

**The Past is Prologue:
Reflections on 40 Plus Years
of System Dynamics Modeling Practice
(Lifetime Achievement Award Address)**

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THREE PROJECTS

A call for change

A burning question

A vision for change

- Thank you Dennis. Thank you, Jack, John, Peter, Khalid and Earling for honoring me with this award.
- When I received Jack email, one Sunday morning in Singapore, my first response was to check for mistaken identity. You see, I had experienced a case of mistaken identity at our Seoul conference. After a plenary session, a group of students saw “RICHARDSON” on my name. They gathered around for a group photograph.
- As bulbs stopped flashing, one student told me, proudly, I loved your book on Feedback Thought in Social Science and Systems Theory.



- Faces fell as I explained “you have the wrong Richardson.” Happily I spotted George nearby and was able to lead the group to him. George has won many awards and I have no doubt he, too, will be acknowledged for his lifetime contributions.



Heather Richardson and
one of her creations

- Let me acknowledge two very special people who are here today. First is my daughter Heather whose creativity and compassion never fails to inspire me.



Elizabeth Ong Ling Lee,
Director, Research
Support Group
Lee Kuan Yew School of
Public Policy

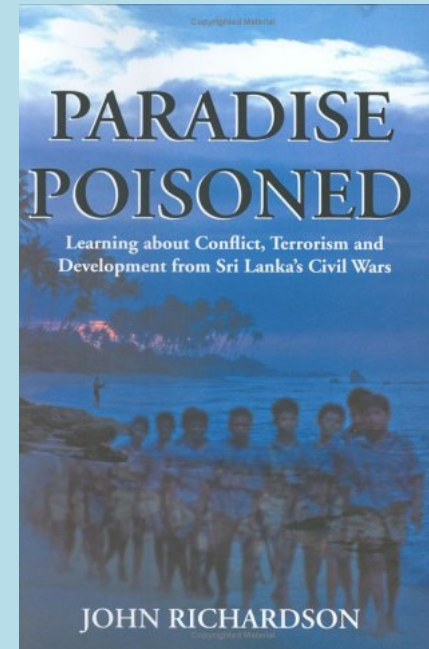
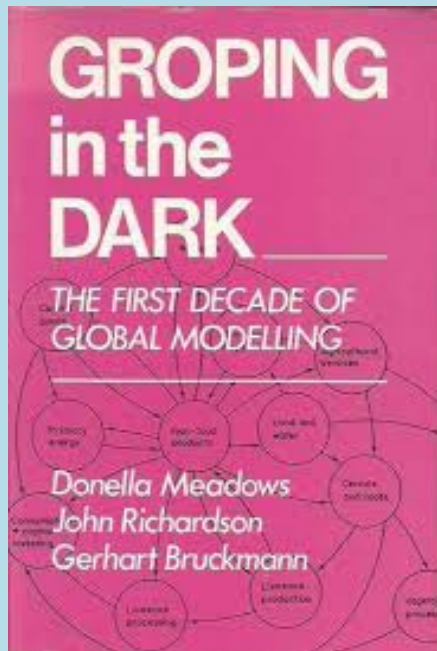
- My Lee Kuan Yew School colleague, Elizabeth Ong Ling Lee, traveled all the way from Singapore to be here. Our joint work in Singapore, would not have been possible without our partnership. A second colleague, who could not be here today, Rehan Ali has also been an invaluable partner, especially in my teaching.



Emily Richardson, Adjunct Professor, University of Maryland, at an event

- My wife Emily also not here today, has supported me, without complaining, as I pursued one twenty year project on the other side of the world, and when that was completed, almost immediately chose another focused on an even more distant location.

Three Projects



The Improbable Resilience of Singapore

By John Richardson, Elizabeth Ong



The city of Singapore has rapidly advanced over the past four decades, posting average economic growth of 8.5 percent between 1965 and 2005. It has also managed this growth responsibly, argue the authors, a historical narrative that could offer insight into achieving goals of sustainable development.

