

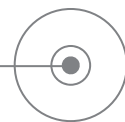
Activity Report

2019



University
of Cyprus

Imperial College
London



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Forewords



Message from the Rector

“The KIOS CoE plays a key role in the University’s vision of becoming a vibrant hub for education, research and innovation

Dear reader,

We live in a constantly competitive and changing international environment, where investment in research and innovation is an essential component for economic development and social prosperity. Academic institutions contribute significantly to the development of the research and innovation culture, create new employment opportunities for young people, and bring new ideas for economic growth.

The University of Cyprus (UCY), is a young and dynamic academic institution of national and international recognition. Focused on excellence in education, and research and innovation, the University of Cyprus is renowned for its high-impact research profile and quality of teaching. In the latest prestigious Shanghai List (2019), it ranked between the top 601-700 in the world, while it was ranked in 2020 amongst the top 477 universities worldwide according to the QS Global World Ranking. UCY is also included in the top 401-500 universities, according to the Times Higher Education World University Rankings.

Today, there are 8 faculties and 22 departments at the University of Cyprus, offering a wide range of undergraduate, postgraduate, PhD and research programs which cater to almost 7,000 students. In 2019, the University of Cyprus has implemented a large number of research projects funded by the European Commission, the Cyprus Research Innovation Foundation, several public and private research organizations, as well as industry and governmental organizations.

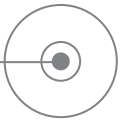
The KIOS Research and Innovation Center of Excellence plays a key role in the University’s vision of becoming a vibrant hub for education, research and innovation, with a strong international character and global reputation. In the last year, the Center made a significant contribution in developing knowledge and promoting research and innovation excellence at the local and international level.

I would like to congratulate the Faculty and researchers of the KIOS Research and Innovation Center of Excellence for their remarkable dedication and tireless efforts to maintain and further enhance the outstanding work of the Center in promoting research and innovation excellence.

Sincerely,



Professor Tasos Christofides,
Rector, University of Cyprus



Message from the Director

“ The Center utilizes its scientific expertise to solve real-life societal and technological problems

The world is changing rapidly. We are facing a range of global research challenges in the areas of energy, environment, ICT, urbanization, health, and security. The KIOS Research and Innovation Center of Excellence embraces these changes and utilizes its scientific expertise to solve real-life societal, and technological problems and create value for society.

The Center was established in 2008 and upgraded to a Center of Excellence in collaboration with Imperial College London in 2017, through a highly competitive EU strategic Horizon 2020 Teaming program aimed at “spreading excellence and widening participation.”

The period covered in this Activity Report, January-December 2019, has been a successful year for the KIOS Center of Excellence. The Center participated in several multidisciplinary research projects funded by international and national funding sources. This created exciting new opportunities for young talented researchers to pursue research in cutting-edge areas such as machine learning, automation and robotics, Internet of Things, and cybersecurity, and utilize their research findings in application areas of global importance.

Significant work has also been undertaken during 2019 to strengthen the Center's collaboration with industry, through new research and innovation projects. Such initiatives help to create a vital ecosystem between academia, industry, and governmental organizations, resulting in major economic and societal benefits for Cyprus and Europe.

Furthermore, in the last year, the Center has made significant progress in the development of innovative testbeds for critical infrastructure systems and the implementation of education and training activities, including the launch of a new MSc program on *Intelligent Critical Infrastructure Systems*.

These successes would not have been possible without the dedication and hard work of the KIOS personnel, who worked cooperatively towards a common goal. I would also like to thank the leadership of the University of Cyprus, for their ongoing strong support, that has enabled the Center to flourish.

We hope that you will find this report informative. For further information about the Center, please visit the KIOS website, www.kios.ucy.ac.cy, or come and visit us in person.

Prof. Marios Polycarpou,
Director, KIOS Research and Innovation Center of Excellence
Professor, Department of Electrical and Computer Engineering, University of Cyprus
Member, Cyprus Academy of Sciences, Letters, and Arts

In brief



The KIOS Research Center was established in 2008 at the University of Cyprus and was subsequently selected by the EU to advance into a Research and Innovation Center of Excellence in 2017.

The mission of the KIOS Research and Innovation Center of Excellence (KIOS CoE) is to conduct multidisciplinary research and innovation in the area of Information and Communication Technologies (ICT), with emphasis on the monitoring, control, management, and security of critical infrastructures. These infrastructures include large-scale, complex systems such as power and energy systems, water systems, transportation systems, telecommunication networks, and emergency management and response systems.

The Center's vision is to provide an inspiring environment for conducting excellent, cutting-edge research at a global scale, producing new knowledge and advanced engineering and management tools that can be applied to solve timely and real-life problems within the context of critical infrastructure systems.

Research in high-tech areas important to Cyprus and the global economy

SCIENTIFIC FOUNDATIONS

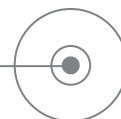
- Computational Intelligence & Machine Learning
- Control & Optimization
- Modelling & Simulation
- Intelligent Data Processing
- SW/HW System Design & Integration

APPLICATION AREAS

- Power & Energy Systems
- Water Systems & Environmental Monitoring
- Intelligent Transportation Systems
- Telecommunication Systems & Networks
- Emergency Management & Response

RESEARCH OUTCOMES

- Intelligent Monitoring & Control
- Resilience, Adaptation & Reconfiguration
- Security, Safety & Trustworthiness
- Big Data Analysis & Management
- Performance & Energy Optimization



Research Activities

Scientific dissemination

Scientific dissemination is an important and integral part of the KIOS CoE since it fosters the transfer of knowledge and results in international scientific communities.

In 2019, the KIOS Faculty and the wider KIOS research team have published 88 journal and conference papers.

• Peer-reviewed journal publications

Academic journals serve as one of the principal forums for researchers, to disseminate their research work within the scientific community. The KIOS CoE researchers continue to target high-quality and high-impact journals, whose topics of interest cover the research activities of the Center. In 2019, the KIOS research team has published 30 peer-reviewed journal papers in academic journals within their areas of expertise.

