

Vadim Ermolayev  
Aleksander Spivakovsky  
Mykola Nikitchenko  
Athula Ginige  
Heinrich C. Mayr  
Dimitris Plexousakis  
Grygoriy Zholtkevych  
Oleksandr Burov  
Vyacheslav Kharchenko  
Vitaliy Kobets  
(Eds.)



# **ICT in Education, Research and Industrial Applications: Integration, Harmonization and Knowledge Transfer**

Proceedings of the 12th International Conference,  
ICTERI 2016

Kyiv, Ukraine  
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Ermolayev, V., Spivakovsky, A., Nikitchenko, M., Ginige, A., Mayr, H. C., Plexousakis, D., Zholtkevych, G., Burov, O., Kharchenko, V., and Kobets, V. (Eds.): ICT in Education, Research and Industrial Applications: Integration, Harmonization and Knowledge Transfer. Proc. 12<sup>th</sup> Int. Conf. ICTERI 2016, Kyiv, Ukraine, June 21-24, 2016, CEUR-WS.org, online

This volume represents the proceedings of the 12th International Conference on ICT in Education, Research, and Industrial Applications, held in Kyiv, Ukraine, in June 2016. It comprises 62 contributed papers that were carefully peer reviewed (3-4 reviews per paper) and selected from 125 submissions. The volume opens with the abstracts of the keynote talks and invited tutorial. The rest of the collection is organized in 2 parts. Part I contains the contributions to the main ICTERI conference tracks, structured in four topical sections: (1) Advances in ICT Research; (2) Information Systems: Technology and Applications; (3) Academia/Industry ICT Cooperation; and (4) ICT in Education. Part II comprises the contributions of the three workshops co-located with ICTERI 2016, namely: 2<sup>nd</sup> International Workshop on Theory of Reliability and Markov Modeling for Information Technologies (TheRMIT 2016); 5<sup>th</sup> International Workshop on Information Technologies in Economic Research (ITER 2016); International Workshop on Professional Retraining and Life-Long Learning using ICT: Person-oriented Approach (3L-Person).

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## Preface

It is our pleasure to present you the proceedings of ICTERI 2016, the twelfth edition of the International Conference on Information and Communication Technologies in Education, Research, and Industrial Applications: Integration, Harmonization, and Knowledge Transfer, held at Kiev, Ukraine on June 21-24, 2016. This year's edition focused on research advances, business/academic applications of Information and Communication Technologies, design and deployment of ICT Infrastructures. Emphasis was also placed on the role of ICT in Education. These aspects of ICT research, development, technology transfer, and use in real world cases are vibrant for both the academic and industrial communities.

The ICTERI 2016 Call for Papers as well as the main conference itself were structured into four tracks reflecting these research fields.

The conference program was complemented by two invited keynote speeches, one invited tutorial, a Ph.D. mentors panel, industrial IT Talks sub-event, and the contributions to three co-located workshops:

- The 2nd International Workshop on Theory of Reliability and Markov Modeling (TheRMIT 2016) addressing long-standing research aspects of reliability modeling and assessment
- The 5th International Workshop on Information Technologies in Economic Research (ITER 2016) focused on cross-disciplinary issues in the use of Information Technology in economics and finance
- The International Workshop on Professional Retraining and Life-Long Learning using ICT: Person-oriented Approach (3L-Person 2016) presenting new uses of information technology for life-long learning

The rationale behind the Ph.D. Mentors Panel was to provide the opportunity to Ph.D. candidates to listen to and discuss the visionary ideas and promising topics for Ph.D. research offered by several renowned experts.

The tutorial by Prof. Oscar Corcho from the Universidad Politécnica de Madrid discussed the use of agreed vocabularies and appropriate data structures for supporting the sharing of open data in a smart city environment. The first keynote was delivered by Drs. John Davies and Sandra Stinčić Clarke from British Telecom on technical challenges for interoperability in the realm of the Internet of Things. In the second keynote Prof. Dr. Wolfgang Reisig of Humboldt University addressed the role of service orientation as a programming paradigm.

Overall ICTERI 2016 attracted a substantial number of submissions – a total of 122 comprising the main conference and workshops. Out of the 58 paper submissions

to the main conference we have accepted 27 high quality and most interesting papers to be presented at the main conference and published in our proceedings. The acceptance rate was therefore 46.5 percent. Our three workshops received overall 57 submissions, of which 35 were accepted by their organizers and also included in this volume.

The conference would not have been possible without the support of many people. First of all we would like to thank all the authors who submitted papers to ICTERI 2016 and thus demonstrated their interest in the research problems within our scope. We are very grateful to the members of our Program Committee for providing timely and thorough reviews and also for been cooperative in doing additional review work. We would like to thank the local organizers of the conference whose devotion and efficiency made this instance of ICTERI a very interesting and effective scientific forum. Finally a special acknowledgement is given to the support by our editorial assistant Victoria Kosa who invested a considerable effort in checking and proofing the final versions of our papers.

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