OVERVIEW – THREE PROJECTS

- When I asked Dennis for suggestions this talk, he told me: “Just share some of the interesting projects you have worked on and where they have had led you, he told me.” Following that suggestion, I have picked just three projects.
- The first produced a book called *Groping in the Dark: the First Decade of Global Modeling* coauthored with Dana Meadows and Gerhart Bruckmann. I’m glad to see have a session on Global Modeling this week. These projects looked at problems we now label with words such as sustainability and resilience. Probably many of you have read “The Limits to Growth,” co-authored by Dana Meadows, Dennis Meadows and others, which described the first of these projects
- A second project used system dynamics to seek better understanding of why development efforts by people like me were so often followed by violent conflict rather than improvements in human well-being. A book called *Paradise Poisoned: Learning about Conflict, Terrorism and Development from Sri Lanka’s Civil Wars* described this work.
- A third, recently initiated project, focusing on Singapore’s development has returned to the issues highlighted by global modeling projects. It again seeks to answer questions about sustainability and resilience, focusing on questions of urban development in particular.



- Before turning to Groping in the Dark, I need to say something more about my relationship with Dennis Meadows, because it has played such an important role in my System Dynamics Modeling work. It all began when Dennis and Dana welcomed me as an ad hoc member of their Limits to Growth modeling group at a NATO Advanced Study Institute they were teaching in Hannover, Germany, more than 40 years ago.



- Later, Dana and I collaborated on several projects, including Groping in the Dark. After Dana died, Dennis invited me to reconnect with the Balaton group, a network of sustainability focused scholar-practitioners.

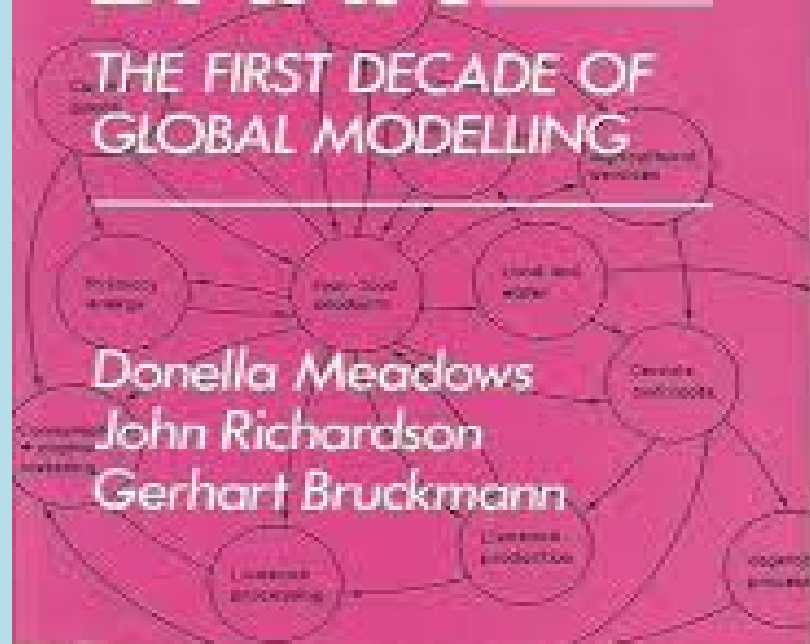


- The Balaton Group played an important role shaping my work in Singapore. This is a friendship that has empowered and enriched me, professionally and personally for more than 40 years and continues to do so. Thank you.

GROPING in the DARK

THE FIRST DECADE OF
GLOBAL MODELLING

Donella Meadows
John Richardson
Gerhart Bruckmann



When I learned I would be speaking today, I knew that *Groping in the Dark, The First Decade of Global Modeling*, would be one project I wanted to share.

Let me describe three qualities that made it distinctive.

- The first was its content.
 - It began with a parable and ended with a prayer
 - It was written on four different colors of paper
 - It included personal reflections of the authors, some expressed in blank verse poetry.
- Second was its theme of consensus. This differed radically from the image presented in news reports and other popularizing media of squabbling prima donnas presenting radically different views of humanity's future who couldn't agree on anything.
- Given these deviations from academic norms, the fact that the book also survived rigorous vetting and was published by John Wiley and sons, one of the worlds' leading publishers in science and technology also made it distinctive.
- *Groping in the Dark's* most important messages are the "lessons about the world," intended for general publics, However since this is an audience of modelers, let me first share one lesson about modeling. 40 years later many debates about the utility of modeling still fail to acknowledge them.