• Conference proceedings

Conference proceedings can facilitate fast scientific dissemination, allowing researchers to present their research to conferences, workshops and symposia, aiming at the fast and wide adoption of their research ideas by their peers in the scientific community. In 2019, the KIOS research team has published 58 peer-reviewed papers in Conference Proceedings.



KIOS CoE Open Knowledge Portal (Zenodo)

The KIOS CoE has recognized the significance of openly disseminating scientific results. Towards that goal it has created the KIOS Open Knowledge Portal (Zenodo), which is an online repository that stores and manages all research-related papers, open research data and open source code produced at the KIOS CoE.

At this moment, the KIOS Open Knowledge Portal is the Center's main channel to release most of the research publications as open access, as well as the associated research data and/or the source code of the tools, algorithms, and techniques developed as part of the research process. In this way, the KIOS CoE follows the best practices in open access and contributes to reproducible research. The majority of the Center's journal and conference publications are available to the scientific community as open access through the KIOS Open Knowledge Portal.



Research Activities

Scientific conferences

During 2019, the KIOS CoE successfully organized two international conferences in Cyprus: the 11th International Workshop on Resilient Networks Design and Modelling (RNDM 2019) and the 8th Management/working Group Meeting of the COST CA15127 Action “Resilient Communication Services Protecting End-user Applications from Disaster-based Failures” (RECODIS).

The aim of both conferences was to attract academic and industrial professionals, scientists and professional engineers from all over the world and give them the opportunity to present their work, to discuss with peers, to exchange ideas and transfer knowledge, as well as to expand their networks and explore future collaborations.

The organization of scientific conferences helps to increase the reputation of both KIOS CoE as a center that promotes excellence in research, and Cyprus as a country that is an ideal destination for hosting high-quality scientific events.

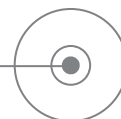


KIOS CoE participation in EU level networks

In 2019, the KIOS CoE research team participated in a number of brokerage events organized by the EU, aiming to increase the visibility of the Center and to exploit future collaborations. This enables the KIOS CoE team to reach potential partners and increase access to proposal consortiums.

A sample of events in 2019 with KIOS researchers participation:

- H2020 Energy Info Days (25-27 June 2019, Brussels)
- Smart Solar Power in Europe (16 May 2019, Munich)
- CrowdHelix [Vision2020] Digital & Cybersecurity Event (6 February 2019)
- Water Innovation Europe 2019 (12-13 Jun. 2019, Brussels)



KIOS CoE Personnel

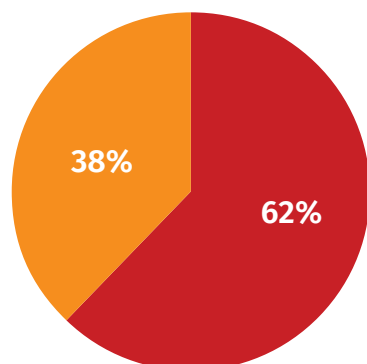
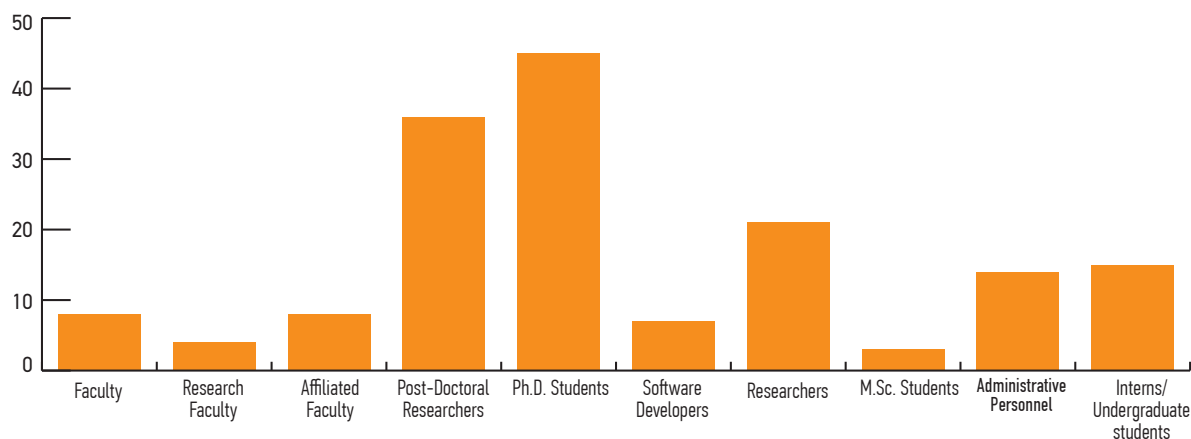
The human capital is the most important factor for the success of an organization. Thus, the KIOS CoE places particular emphasis on recruiting high-caliber researchers who will contribute significantly to the development of the Center.

The KIOS CoE places also particular emphasis on promoting diversity, equal opportunities and gender balance at all levels of its research and innovation teams. Towards this end, the Center aims to increase gender balance among its research personnel by offering female researchers an attractive working environment. In addition, the KIOS CoE has developed recruitment initiatives to attract highly-qualified personnel from Europe and the Middle East - North Africa (MENA) region.

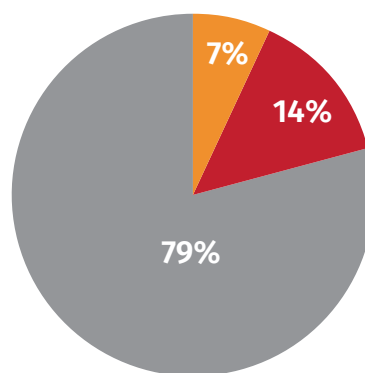
By the end of 2019, the KIOS CoE employed 161 researchers including full-time and part-time employees. This number includes Faculty & Affiliated Faculty, the new Research Faculty Positions, Postdoctoral Researchers, PhD Students, Researchers (non-student), Software Developers, Administrative Personnel, Undergraduate Interns, and MSc Students. In addition, at the KIOS CoE spoke at Imperial College London there are 13 Researchers.

