Systems Analysis to Inform and Support Global Transformations

By Stephen M. Robinson, Elena Rovenskaya, and Ulf Dieckmann

Governments and private decision-makers worldwide are confronted with unprecedented difficulty. The challenges include the increasing scale and coupling of complex systems, the acceleration of technological advances, economic interactions, and information flows.

New Kinds of Global Challenges

Four relatively new trends heighten the difficulty of the aforementioned problems. First, the increasing scale of the world’s population and people’s activities—and hence their impact on the natural environment—runs the risk of exceeding planetary boundaries. Secondly, interdependencies among people, companies, and countries have grown to the extent that local failures in public services can create mass emergencies; the systemic risk underlying the latest global financial crisis is a prominent example. Thirdly, the high speed of technological advances presents challenges to governments and private decision-makers worldwide now confront problems of unprecedented difficulty. The challenges include the increasing scale and coupling of complex systems, the acceleration of technological advances, economic interactions, and information flows.

The key dimensions in these examples are economic, but rather social and/or political. The key is to recognize that “access to” does not necessarily mean “mastery of.” What we should be able to do is teach the students both how to work with experts in those other dimensions, and why such collaboration is necessary to develop solutions to problems arising in complex systems. As yet, few OR programs do this effectively. Some do not even realize that technical disciplines, it makes sense to do so by having students work to solve a complex, multidimensional real-world problem under the guidance of experts skilled in multidisciplinary research. In fact, this is quite feasible; the Young Scientists Summer Program (YSSP) at IIASA has utilized this approach for nearly 40 years, bringing together about 50 young scientists for three months each summer to work in this format as a multidisciplinary group.

A Practical Way Ahead

How might we change this situation? A helpful role model might be the “capstone” courses taken shortly before graduation by students in many engineering programs. In these courses, students work in teams to solve real-world problems in their respective disciplines, often in cooperation with industries or government agencies. This helps prepare them for the kind of situations they will face after graduation.

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