Should “models” be used is
not the question.
Both mental models
and
computer models
are needed!!

- We emphasized that every decision is based on some approximation of reality. There is no absolute “reality.” Asking the question, “should models be used” is silly. What is the best model for the task at hand should always be the question.

“LESSONS ABOUT THE WORLD”

- There is no known reason why basic needs cannot be supplied for all the world's people into the foreseeable future.
- Population and physical capital cannot grow forever on a finite planet.
- Cooperative approaches turn out to be more beneficial in the long run to all parties than competitive ones.

Lessons about the world

- We wrote our 12 lessons about the world when we realized differences we modelers argued about focused on arcane technical issues of little interest to members of our “everyone” audience, even if they understood them. Yet in personal conversations we had agreed about many issues of fundamental importance. Our 12 lessons became Groping in the Dark’s most widely quoted excerpt.
- This view shows three of the most important ones.

We must not destroy the system upon which our sustenance depends.
Poverty is wrong and preventable.
The exploitation of one person or another degrades both the exploited
and the exploiter.
It is better to cooperate than to fight.



THE FUTURE WILL BE IN OUR HANDS AND WILL
BE NO BETTER OR WORSE THAN WE MAKE IT.

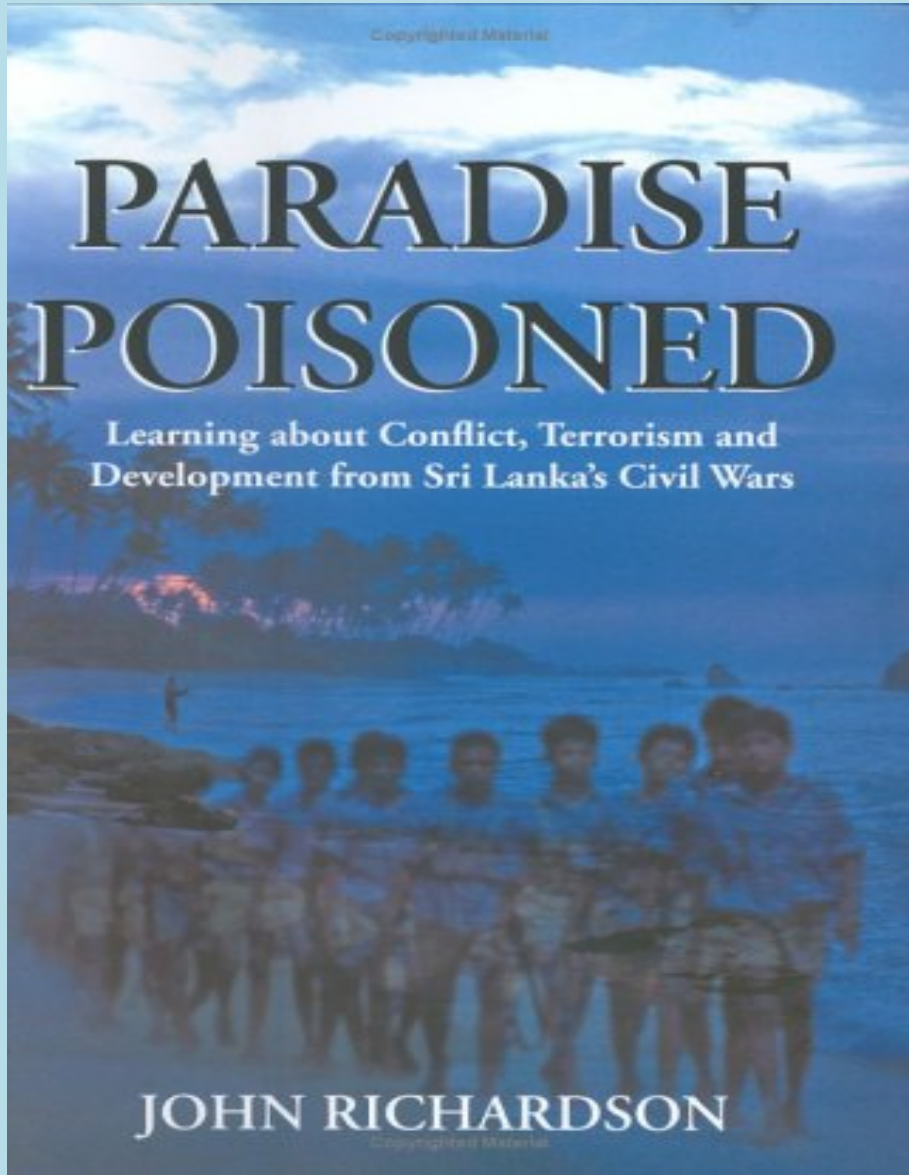
HERE IS AN EXCERPT FROM OUR CONCLUDING PRAYER (Don't Read)