161
RESEARCHERS
EMPLOYED
by KIOS
at the end
of 2019

KIOS CoE PERSONNEL 2019



Gender
Male
Female



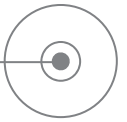
Country of Origin
Cyprus
EU
Non-EU

27 FUNDED RESEARCH PROJECTS in 2019

Competitive R&I funded projects

In 2019, the KIOS CoE participated in a number of collaborative research and innovation projects funded by various competitive funding programmes including Horizon H2020, the Cyprus Research and Innovation Foundation, other EU funding programmes, including INTERREG and SolarEranet Co-fund, as well as EU funding programmes tackling specific EU policy and objectives such as emergency response. These projects which involve multidisciplinary international consortiums address important global challenges for critical infrastructure systems such as power and energy systems, water networks, transportation networks, telecommunication networks, and emergency management and response systems.

ACRONYM	FULL TITLE	FUNDING SOURCE	KIOS ROLE
1 KIOS CoE*	The KIOS CoE project focuses on the significant development of KIOS into a world-class research and innovation Center of Excellence. The project which is part of the EU's strategic program "Spreading Excellence and Widening Participation", is being implemented in collaboration with Imperial College London	EU - H2020 TEAMING	Coordinator
2 EMPOWER	Empowering the Cyprus power system with sustainable and intelligent technologies	Cyprus RIF ¹ - RESTART	Coordinator
3 SmartWater2020	Intelligent Water Distribution Networks for Reducing Loss	EU - INTERREG Greece -Cyprus	Coordinator
4 SWIFTERS	Safe and Rapid Evacuation Facilitated by UAV Swarms	EU CIVIL PROTECTION	Coordinator
5 FAULT LEARNING	Online Class Imbalance Learning for Fault Diagnosis - MSCA Widening Fellowship	EU - H2020 MSCA IF	Coordinator
6 GLADIATOR	Next-generation theranostics of brain pathologies with autonomous externally controllable nanonetworks: a trans-disciplinary approach with bio-nanodevice interfaces	EU - H2020 FET OPEN	Coordinator
7 REALFLON	Resource Allocation in Flexible Optical Networks	Cyprus RIF - RESTART	Coordinator
8 ENHANCE	Enhanced rooftop PV integration through kinetic storage and wide area monitoring	Cyprus RIF and EU SOLAR - ERANET ²	Coordinator



	ACRONYM	FULL TITLE	FUNDING SOURCE	KIOS ROLE
9	ITS-CONNECT	Intelligent Transportation Systems in the era of Connected Vehicles	Cyprus RIF - RESTART	Coordinator
10	COM-MED	COMMunication systems with renewable Energy micro-grid	Cyprus RIF and EU ERANETMED ³	Coordinator
11	REDESIGN	Redesigning educational curricula and digitally afforded collaborations to promote multimodal learning experiences	EU - ERASMUS+	Coordinator
12	GLADIATOR Complementary	Complementary infrastructure to support the development of a working prototype of a complete, autonomous and clinically applicable, nanonetwork-based, molecular communications platform.	Cyprus RIF - RESTART	Coordinator
13	CAPACIDI	Complementary Action for Projects to Achieve Improvements in Delivery and Impact	Cyprus RIF - RESTART	Coordinator
14	CUREX	seCUre and pRivate hEalth data eXchange	EU - H2020	Partner
15	DOMOGNOSTICS +	Semintically enhanced IoT-enabled Building Analytics and Diagnostics	Cyprus RIF - RESTART	Partner
16	CARMEL	Artificial Intelligence based cybersecurity for connected and automated vehicles	Cyprus RIF - RESTART	Partner
17	EnergyXchange	Smart Energy Platform Facilitating the Cyprus Liberalized Energy Market	Cyprus RIF - RESTART	Partner
18	Pvgnosis	Diagnosis maintenance and operation of PV plants	Cyprus RIF and EU -SOLAR ERANET	Partner
19	CERETAB	CoopERation for incrEased siTuational Awareness estabLishment	EU Internal Security Fund Borders and Visa	Partner
20	LEAPFROG	Introducing RPAS modules to the voluntary pool of response capacities and leading activities for enrolment of RPAS units in the voluntary pool	EU CIVIL PROTECTION	Partner

