

OPENING ADDRESS BY THE IFORS PRESIDENT

Challenges for Operations Research

As President of IFORS you might expect that I am very optimistic about the future for operations research in the world. Indeed, I am. Furthermore, I do not feel that this is a misplaced optimism. For as I look at the situation, it is not a question of whether the glass is half full or half empty but rather that the glass is overflowing. We continually need to find larger "containers" to present the many successes of our field.

In a recent paper in the EURO Journal, my good colleague Jacques Lesourne used an interesting and accurate word in describing the world we face as operations researchers. He described this environment as "turbulent". Indeed our environment is turbulent. So turbulent, in fact, that 25 years ago when I first professionally entered operations research, no one in their wildest imaginings was predicting either the world we live in or the world of operations research we have today. Major economic, social and political forces are shaping new institutions and governments in Eastern Europe, Asia, South America and Africa. Technological progress proceeds at a rate which continues to raise productivity levels in the developed world to new heights each year. Scientific thought proceeds at a rapid pace - achieving such seemingly impossible results as superconductivity at near-ambient temperatures, genetic engineering of DNA and RNA molecules, and new visions of the Universe which constantly keep changing our ideas about its origins. In economics, market economies produce increasing standards of living. In the developed countries and many developing countries, health care has improved so that life expectancy at birth has lengthened to over 75 years for males and 80 years for females. We have conquered many diseases and are in the process of conquering more and understanding the actual phenomena of aging. Although this list could go on and on, it would not be complete without mentioning that aspect of turbulence in our world which greatly affects operations researchers: this is the turbulence caused by the phenomenal growth and change in the information and computing industries. Political, sociological, economic or industrial information that formerly took days or months to reach us now is virtually available in real time. Large computers which sold for millions of dollars now are on our desks for a few thousand dollars. This latter is also a boon to our many members from developing countries.

But where is operations research in all of this turbulence and change? Twenty-five years ago, IFORS had a handful of societies; it now numbers 38 member societies and is growing. There were a few journals; now there are dozens and dozens. There were a few degree programs; now there are hundreds. There were a few members of our member societies; now there are over 30,000 members and an additional tens of thousands of OR workers outside of our societies. So structurally and demographically IFORS has grown considerably.

Knowledge has grown also. Twenty-five years ago, one could master most of the written material in OR. Today there are so many subdivisions of mathematical programming alone that it is virtually impossible for any member of our profession to master that level of knowledge or to maintain it even if one gets to the point of understanding the main principles. The same is true in stochastic processes, simulation and decision theory. But, it is also true in such tried-and-true OR areas as production, inventory and scheduling. Again, 25 years ago there were but two or three or four books in those areas which contained pretty much the full extent of knowledge at that time. Today there are entire books devoted to flexible manufacturing, robotics systems, materials

requirements planning, just-in-time, facilities location, and distribution networks. In transportation alone we now solve problems involving the real-time optimal movement of thousands of rail cars across vast rail networks to significantly improve deliveries to the appropriate destinations on time. Some of this is being helped by satellite communications technologies and such innovations as bar code screening. But it is the basic OR modelling which provides the optimal scheduling and routing to make the supply to customer linkages effective and efficient.

Traditionally OR has found its primary strength as a multidisciplinary approach to solving important operational problems. We have the ability to systematically model complex phenomena which aid in the achievement of improved or optimal decisions and results. To do this we have developed an amazing depth of knowledge in theory and methodologies and an amazing number of successes in many practical applications. We have a highly recognized value by other disciplines as they seek to solve their own problems.

So what are the challenges for OR for the next decade or even more grandiously for the next quarter century?

1. We must continue to challenge ourselves to define broader boundaries for operations research. Pioneers in our field understood this. You here today understand this. We must continue to communicate this to our colleagues who are not here and to our students and employees. An example comes to mind involving a project undertaken by someone I know well in the United States. He faced the problem in how to deliver more effective medical and social care to the elderly in a large region. The problem was very similar to that underlying the Balance of Care model developed in Great Britain in the late 70s and early 80s. The interesting feature of both of these problems was that the OR person was the catalyst for the entire project and the only one who was able to bring systematic knowledge to bear on a complex problem involving physicians, nurses, economists, social workers and other professionals. Indeed, if it were not for the OR person's ability to dissect, analyze, systematize and define the situation, the work would not have proceeded effectively. The physicians knew a great deal of the pathology, diagnosis and treatment of disease. The nurses knew a great deal about the delivery of the physical and medical care to the patients. Social workers knew about coordinating and delivering social services in the area. Economists knew how to calculate cost benefit and cost effectiveness of various sub-programs. None of them, singly or as a group, were able to put the entire project together. However, doing so demanded a tremendous amount of energy by the OR person to learn the others' paradigms. He had to have sufficient knowledge of these other disciplinary areas to communicate and to structure the problem so it could be solved. Had the OR person stayed within the simple boundaries of problems he had known how to solve in the past, this project would have never succeeded.
2. We need to challenge OR workers to enter new fields. A new field I've entered is primary, secondary and vocational educational improvement. The issue is how can these areas be improved so that students and employees can receive the education they will need for a future highly technological world. The growth of new work in fields like education will directly affect business and engineering - our traditional strengths. Hopefully the persons entering new fields will maintain roots in OR as these fields develop; if not we will surely have advanced the quality of thought in other areas.
3. We must challenge ourselves to continue to expand the depth and breadth of the tools and methods and theories in our basic disciplinary areas so we can solve even more important real problems. We are all familiar with the tremendous impetus created in mathematical programming by the works of