- We must not destroy the system upon which our sustenance depends
- Poverty is wrong and preventable
- The exploitation of one person or nation by another degrades both the exploited and the exploiter
- It is better to cooperate than to fight
- The future is in our hands and will be no better or worse than we make it.
- These messages have been around for centuries, we concluded,
- They reemerge periodically in different forms
- And now in the outputs of global models
- Anything that persists so long and comes from such diverse sources as gurus and input-output matrices must be coming very close to
- the truth.
- We all know the truth, at some deep level, within ourselves.
- We have only to look honestly and deeply to find it.
- And yet, we don't live as if we knew it.
- Maybe it's worth thinking another way,
- as if we cared and made a difference.
- Even if its just groping in the Dark.

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PARADISE POISONED

Learning about Conflict, Terrorism and
Development from Sri Lanka's Civil Wars



JOHN RICHARDSON

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- Here is the cover of Paradise Poisoned. Everyone who sees this book for the first time reacts in the same way. “That’s a big book” they say and it is. 763 pages, in fact.



Amir Abbas Hoveyda, Iran's longest serving Prime Minister. Executed by a Revolutionary Court, April 7, 1979.



- Motivation for writing it came from viewing graphic pre-execution photos of a man with whom I had enjoyed friendly conversations, Iran's former Prime Minister Amir Abbas Hoveyda. I had consulted with the Shah's government, along with others in our global modeling group, on long-term development issues.
- Iran's revolution nagged at me - it nagged at my conscience. Did my work contribute to the scenario that ended Dr. Hoveyda's life with three bullets to the back of his neck? Was it possible, or even probable I asked myself, that international development practice could contribute more to deadly conflict than enhanced well being? Twenty years later, Paradise Poisoned concluded that, not infrequently, the answer was "yes."

Paradise Poisoned – Lessons

- A primer of system dynamics thinking, modeling and analysis
- A discussion, with examples, of why and how reference mode graphs can be useful.
- It demonstrates value of case studies, over long time periods in which one “immerses oneself in the system.”

What do I view as this work's most useful contributions to our field.

- First, it provides a primer of basic system dynamics thinking, modeling and analysis. It emphasizes the importance of a world view comprising feedback loops and delays, why explanations must be framed in terms of relationships between structure and behavior, why the parable of the blind monks and the elephant points to shortcomings in so much of discipline based research
- Second, it provides a technical discussion of why developing reference mode graphs, describing problematic behaviors over time is useful. It illustrates this utility by describing events-based violent conflict and state sanctioned violence reference modes that picture the first 40 years of Sri Lanka history.

- Third, it provides a compelling argument, based on theories of the relationship between structure and behavior as to why systems analyses focusing on a single case, unfolding over a long period of time, may provide a more valid basis for generalizing than generalizations based on correlations of cross sectional data describing a number of countries. It deeply immerses readers in the case by combining system dynamics modeling with historical-archival research, ethnographic field research and political economy.



- What about giving advice to policy makers based on research such as this? A Low profile, humility and circumspection are good watchwords. What comes to mind is talk I gave years ago in Sri Lanka, to an auditorium filled with policy makers, during a time that two civil wars, one involving urban terrorism in Sri Lanka's capital city Colombo, where we were meeting, were raging, I told them that I was happy to offer recommendations based on my research, but understood that policy implementation involved much more. I emphasized that my prayers might be as useful as my recommendations; perhaps even more so.