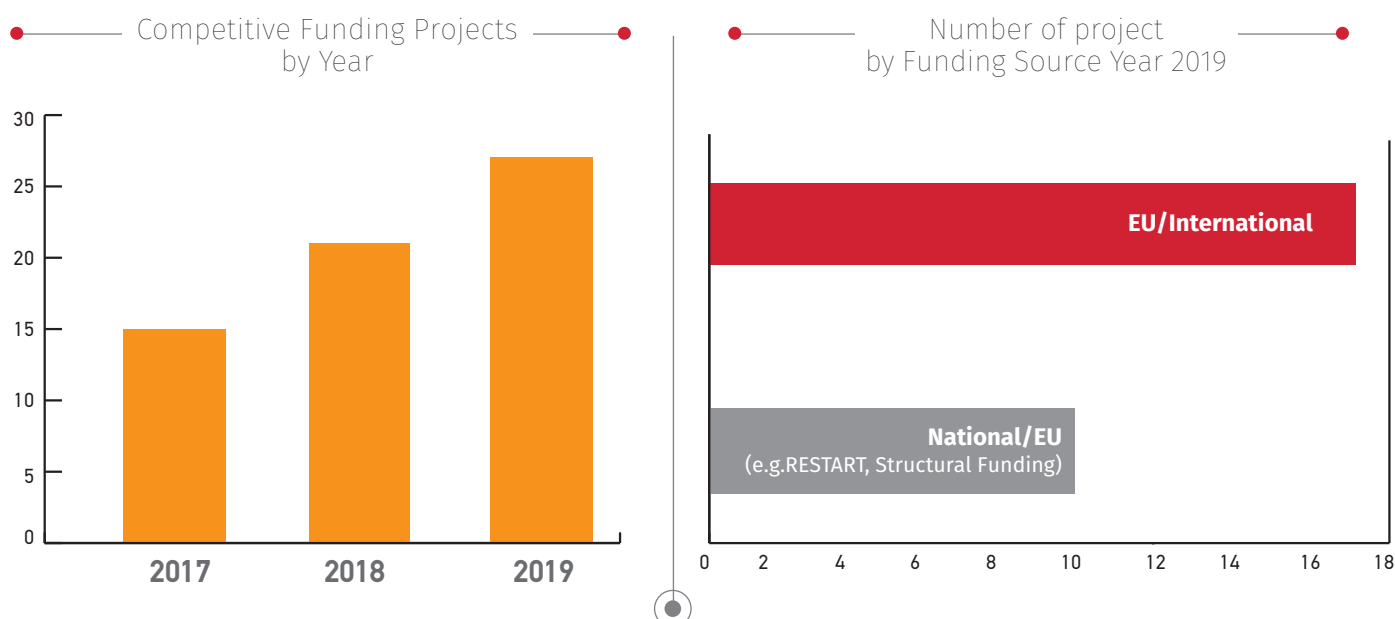
	ACRONYM	FULL TITLE	FUNDING SOURCE	KIOS ROLE
21	WaterAnalytics	Smart Analytics for Improving Efficiency of Water Distribution Networks	Cyprus RIF - RESTART	Partner
22	ERASMUS - Physics Phase 2	Improvement of master-level education in the field of physical sciences in Belarusian universities	EU - ERASMUS+	Partner
23	FLEXITRANSTORE	An Integrated Platform for Increased Flexibility in smart Transmission grids with storage Entities and large penetration of Renewable Energy Sources	EU - H2020	Partner
24	FLOBIT	Smart Water Usage and Savings Enablement Metering System, Supported by Artificial Intelligence and Machine Learning Methods, for Building Environments	Cyprus RIF - RESTART	Partner
25	RONDA	ROadway Network Distress Assessment	Cyprus RIF - RESTART	Partner
26	3D-Micro-grid	Innovative Technologies for smart energy management and control of a micro-grid	Cyprus RIF and EU ERANETMED	Partner
27	ATOM	Advancing the state of the art of MIMO: the key to the successful evolution of wireless networks	EU - H2020 MSCA RISE	Partner

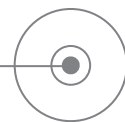
(1) Cyprus RIF - Cyprus Research & Innovation Foundation

(2) Horizon 2020/FP 7 SOLARERA.NET Cofund and the Cyprus Research and Innovation Foundation

(3) FP7 ERANET-MED Cofund and the Cyprus Research and Innovation Foundation

* Complementary funding for the KIOS CoE is provided by the Government of the Republic of Cyprus through the Directorate General for European Programmes, Coordination and Development, by the University of Cyprus and Imperial College London.





Competitive R&I funded projects

Selected projects

A sampling of research at KIOS CoE is presented below.



Empowering the Cyprus power system with sustainable and intelligent technologies

The EMPOWER project aims to modernize the Cyprus power system in order to improve its stability and reliability, even in the presence of a very high penetration of renewable energy sources. This project builds on a high quality, complementary and multidisciplinary consortium that will create essential synergies between organizations with research expertise and stakeholders from the industry.

This project is funded by the Research and Innovation Foundation of Cyprus.



Artificial Intelligence-based Cybersecurity for Connected and Automated Vehicles

The CARMEL Innovation Action project addresses the cybersecurity challenge of the next generation mobility, contributing to the long-term vision of safer roads with zero fatalities.

This project is funded by the EU under the Horizon 2020 programme and includes 15 organizations from 8 European countries with complementary expertise and skills.



Innovative solutions for the protection and security of health data

The CUREX project addresses comprehensively the protection of the confidentiality and integrity of health data by producing a novel, flexible and scalable situational awareness-oriented platform.

This project is supported by a multidisciplinary consortium of 16 organizations and receives funding from the European Union's Horizon 2020 research and innovation programme.



Artificial Intelligence-based fault diagnosis of critical infrastructure systems

The project Fault-Learning is a Marie Skłodowska Curie (MSCA) Widening Fellowship and aims to design and develop an online learning-based fault diagnosis engine with adaptation capabilities, that monitors and analyzes in real time data obtaining from critical infrastructure systems.

This project is funded by the European Union's Horizon 2020 research and innovation programme.

Pioneering technologies for border monitoring and security

This research project focuses on utilizing new, state-of-the-art border surveillance technologies, such as the deployment of Unmanned Aircraft Systems (UASs) that will facilitate information exchange in order to prevent cross border crime and illegal migration, and significantly enhance border monitoring and security.

This project is funded by the European Commission Directorate-General for Migration and Home Affairs (DG HOME).



Smart building systems for better monitor and control

Domognostics+ innovation project aims to conduct industrial research, and develop and evaluate an innovative low-cost intelligent software/hardware solution designed for building operators to better monitor and control their building systems.

This project is funded by the Research and Innovation Foundation of Cyprus.



Novel Technologies for cancer monitoring and therapy

GLADIATOR, will provide for the first time a working prototype of a complete, autonomous and clinically applicable, nanonetwork-based, theranostic system based on the conceptual framework of Externally Controllable Molecular Communications.

The project has received funding from the European Union's Call "Future and Emerging Technologies-Open: Novel Ideas for radically new technologies".

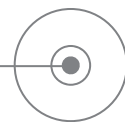


Novel solutions for advanced diagnosis, maintenance and operation of PV plants

The research project "PVgnosis", aims to develop and demonstrate technical novel solutions to advance the operation, maintenance and lifetime of PV plants towards the massive adoption of solar energy.

This project is supported under the umbrella of SOLARERA.NET Cofund 2 by the Cyprus Research and Innovation Foundation.





