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Important Environmental and Social Systems as System-of-Systems (SoS)

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Abstract The sustainability of countries depends on a multitude of factors. Broadly speaking these factors can be grouped into two major categories, the ecosystem (ECOS) and the human system (HUMS). ECOS depends on four subsystems: AIR, WATER, LAND, and BIOD (biodiversity) and HUMS on another four: HEALTH (health system), WEALTH (economy), KNOW (education), and POLIC (policies). Each of these eight subsystems depends in turn on such inputs as CO_2 emissions, endangered species, children mortality etc. This is a multilayered setup of sustainability that can be viewed as a System-of-Systems.

To improve the sustainability of a country certain actions must be taken to lead the systems above to target regions. For example CO_2 emissions should be such that average global temperature won't exceed 2^oC by 2100 or children mortality should be as low as possible, say about that of the Scandinavian countries. To achieve such goals policies should be designed that work adaptively, unlike optimal control where uncertainties and prediction are first resolved. A number of scenarios is developed in the context of SoS that span all possible uncertainties to bring the system within the target region.

Each system is modeled as a SoS at various levels and each level is in turn modeled according to existing knowledge. Various adaptive policies are then designed that take into account missing intermediate targets. A host of strategies are finally developed so that environmental and societal systems contribute to

About the Speaker: **Yannis A. Phillis** received his diploma in electrical and mechanical engineering from the National Technical University of Athens, Greece, in 1973 and the M.S., Engineer Degree, and Ph.D. degrees from the University of California, Los Angeles, in control systems in 1978, 1979, and 1980, respectively.

From 1980 to 1986, he was with Boston University, Boston, MA. Since 1986, he has been with the Department of Production Engineering and Management, Technical University of Crete, Chania, Greece where he is professor and director of the CAM Laboratory. In 1992 and between 2005 and 2007 he was visiting professor at UCLA's Chemical Engineering Department. Between September and October 2008, as Onassis Foundation Senior Visiting Fellow in the US, he lectured on environmental issues in four American Universities. His research interests are in stochastic control, discrete-event systems, and applications in manufacturing networks and environmental systems.

Dr. Phillis is Editor of the Journal of Intelligent and Robotic Systems, Advisory Board Member for the IEEE Systems Journal, Associate Editor for the International Journal of Engineering Management, Member of the Editorial Advisory Board for the Environmental Engineering and Management Journal, and was on the Editorial Board of the Encyclopedia of Life Support Systems, and past Editor of the IEEE Robotics and Automation Magazine. He has also served as Trustee of the Venizelos Research Institute and the Center of Mediterranean Architecture in Greece between 1999 and 2005.

He is an AAAS Fellow and recipient of numerous honors among which Professor of the Year Award at Boston University in 1986, an award by the Academy of Athens for his environmental activities in 2007, Fellow of the Venizelos Research Institute in Greece, and recipient of awards by the Municipalities of Chania and Assini, Greece in 2005 and 2008 respectively for his service to society.

He was general chair of the Fifth International Conference on Advances in Communication and Control (1995) and the 3d and 5^{th} International Conference on Management of Technological Change (2003, 2005).

Dr. Phillis was rector of the Technical University of Crete for 10 years until 2005. In 1994 founded and developed the 80-acre Park for the Preservation of Flora and Fauna in Crete. The Park has a laboratory for the study and preservation of endangered plant species, which is also actively involved in ethnobotanical issues. The Park is visited by thousands of people every year.

He has published over 90 scientific papers and four technical books. He is an award winning writer in Greece and the US, having published five poetry collections, three novels, and two environmental books. He is a Fellow of AAAS; a Senior Member of IEEE; and Member of Sigma Xi; Poets and Writers, USA; P.E.N. Club; and the European Art Center, Athens.