Location of SINGAPORE in world map



Map not to Scale

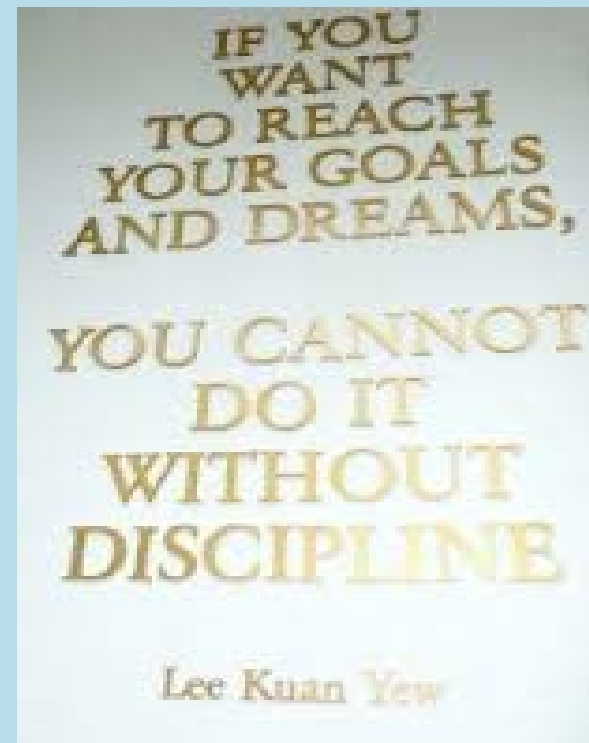
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- Now to project number three, focused on research, teaching and program development, emphasizing System Dynamics Modeling, in the small Island City-State of Singapore.
- What motivated my interest in Singapore? I knew it was a development success story that was at or near the top of world rankings on many indicators. Modernization had been achieved - peacefully in a multiethnic society that resembled Sri Lanka in some respects.



Lee Kuan Yew
School of Public Policy

National University of Singapore



- After some exploratory work and a brief visit to Singapore I wrote the Dean of Singapore's Lee Kuan Yew School of Public Policy and asked if he will be willing to have the school host me for a six month sabbatical.
- At this point, serendipity intervened, The Director of the Lee Kuan Yew School's Institute of Water Policy, was a former MA student of Khalid Saeed's and passionate about raising the profile of system dynamics modeling in Singapore. This created the opportunity in 2010. for a seven-month sabbatical leave appointment at the Lee Kuan Yew School as Visiting Professor. Elizabeth Ong became my research assistant. A teaching opportunity followed and, after a few bumps along the road I assumed primary responsibility for teaching system dynamics modeling at the Lee Kuan School in 2012 with an appointment that is projected to continue at least through 2015.

PP5294: Dynamic Modelling of Public Policy Systems



Health and Healthcare



- 1:10 PM *Burden of Chronic Kidney Disease in Singapore*
- 1:20 PM *Diffusion of TB Infections in Indonesia, 1990-2011*
- 1:30 PM *Controlling the Plague in Eyam, England, 1665*
- 1:40 PM *Nursing Capacity Shortage in Public Hospitals in Singapore*
- 1:50 PM *Overcrowding in Singapore's Hospitals*
- 2:00 PM *Pollution in Beijing*

Business



- 2:10 PM *Dynamics of Hawker Centres in Singapore*
- 2:20 PM *Low Productivity in Singapore*
- 2:30 PM *Strengthening R&D in Singapore*

Populations



- 2:40 PM *Atlantic Cod Fishery Depletion in Newfoundland, Canada, 1900-2000*
- 2:50 PM *Declining Resident Singaporean Representation in Singapore*
- 3:00 PM *Hog Production and Consumption in China*
- 3:10 PM *Post-Earthquake In-Migration to Mansehra, Pakistan*

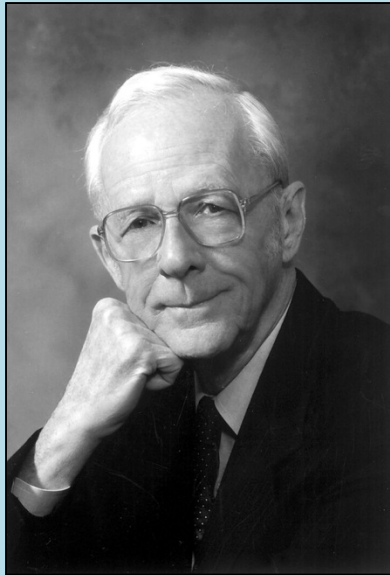
Resources



- 3:20 PM *Incineration: Better Waste Management?*
- 3:30 PM *Recovery of Costa Rica's Forests*
- 3:40 PM *Recycling in Singapore*
- 3:50 PM *Water Supply and Demand in Singapore*

In 2013, 35 graduate students from four different University faculties, successfully completed the course. It culminated in a public event where students presented 18 original modeling projects. 29 guests from the wider Singapore community, including representatives from four government ministries, three research institutes, three other Singapore universities and two for-profit consulting groups attended. Most remained for the entire three hours of presentations.