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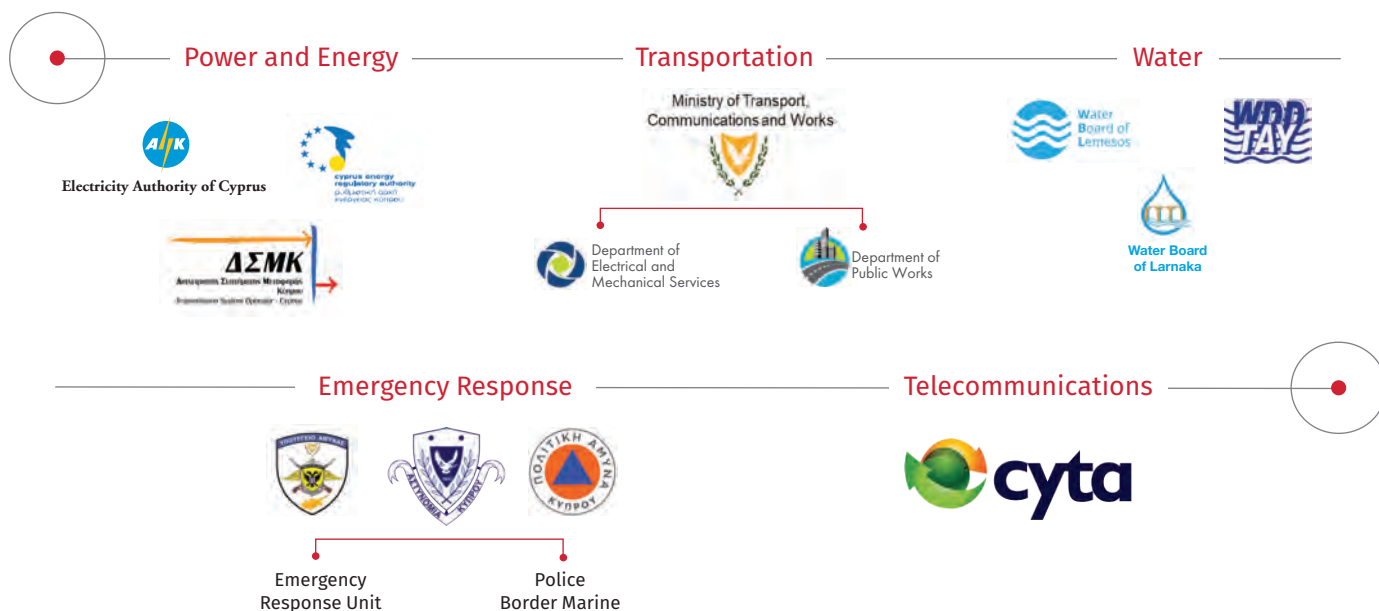
ACTIVE PROJECTS with the INDUSTRY in 2019

KIOS Innovation Hub: Collaboration with Industry

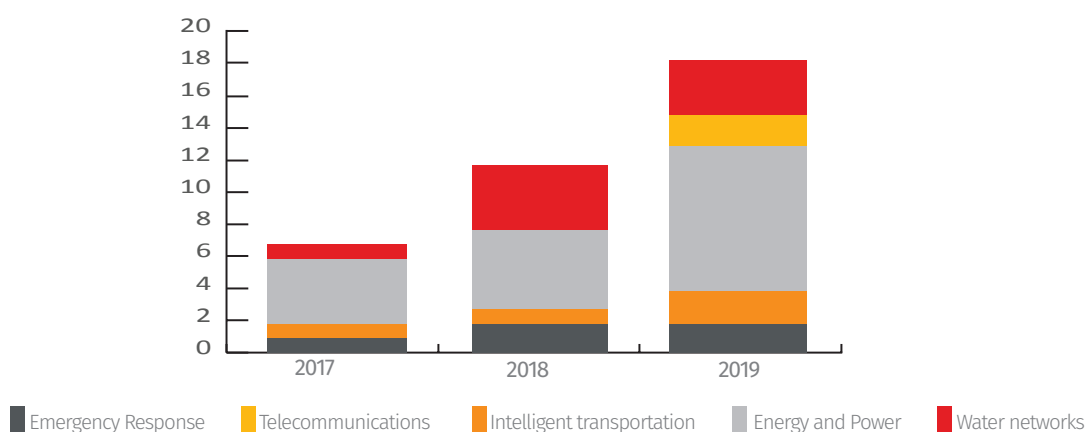
The KIOS Innovation Hub was created in 2017 with the aim to enable the technology transfer of the core research competencies of KIOS CoE in the area of ICT to organizations involved in the monitoring, control, security and management of critical infrastructures.

Its vision is to promote collaboration between academia, industry, operators of critical infrastructure systems, regulators, as well as governmental organizations with the ultimate goal to create an ecosystem that spans the entire innovation cycle from conception of an idea to its commercialization.

Innovation Hub Partners



Active Projects per Application Area

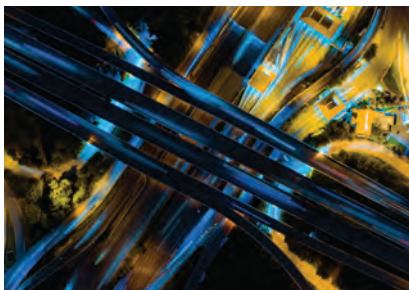


KIOS Innovation Hub



Power and Energy Systems

In 2019, the KIOS CoE undertook several research projects in collaboration with the Electricity Authority of Cyprus (EAC) and the Transmission System Operator (TSO), which are related to the optimization of the Cyprus transmission and distribution power systems. Further, it undertook projects related to EAC's risk management, as well as its communications network infrastructure. This research collaboration has created benefits not only for EAC, but also for Cyprus and its citizens, as these projects aim at optimizing EAC's power system operation, improving energy efficiency, and reducing cost.