Khachian and Karmarkar. Perhaps less distinctively associated with individuals' names, there are just as exciting advances in new modelling languages, graphics interfaces and decision aiding screens in simulation, in interactive decision aiding techniques in multi-objective, multi-constituency situations and in solution methods for large scale stochastic networks.

4. We must challenge ourselves to improve our professional artistry and skills in modelling. Models are becoming so complex that even our own colleagues have difficulty assessing their validity, reliability and flexibility. Good examples of this complexity are the new weather and environmental models which require the largest supercomputers. If nothing else were done, major improvements in modelling capability alone would put OR workers and their knowledge base in great demand.
5. Just as we have been able to exploit other disciplines for our advancement in the past, we must continue to challenge ourselves to learn and adopt knowledge from other disciplinary areas. We should not only continue to scan the traditional areas of mathematics, economics, and the physical sciences, but also new areas in the cognitive sciences, including artificial intelligence and linguistics; areas in the behavioral sciences including psychology, sociology; and areas in the experimental sciences such as statistics, genetics, econometrics and psychometrics. I personally have learned much from medicine and epidemiology in modelling the prevention of contagious diseases. Others are starting to use knowledge from genetics and evolution to create new computer algorithms and AI results.
6. We must challenge ourselves to learn from each other in the OR profession. There are diverse visions and approaches taken by colleagues from different cultures, countries and societies. From these we can learn much about how others incorporate different objectives and values in their decision processes. Values are particularly important because they change the modelling perspectives and decisions made. Also we can learn how the decision processes function and how some groups under certain conditions make more effective and efficient decisions to achieve their goals. Most importantly we can synthesize and extend the learning for further advancement.
7. We must challenge ourselves to discover advances in techniques, processes and approaches to solving policy and strategy problems. Our forte is in the operational area; our visibility is in the policy and strategy area. Jacques Lesourne in his recent EURO Journal article has given us new insight in how to accomplish this.

Given these challenges how might we accomplish this agenda?

For us as individuals we can:

1. tackle complex "messy" problems in teams
2. try new application areas
3. develop substance knowledge of our field, the "science of OR"
4. publish new initiatives outside our regular domains
5. learn new paradigms
6. continue to develop our traditional strengths

In our journals we can:

1. publish uncommon articles from other disciplines
2. publish papers which expand the borders of OR
3. create journals in new growth areas
4. publish articles on professional OR artistry and skills
5. publish for readers more than for authors

In our educational, business and governmental institutions we can

1. teach professional and craft skills
2. require a minor in another distinct paradigm/field for doctoral degrees
3. attract students who wish to solve problems of people, organizations, and technology using science and mathematics
4. require a practicum for MS and Ph.D. students
5. provide faculty with experiential leaves for industry or government OR and provide industrial/governmental OR leaders to universities
6. provide serious tutorials for lifelong learning for faculty, graduates and employees

In our member societies and in IFORS, we can:

1. sponsor meetings and conferences
2. seek new members from other disciplines
3. publish journals with outreach
4. encourage educational program development and quality
5. take risks in new fields
6. provide international information exchange
7. encourage cross-cultural and cross-country educational programs
8. advance OR in all nations

Our challenges are enormous and our capabilities equally so. Like the child in the toy store, there are so many exciting and interesting toys available that it is difficult to choose. I personally find it difficult because there is so much that I would like to know and do in OR. But with only limited time and limited intellectual capabilities I must make choices. Most of us face this situation. We do well. But what we need to do is to continue to ask our students and colleagues and employees to reach out for new challenges.

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BANQUET ADDRESS BY THE IFORS PRESIDENT

Greetings my friends and colleagues. I hope you are having a marvelous time at our conference.

