIODIVERSITY
- 13** | AGRICULTURAL INTEROPERABILITY ANALYSIS SYSTEM





Angelina Bintoudi receives the award

## **“WE WILL GO ON OFFERING SOLUTIONS FOR A MORE SUSTAINABLE AND DEMOCRATIC ENERGY FUTURE THROUGH THE NEW GENERATION MICROGRIDS”**

The first prize worth 10,000 euros won the spin - off company of the Centre for Research and Technology Hellas (CERTH), Optimems Smart Energy Solutions, in the competition held by the StartSmart SEE startup accelerator. Among more than 100 applications from companies in order to participate in the autumn 2023 cycle, Optimems stood out as one of the 20

companies that had the opportunity to attend an intensive three-month of entrepreneurship workshops through the StartSmart SEE accelerator. Following a successful course during the program, Optimems was among the eight startups, (Bitloops, Digital Bites, Games World League, Moverse, Optimems, Orbito Travel, OptiCV and Ratepunk),

which reached the final. There, they presented their solutions to a group of investors and executives in the central auditorium of the EKEFE "Demokritos", on December 13, 2023, in the presence of the Minister of National Defense Nikos Dendias. The three who stood out, were awarded.



“ Possessing this new asset we feel ready to go on with our work offering **solutions for a more sustainable and democratic energy future through the new generations microgrids**, Angelina Bintoudi, member of Optimems Smart Energy Solutions’s team

The first prize was given to the promising integrated solution of Optimems Smart Energy Solutions, which is about the optimal management of energy resources for microgrids and virtual power plants. Optimems software is able to integrate heterogeneous energy generation and storage technologies as well as controlled loads (e.g. electric vehicles, heat pumps), under the umbrella of a holistic optimal energy management system, based on technologies such as dynamic scheduling, machine learning and the internet of things. As the demands of modern

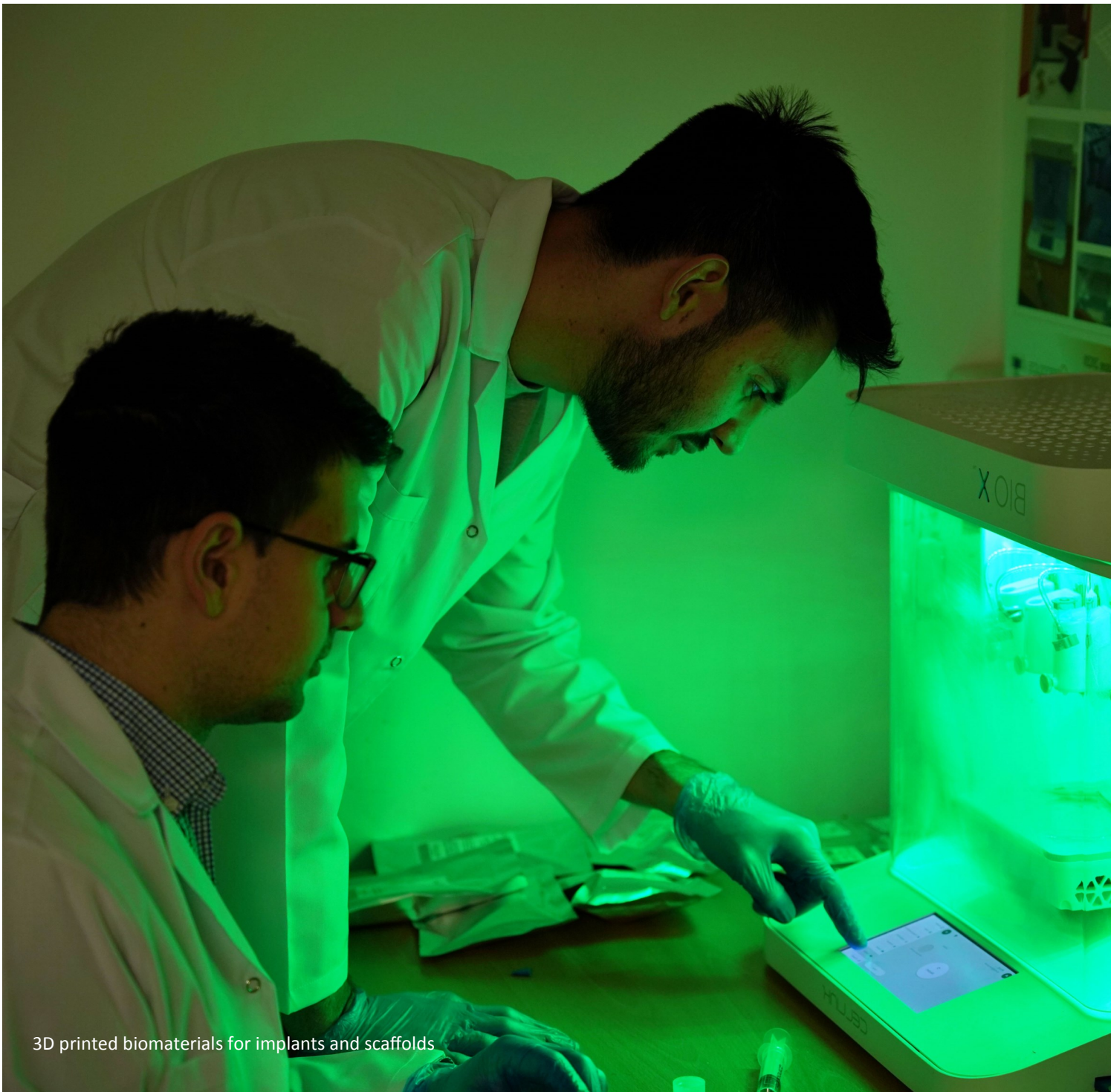
reality dictate the minimization of energy needs, this distinction suggests for Optimems an important recognition of its work, as the spin-off offers a "software center or brain" that has the ability to offer optimal management to energy supply from a small house or an industry, up to the level of a smart city, achieving a benefit of up to 30%. *“The most important advantage for us was the Accelerator Program. We started as engineers dedicated to our scientific field and after its completion, we were enriched with entrepreneurship knowledge”*, underlines Aggelina Bintoudi,