Transportation Systems

During 2019, the KIOS research team was involved in two research projects with the Public Works Department (PWD) and one with the Electromechanical Services Department (EMS) both under the Ministry of Communication and Works of the Republic of Cyprus. The projects with the PWD involved the development of two software platforms, "GNOSIS" and "TN-ITS", which are related to the management of the Cyprus road network. The project with the EMS involved the analysis of data collected from the fleet management system of the EMS Department with the ultimate goal to improve the management of the public service fleet.



Water systems and water resource management

In 2019, the KIOS CoE worked on three research projects with the Water Board of Limassol which involved the development of the software platform "Oceanos", the GIS and EPANET modeling, as well as a study on the water network needs for the areas of Moutayiaka and Phinikaria. Their aim was to improve the water distribution system in reducing water losses, increasing efficiency and improving water quality monitoring.



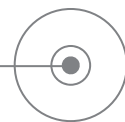
Emergency management and response systems

During 2019, the KIOS research team developed a next generation high speed local telecommunication network and upgraded the innovative "Mission Control" platform for managing mission data and facilitating the operations of the Cyprus Police Emergency Response Unit by providing decision-support features. Moreover, throughout the year, the KIOS CoE research team worked on the development of a new pioneering decision support system for the Port and Marine Police. It is also worth mentioning that in 2019 the KIOS CoE, in collaboration with the Cyprus Civil Defence Force, successfully conducted a four-day training activity on the use of drones in emergency response.



Telecommunications

In 2019, the KIOS CoE signed a research collaboration agreement with CYTA which focuses on the creation of models, tools and applications through the innovative use of machine learning and information and communications technology. The KIOS CoE research team will develop intelligent algorithms which will enhance the processes of the organization in relation to its operations.

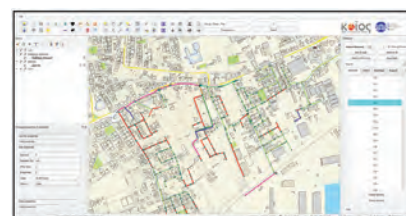


Successful outcomes from research collaborations with the Industry

During 2019, the KIOS CoE was involved in the implementation of three software platforms related to water management, road network data, and emergency response management. These systems assist the CIS stakeholders, specifically the Limassol Water Board, the Public Works Department, and the Cyprus Police to enhance decision making processes within their operations, in an effort to make them more efficient.

“Oceanos” Platform

The platform “Oceanos” has been developed by the KIOS researchers within the research collaboration agreement between the KIOS Innovation Hub and the Water Board of Limassol. This integrated platform gathers, stores, and accesses data from water networks, thus becoming a useful decision-making tool for the Water Board of Limassol. Utilizing this platform, the Board will be able to better monitor and detect any leaks in Limassol’s water network, aiming to reduce the response time for the restoration of the faults.



“GNOSIS” platform

The “GNOSIS” platform is being developed within the framework of the collaboration agreement between the KIOS Innovation Hub and the Public Works Department of the Ministry of Transport, Communications, and Works. “GNOSIS” is an integrated Geographic Information System that collects, stores, analyzes and presents all data related to the Cyprus road network (such as road network topology, speed limits, signs, etc.), aiming to become a useful tool for the optimal management of data for intelligent decision making by the Public Works Department on the Cyprus road network.



“Mission Control” platform

The “Mission Control” platform is implemented in the framework of the research collaboration between the Cyprus Police and the KIOS Innovation Hub and aims at supporting the management of emergencies, decision making, and strategic planning by the Cyprus Police. The platform features a digital map with several capabilities (i.e., calculation of the optimal route to reach a point of interest, measurement of distances, etc.) can be utilized by the Cyprus Police to enhance its decision-making and operational capabilities.

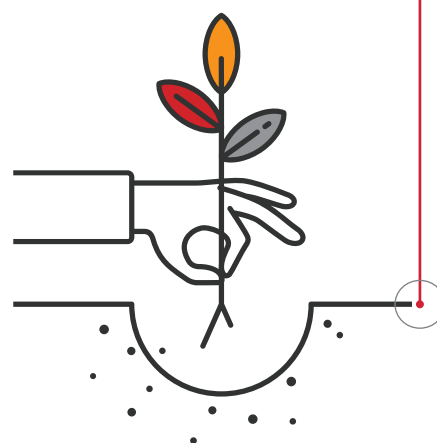


Start-up creation and IP commercialization

In 2019, the KIOS CoE participated in securing pre-seed funding through the “RESTART 2016-2020” Programmes for Research, Technological Development and Innovation (RTDI) of the Research and Innovation Foundation through the Cyprus Seeds non-profit organization. The objective of these initiatives is to develop innovative products and services, with the ultimate goal the creation and development of start-ups.

The KIOS CoE participates as a partner in five projects, which have received pre-seed funding as follows:

- 1) Air Quality Monitoring of Indoor Environments.
- 2) Web-based solution for real-time optimizing the operation of energy storage systems.
- 3) Intelligent swarm multi-drone platform for emergency response situations.
- 4) Preventing unattended data recording and leakage in smart devices.
- 5) Artificially Intelligent Real-Time Drone Monitoring Tactics to Safeguard Sensitive Facilities.



KIOS CoE Research Infrastructure

KIOS CoE Testbeds

The KIOS CoE, together with Imperial College London, develop physical and virtual platforms for conducting rigorous and transparent testing on methodologies, tools and new technologies related to the monitoring, control, management and security of large scale and complex critical infrastructure systems (CIS), namely the KIOS CoE Testbeds. These environments will allow researchers to examine the reliability, safety, security and resilience of a wide range of cyber-physical systems and add value to their research and innovation activities. Furthermore, this type of infrastructure can be utilized by the Center's collaborators and partners to advance the technological readiness levels of new concepts and tools as well as promote the efforts towards the co-creation of new products and services.



Power Systems

The Power Systems Testbed targets high penetration of Renewable Energy Sources (RES) to reduce greenhouse gas emissions. The testbed aims towards modeling, simulation, emulation, and experimental validation of energy systems, with capabilities in the development of smart technology for the efficient and reliable integration of renewable energy sources both at the building and grid level, as well as the generation and storage technologies. Further capabilities include the development of real-time control algorithms for power electronic converters to advance the interconnection of renewable energy sources.