On behalf of all of us, I would like to thank the members of the Organizing Committee for the excellent facilities and arrangements, for the smooth and professional manner in which the conference is operating and for their outstanding goodwill and hospitality: Nicholas Blesseos, Apostolos Bobos, Roulla Kaminara, Demetrious Papoulias, Costas Pappis, Gregory Prastacos and Aris Sissouras.

On behalf of all of us, I would like to thank the Greek OR Society, HELORS, and especially the Secretariat Kathy Papanastassatou for her outstanding work in helping to organize the conference.

On behalf of all of us, I would also like to thank the Program Committee for putting together worldwide, exciting, top quality speakers, workshops and sessions: Graham Rand, Hugh Bradley, Demetrious Papoulias, Sung Joo Park, Pierre Tolla and Andres Weintraub.

Because you often see their names but don't always see them, I would like to introduce the IFORS Administrative Committee members: Jacques Lesourne, Past-President; Peter Bell, Vice-President NORAM; Jean-Pierre Brans, Vice-President EURO; Roberto Galvão, Vice-President ALIO; Woong-Bae Rha, Vice-President APORS (not present); Luis Tavares, Vice-President; Helle Welling, Secretariat; and David Schrady, Treasurer.

Finally I would like to mention and introduce three persons who have attended all eleven of our IFORS Triennial Conferences over the past 33 years: Brian Haley from Great Britain, Germain Kreweras from France, and Hugh Miser from the United States. These three distinguished OR leaders are role models for us. They have and are giving dedicated service to the OR profession and to IFORS.

O.R.: WISDOM FOR THE WORLD TODAY

I would like each of you to take a few seconds and think of someone you know who is a wise person. It may be your mother, father, brother or sister. It may be a professor, a politician, a friend or some figure in history. Now, in thinking about that wise person, what characteristics does he/she have?

I am not a philosopher but as a layman, I view a wise person as:

1. usually older, more mature
2. usually understanding and intelligent
3. usually having broad experience
4. usually able to make good decisions or give good advice on complex people-related problems

Indeed, I think of Wisdom as the knowledge and understanding to make the correct analysis and decisions about a problem. Wise persons do just that.

Now, what is Operations Research? OR is an approach and methods and theories to make the best decisions about a problem in an environment of scarcity and, often of uncertainty and complexity. So OR is a field which indeed provides Wisdom for the World Today.

In the early days of OR:

1. OR problems were simpler - not because complex problems weren't available, but because we didn't have the methods and tools to handle them.
2. OR methods and tools were simpler. And we have expanded our knowledge base by being creative and by borrowing heavily from others.
3. OR applications were primarily military logistics and manufacturing, inventory, and production.

TODAY:

1. OR is older, more mature, wiser and more capable. We understand our strengths and weaknesses better. We have pride in what we know and have accomplished.
2. OR has many successes beyond the military and manufacturing - into the areas of health, energy, transportation, environment, marketing, finance, agriculture, and on and on.
3. OR has deeper theory and methods it can call its own and that other fields "borrow".
4. OR is developing the beginnings of some "science" - some physical truths about human and systems behavioral phenomena.

We can solve much more difficult and important problems today. This is not the boast of Scaramouche in the Comedia dell'Arte and Farce. We have passed the acidity test. Our litmus paper shows great change.

But we have more to do. As I toured Crete, Istanbul and Athens prior to this Conference, I was inspired by three great wise civilizations. First, I was singularly impressed with the Wisdom of the Minoans four millennia ago. They constructed great buildings and social structure. And even now, one sees the remains of a water and sewage system better than many places in the world today. They were so wise as to understand fully that a great society cannot exist in the absence of the public health of its people. Surely they had little, if any, typhus or dysentery.

Next, I was awed by the Hagia Sophia in Istanbul - the early Byzantine church dedicated to Wisdom. The very massive dome (perhaps near 200 feet in diameter) is supported by only four corner columns. This marvelous knowledge of engineering was lost for centuries through the Middle Ages.

Finally, I was overwhelmed by the sense of history of the Acropolis - with its tribute Palace Athena to the Goddess of Wisdom herself. She gave the Athenians the olive tree, which brought peace, stability and nourishment to a people so they could afford the time and effort to develop one of the most learned, wisest civilizations of the world.

OR has far to go to achieve such Wisdom. But every OR generation adds to this treasure. I paraphrase what another civilization also having great wisdom, the ancient Chinese, have said: "A journey of 1,000 miles begins with a single step".

Each year OR takes new steps.

So I say: Hurrah! Hurrah for Operations Research, for this Congress and for IFORS! Wisdom for the World Today!

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