member of Optimems, and she adds: *“possessing this new asset we feel ready to go on with our work offering solutions for a more sustainable and democratic energy future through the new generation microgrids”*. The team of Optimems Smart Energy Solutions consists of the Electrical and Computer Engineers, Aggelina Bintoudi, Lambro Zyglaki, Christos Timplalexis, Dimtrios karanasios, Napoleon Mpezas, Spiros Kopolas, Dr. Dimosthenis Ioannidis and Dr. Dimitrios Tzovaras.

#### About StartSmart SEE

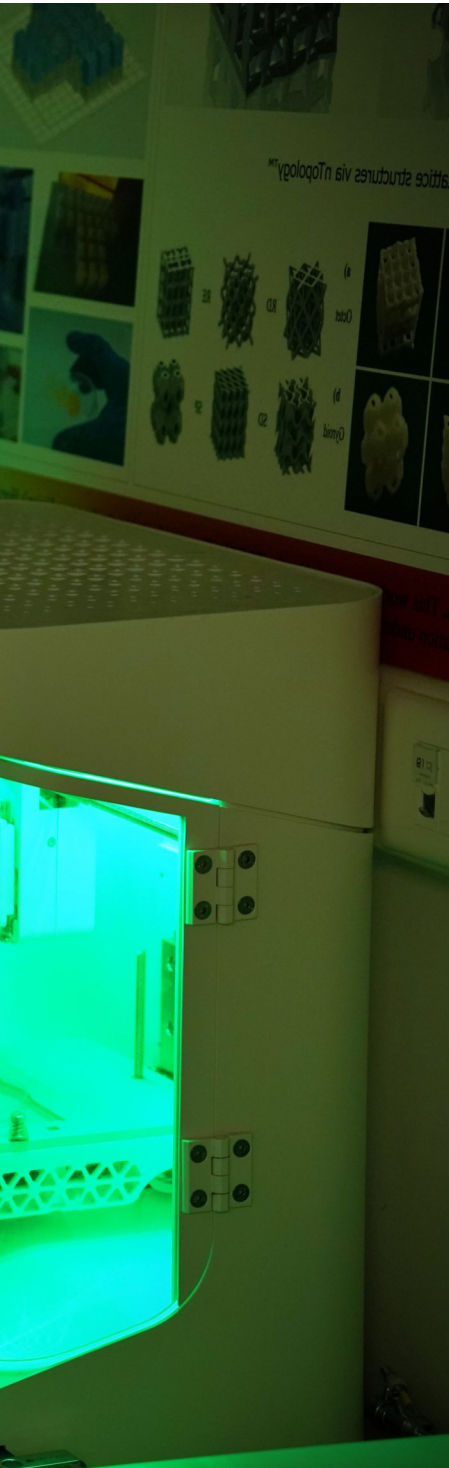
Designed to accelerate the development of innovative technology businesses from South East Europe, the StartSmart SEE accelerator program provides access to a wealth of resources and information. Through the collaboration with the MIT J-WEL and MIT Open Learning networks, it enables the exchange and dissemination of high-level knowledge and, above all, access to a global network of partners.