Water Systems

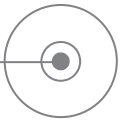
The Water Systems Testbed is an interconnected physical and virtual water transport and distribution system, which allow users to solve problems related to cyber-physical attacks, detection and mitigation of contamination events, energy efficiency of water pumps and efficiency of water resources management. The physical testbed is coupled with a virtual city of 10,000 inhabitants and captures the variability in the demands in a realistic way.



Transportation Systems

The Transportation Systems Testbed consists of robotic cars representing real-life Connected and Autonomous Vehicles (CAVs) at a scale of 1:10. The CAVs will play a significant role in future transportation systems and will provide enormous societal and environmental benefits in terms of reducing traffic accidents, enhancing quality-of-life, improving the efficiency and costs of transportation systems, and reducing greenhouse gas emissions. The testbed will be a real-time experimental platform with various sensors installed to collect real-time measurements that will allow the development and evaluation of novel monitoring, management and control schemes related to the recently introduced CAVs within a low-cost, controlled and safe environment.

All testbeds will be inter-connected through a Telecommunication network, comprising of both physical and virtual components.



Emergency Response Technologies

The KIOS CoE develops state-of-the-art tools and methodologies for emergency response management, monitoring and inspection of critical infrastructures through the utilization of Unmanned Aerial Vehicle (UAVs), sensors, and robotics technologies.

These technologies are used for the development of intelligent functionalities including automated path-planning, real-time image analysis, object detection and coordination architectures for multi-drone systems that ensure scalable and robust operations. The key benefits of such systems include the enhancement of public safety, improvement of CIS efficiency, safety of operations and hazards avoidance as well as reduction of person-hours and costs.



KIOS Virtual City

The KIOS Virtual City is a specially designed virtual platform to assist with the management and operation of interdependent critical infrastructures systems (e.g. water, power, telecommunications, transportation, and health systems) and can be used to assess the cascading effects of natural or manmade disasters (e.g. flooding, power blackouts) which can seriously impact people's everyday lives, affecting their safety and well-being.

The Virtual City emulates the actual operation of Critical Infrastructure Systems within the urban and sub-urban environment and offers a virtual decision support facility for assessing the security and efficiency of a city as well as its environmental footprint and operational costs.

This platform is ideal for use by policy makers, CIS operators and other stakeholders to assist them towards their decision making with respect to the management of a smart city environment.



Education & Training Activities

Education and training activities are essential for building and maintaining scientific excellence at the Center. During 2019, a number of activities have been implemented such as the launch of the MSc program in Intelligent Critical Infrastructure Systems and the organization of the KIOS Graduate Summer School, the Distinguished Lecture Series, and the Seminar Series.



Master of Science in
INTELLIGENT CRITICAL
INFRASTRUCTURE SYSTEMS

MSc Program in Intelligent Critical Infrastructure Systems

In September 2019, the novel MSc Program in Intelligent Critical Infrastructure Systems successfully launched and accepted its first class of students.

This program is offered by the Department of Electrical and Computer Engineering at the University of Cyprus in collaboration with the KIOS Research and Innovation Center of Excellence and Imperial College London. It is designed to train high-qualified engineers on the newest ICT approaches, in order to be able to deal with the challenges in monitoring, control, management and security of critical infrastructure systems. Students take a variety of courses, both theoretical and applied, including a Masters thesis that addresses a problem in one of four CISs, namely power systems, water distribution networks, telecommunication networks and transportation systems.

The duration of the program is 3 semesters (1.5 years) and is also available for part-time students (6 semesters / 3 years). Courses are delivered by academics from the University of Cyprus and Imperial College London.

For more information about the program please visit the website:
www.msccis.ucy.ac.cy

KIOS CoE Graduate Summer School

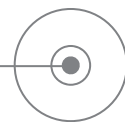
The KIOS CoE in collaboration with Imperial College London, organized the “KIOS Graduate Summer School 2019 on Intelligent Systems and Control” for the second consecutive year.

Two world-recognized experts in their fields, Professor Marco Gori (University of Siena, Italy) and Professor Alberto Bemborad (IMT School for Advanced Studies Lucca, Italy) led the school. Furthermore, the co-founder and Director of Chrysalis Leap, the first accelerator in Cyprus, Mr. Stelios Prokopiou gave a one-day course on entrepreneurship and innovation.

More than 70 participants from Cyprus and abroad participated in the KIOS Graduate Summer School 2019 and had the opportunity to broaden their knowledge and skills alongside internationally recognized scientists and mentors. (photo 1)



1



KIOS CoE Distinguished Lecture Series

The aim of the KIOS Distinguished Lecture Series is to host world-class researchers at the University of Cyprus and to deliver specialized lectures in relevant science and technology fields. In 2019, the KIOS CoE hosted 5 internationally recognized scientists who gave talks on cutting-edge research and innovation advances in their respective fields.

Professor Cesare Alippi from the Politecnico di Milano and Università della Svizzera Italiana gave a talk on "Adversarial learning and constant curvature manifolds to detect changes in graph streams" (photo 2). Professor Markos Papageorgiou from the Technical University of Crete presented the topic "Freeway Traffic Control" (photo 4). Professor Bart De Schutter from Delft University of Technology talked about "Multi-level control of large-scale traffic networks" (photo 3), whereas Professor Dragan Savić from University of Exeter and CEO of KWR Water Research Institute presented the topic "Smart Water Systems – Reality or a Pipe Dream?" (photo 1). Finally, Professor Zhongsheng Hou from Beijing Jiaotong University and Qingdao University gave a lecture on "PID and Its Puzzles – MFAC and Progress".

5

Distinguished
SCIENTISTS
shared their
KNOWLEDGE
and **EXPERTISE**
with researchers
in 2019



Honors & Awards

“ The KIOS CoE developed an innovative software platform to automate the operation of Unmanned Aerial Vehicles in emergency situations

KIOS Center of Excellence wins the Cyprus Innovation Award 2019

The KIOS CoE was awarded the “Cyprus Innovation Award 2019” in the Public Sector category, for its novel software platform “Swifttag”, from the Cyprus Employers and Industrialists Federation (OEB) (photo 1).

“Swifttag” is an innovative software platform developed at the KIOS CoE to automate the operation of Unmanned Aerial Vehicles (i.e., drones) in emergency response missions. Specifically, researchers designed, developed, and implemented efficient and robust search and rescue algorithms in order to enhance the situational awareness capabilities of the first responders in the field. The “Swifttag” platform was tested in emergency response exercises both in Cyprus and abroad, and was used in real emergency incidents by the Cyprus Civil Defense.

The award ceremony for the “Cyprus Innovation Awards 2019” took place on the 12th of December 2019, at the Hilton Park Hotel in Nicosia, during which the awards were presented by the President of the House of Representatives, Mr. Demetris Syllouris. The event was co-organized by the Cyprus Employers & Industrialists Federation and by the Cyprus Research and Innovation Foundation, with the support of the Cyprus Ministry of Energy, Commerce, Industry, and Tourism. During the ceremony, a video was presented describing the innovative technologies developed at the KIOS CoE (<https://www.youtube.com/watch?v=61vhFT1IzOs>).

The “Cyprus Innovation Award 2019” is a prime example of how innovative technology developed at the Center can have a positive contribution to our society. At the same time it also shows the potential of Cyprus towards becoming a regional research and innovation hub.

The UCY Entrepreneur Award

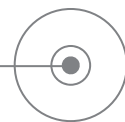
Dr. Demetris Eliades, currently a Research Assistant Professor at the KIOS CoE and co-founder of PHOEBE Research and Innovation Ltd, was awarded the “University of Cyprus Entrepreneur Award” for his entrepreneurship activities. During the presentation of the awards, Demetris presented his entrepreneurial journey and his vision to make research results accessible to industrial operators. Finally, he expressed his hope that, with the new spin-off legislation, more researchers will begin to explore the entrepreneurship avenue. (photo 2)



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Communication and Dissemination Activities

“ KIOS places special emphasis on communication and dissemination activities in order to encourage people to understand and appreciate the multiple benefits of research and innovation within society

The KIOS Research and Innovation Center of Excellence is committed to making its research activities and results accessible to its stakeholders, partners, and the general public. To this end, KIOS places special emphasis on communication and dissemination activities in order to encourage people to understand and appreciate the multiple benefits of research and innovation within society.

For the year 2019, the Center's dissemination and communication activities included:

- High profile events and visits
- Networking events with the industry
- Outreach activities
- Online presence
- Media publicity

High profile events and visits

In 2019, the KIOS CoE gained significant national and international visibility through high-profile events and visits that took place in Cyprus and the UK.

Examples include: (1) the KIOS CoE participation in the special event organized by Buckingham Palace and hosted by HRH the Prince of Wales (photos 1, 2) the visit of the Director-General of EU Research and Innovation Mr. Jean-Eric Paquet at the KIOS premises and (3) the special event titled “Opportunities for Research and Study through Imperial College London – University of Cyprus collaboration at the KIOS Center of Excellence”, which was organized by Imperial College London and the High Commission of the Republic of Cyprus in the UK.

During 2019, the KIOS CoE also hosted numerous official visits from international experts, national policy and decision makers, as well as enterprise and innovation experts.





Visit by Mr. Jean-Eric Paquet at the KIOS CoE premises



Special event organized by Imperial College London and the High Commission of the Republic of Cyprus in the UK

Networking events with the industry

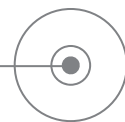
During 2019, the KIOS CoE organized three networking events to promote its research activities and the successful collaboration with its industrial partners through the KIOS Innovation Hub. The first event involved the Electromechanical Services Department (photo 1) of the Ministry of Transport Communications and Works, the second the Cyprus Police (photo 2) and the third the Public Works Department, the Limassol Water Board, the Electricity Authority of Cyprus, and the Cyprus Police. All events attracted stakeholders, decision makers and government officials and highlighted the benefits of research and innovation in the society.



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Communication and Dissemination Activities



Outreach Activities

Undergraduate Research Opportunities Program

The KIOS CoE organized the prestigious Undergraduate Research Opportunities Program (UROP) for young students for the 11th consecutive year. In 2019, KIOS accepted eight students into the program. The selected students had the opportunity to work with KIOS faculty and researchers on innovative research projects for 2 months.

Researcher's Night

The KIOS CoE participated in the Researcher's Night 2019, which was organized by the Research and Innovation Foundation of Cyprus. The KIOS CoE researchers demonstrated interactive activities related to renewable energy sources, water, transportation, and telecommunications networks, as well as robotics and drones.

Pancyprian Robotics Competition "Robotex Cyprus"

The KIOS CoE participated in the Pancyprian Robotics Competition "Robotex Cyprus", where the KIOS team demonstrated a robotic exoskeleton arm, as well as the capability of drones in detecting people and objects.

School Visits

In 2019, over 250 students visited the KIOS CoE premises and learned about the research and technology being undertaken at the Center. A number of the KIOS Researchers have also given lectures to pupils at public and private schools in various areas of Cyprus.

Online Presence

The KIOS CoE uses a number of online communication mediums to disseminate the Center's research results, news and events, achievements etc. Examples include website, newsletter, as well as our social media pages (Facebook, Twitter, LinkedIn, and YouTube).

Media Publicity

The research activity undertaken at the KIOS CoE has been widely published in the printed and electronic media. This includes a number of articles in newspapers and websites with large readership numbers.





The KIOS Center of Excellence project has received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreement No. 739551 (KIOS CoE).



The KIOS Center of Excellence project has received funding from the Government of the Republic of Cyprus through the Directorate General for European Programmes, Coordination and Development.

Complementary funding for the KIOS CoE is also provided by the University of Cyprus and Imperial College London.