3D printed biomaterials for implants and scaffolds

# ADDITIVE MANUFACTURING: SHAPING THE FUTURE OF PRODUCTION



In the era of the 4th Industrial Revolution, 3D printing is one of the most important means of the production process. At the same time, it is one of the fastest growing technologies worldwide, which finds application in a wide range of industrial sectors such as the automotive industry, aerospace, architecture, medicine, biotechnology and the food industry.

The Additive Manufacturing Unit (AMU) of the Centre for Research and Technology Hellas (CERTH) -one of the most advanced 3D printing laboratories in Greece- includes a variety of 3D printers and lab equipment in 3D scanning and design.

Dr. Dimosthenis Ioannidis and Dr. Eleftheria Pechlivani, researchers of CERTH, talk about the Research Centre's expertise in 3D printing technology, the services provided by the Additive Manufacturing Unit, the advantages of this technology and its impact on the economy.

**“The Additive Manufacturing Unit of CERTH offers industry and especially small and medium-sized enterprises a series of services, regarding **customized 3D printing of objects, reverse engineering through 3D scanning and the selection of the most suitable materials for their optimal prototyping,**** Dr. Dimosthenis Ioannidis, researcher Grade B’, CERTH|ITI

**Dr. Ioannidis, the Additive Manufacturing Unit (AMU) of CERTH, was created a few years ago. What led to its establishment and what are the services it offers?**

The idea came from the present Chairman of CERTH, Dr. Dimitrios Tzovaras, in 2017, in order to bridge the gap between Information and Communication Technologies and production systems, establishing a laboratory according to the standards of digital manufacturing. AMU was co-funded by CERTH’s own funds and the “ODYSSEAS” research program within the National Strategic Reference Network 2014-2020. The laboratory

started operating in 2019, providing -among others- 3D printing and reverse engineering services as well as prototyping of innovative products.

**To date, how has AMU served the needs of industrial production?**

AMU offers industry and especially small and medium-sized enterprises a series of services, regarding customized 3D printing of objects, reverse engineering through 3D scanning and the selection of the most suitable materials for their optimal prototyping. Since 2019 to date, the laboratory has concluded more than 25 bilateral

industrial contracts and sub-contracts with companies such as KLEEMANN, ALUMIL and ENNEAS, etc. During these 5 years of operation, it has managed to file 10 patents with the Hellenic Industrial Patent Organization. These patents support its contribution to the production of products, devices and systems through innovative methods of Additive Manufacturing, as well as more than 15 funded research projects, that provide solutions to industrial research and applications.





3D printed metal prototypes utilizing a Selective Laser Melting printer at the Additive Manufacturing Unit of CERTH|ITI.

«This technology offers great freedom in the design and manufacture of complex geometries that are either impossible or unprofitable to manufacture with conventional manufacturing methods, Dr. Eleftheria Pechlivani, researcher Grade B', CERTH|ITI

**Dr. Pechlivani, what are the advantages of 3D printing?**

This technology offers great freedom in the design and manufacture of complex geometries that are either impossible or unprofitable to manufacture with conven-

tional manufacturing methods. What's more, it allows the use of a wide range of available materials, including polymers, ceramics, metals, composites and exotic materials. At the same time, 3D printing reinforces the circu-

lar economy by making good use of agricultural waste and other waste such as branches and leaves, plastics from blue bins as well as construction and demolition waste for the production of secondary products.



Dr. Eleftheria Pechlivani and Dr. Dimosthenis Ioannidis showcasing MultiJet 3D printed resin-based prototypes at the Additive Manufacturing Unit of CERTH-ITI.

Faster design, prototyping and the elimination of tools and time, to change production units in a factory for new products through this flexibility will no longer be a competitive factor, but **a necessity for the sustainability of a business in the market.**

#### **What is its impact on the economy?**

Its impact on the local community is interrelated to the digital transformation of SMEs, which allows businesses to proceed with the immediate and economically feasible development of their ideas through research and development.

Faster design, prototyping and the elimination of tools and time, to change production units in a factory for new products through this flexibility will no longer be a competitive factor, but a necessity for the sustainability of a business in the market.

At the same time, 3D printing contributes to social construc-

tion, demonstrating a positive social impact as in the case of AMU. Through a digital open platform, AMU provides the possibility of co-creating a 3D printing prototype with 3D design tools and visualizing them with virtual and augmented reality in their place of use and tailored to their specific needs.



**3D printing is a high potential technology. However, the problem of mass production remains. How do you think this challenge is expected to be addressed?**

**Dimosthenis:** You are right that mass production is the Achilles's heel of additive manufacturing but let us not forget that we stand on the threshold of Industry 5.0, the basic principle of which is the

mass customization of products, in order for the production to be more human-centric. Indeed more and more items such as shoes or accessories, for instance, are given the opportunity of customized production through [online](#) design and ordering platforms. So in this business model, additive manufacturing plays a very important role.

**Eleftheria:** 3D printing acts according to the Manufacturing-as-a-Service model, offering bespoke product design and production promoting 'just in time' production close to the point of sale. Therefore, as 3D printers become cheaper and faster, more manufacturing centers will be created for the mass customization of products in order to fully meet the needs of the customers.



The team of the Additive Manufacturing Unit (AMU) of CERTH|TI.







# MAKING TRANSPORT INFRASTRUCTURE MORE SUSTAINABLE FOR BIODIVERSITY

Transport infrastructure is one of the drivers of global economic development. However, through its impact on land use change and ecosystem fragmentation, it is also one of the main causes of and the decline in biodiversity. Given the heightened

global concern over this issue, new regulations and approaches with stricter biodiversity standards are expected in the wake of the concrete goals and targets on securing ecological connectivity included in the Kunming-

Montreal Global Biodiversity Framework.

To answer these challenges, the BISON project envisages a symbiotic relationship between two key commons: biodiversity and infrastructure, promoting resilience in both areas.

## The Strategic Research and Deployment Agenda (SRDA), **envisages a symbiotic relationship between biodiversity and infrastructure**

To realise this vision, the project has developed the present Strategic Research and Deployment Agenda (SRDA) comprising several key elements: (1) it synthesises existing knowledge, making it accessible to stakeholders and facilitating its wide-spread adoption (2) it proposes a clear research path to address environmental challenges in a holistic way, encompassing ecological, so-

cietal, developmental and governance aspects and avoiding duplication of funding and effort (3) it identifies gaps and opportunities in policy and funding, paving the way for a coherent, action-oriented approach.

The Hellenic Institute of Transport (HIT) of CERTH is the Coordinator of BISON project, as well as main contributor of its Strategic Re-

search and Deployment Agenda (SRDA), setting the ground for the necessary actions and innovative solutions for mainstreaming Green & Grey infrastructure across the EU Member States and across the different transport modes.

The BISON research project was funded by the European Commission through the Horizon 2020 program and lasted for 36 months.



## AGRICULTURAL INTEROPERABILITY AND ANALYSIS SYSTEM

Modern agriculture is turning to a data-driven approach. A plethora of digital tools are already available and used by farmers, posing risks of lack of interoperability.

The goal of ATLAS project was the development of an open interoperability network for service-based agricultural ap-

plications, as well as the creation of a biotic ecosystem for innovative data-driven agriculture, using this network.

The solutions developed provide the means to interface agricultural software systems, agricultural machines, and sensor systems. The development of the ATLAS interoperability

network involved stakeholders from all major agricultural sectors, focusing on technical interoperability that enables the exchange of information between different existing systems.





Diseases detection system in vineyards using UGV.

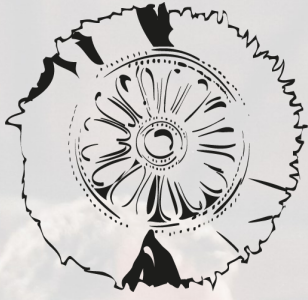
The solutions developed provide the means **to interface agricultural software systems, agricultural machines, and sensor systems.**

The ATLAS interoperability network will allow the flexible combination of agricultural equipment, sensor systems and data analysis tools to overcome the problem of lacking interoperability and to enable farmers to increase the productivity in a sustainable way by making use of the

most advanced digital technology and data on their own. Of a particular importance was the participation of the Institute of Bio-Economy and Agri-Technology of CERTH, that developed applications for labeling hyperspectral images, disease detection and plant stress assessment. Mul-

tilevel data fusion techniques were also developed for crop monitoring decision support.

The research project ATLAS was funded by the European Commission through the Horizon 2020 program and had a duration of 46 months.



# CERTH

CENTRE FOR  
RESEARCH & TECHNOLOGY  
HELLAS

The **Centre for Research and Technology-Hellas (CERTH)** founded in 2000 is one of the leading research centres in Greece and listed among the TOP-15 E.U. institutions with the highest participation in competitive research grants.

Today CERTH includes the following five institutes with indicated major fields of research:

- **Chemical Process and Energy Resources Institute (CPERI)** Sustainable & Clean Energy, Environmental Technologies, Chemical & Biochemical Processes, New Functional Materials
- **Information Technologies Institute (ITI)** Informatics, Telematics and Telecommunication Technologies, Safety and Security
- **Hellenic Institute of Transport (HIT)** Smart Sustainable Mobility, Transport Safety
- **Institute of Applied Biosciences (INAB)** Agri-biotechnology, Health Translational Research, Informatics for big bio-data
- **Institute for Bio-Economy and Agri-Technology (IBO)** Bio-economy, Agri-technology