Jay W. Forrester



Commonalities

Lee Kuan Yew



Both believe:

- Well being is the goal of city leaders
 - Wealth is required to sustain well being
 - A city is master of its own destiny
-
- Well being means physical security, housing, educational opportunity and employment opportunities for all
 - Long term planning is important and, when implemented, can be unpopular
 - Cities must control their borders or otherwise or make themselves unattractive to those who will not contribute positively to well being

Note: Apparently, Lee Kuan Yew was not familiar with Jay Forrester's work.

- Research has also been part of our agenda.

Here are just two examples.

- First is Elizabeth Ong and my paper, *The Relevance of Urban Dynamics to Singapore's Success Story: Lessons for Moving Beyond the Crisis*. Elizabeth presented this at our Society's 2010 Conference in Seoul. It showed how Singapore's development was due, in large degree, to applications of principles from both *Urban Dynamics* and *World Dynamics* by political leaders who were not even familiar with Professor Forrester's work.

The Improbable Resilience of Singapore

By John Richardson, Elizabeth Ong



Mike Behnken

The city of Singapore has rapidly advanced over the past four decades, posting average economic growth of 8.5 percent between 1965 and 2005. It has also managed this growth responsibly, argue the authors, a historical narrative that could offer insight into achieving goals of sustainable development.

- A second paper that Elizabeth and I co-authored, the improbable resilience of Singapore, drew lessons about coping with the unpredictable crises that might arise from overshoot and collapse. These, we argued, were similar to the challenges Singapore's leaders faced and successfully overcame when independence was precipitously forced upon them, in 1965, by Malaysia's government.



SINGAPORE:

A LAND OF OPPORUNITY FOR SYSTEM DYNAMICS

We are piloting a program in system dynamics modeling with one of Singapore's most prestigious elite college preparatory schools.

In the words of the School's Vice Principal, Goh Hoc Leong, "this is part of our grand plan to introduce and promote systems thinking and modeling to all youth in Singapore."

- One insight I have gained is that Singapore is a land of opportunity for applications of systems analysis, especially when rigorously grounded in system dynamics models, intended to impact public policy.
- Among many reasons, I find one particularly exciting. This is the strong emphasis on science and technology in secondary schools. This makes Singapore an unusually receptive environment for achieving Professor Forrester's goal of a society populated by "Systems Citizens."

- Those are my three projects - do I have anything else to share? To borrow a phrase popularized by the late Steve Jobs in his product launches there is just one more thing. That one more thing is: CHINA



CHINA

POPULATION: MORE THAN 1.3 BILLION

STUDENTS ENROLLED IN HIGHER EDUCATION – MORE THAN 20 MILLION

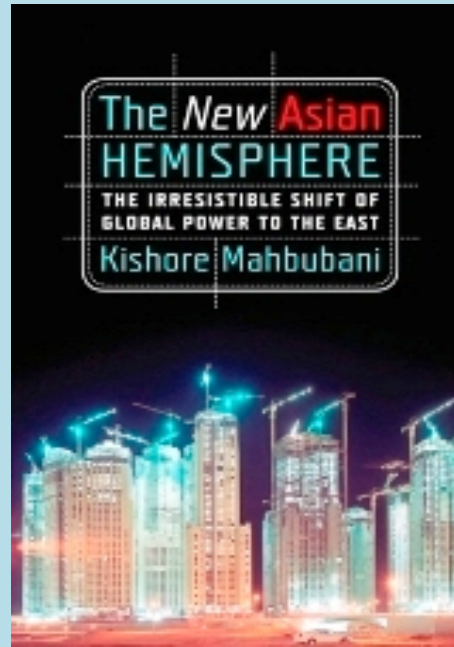
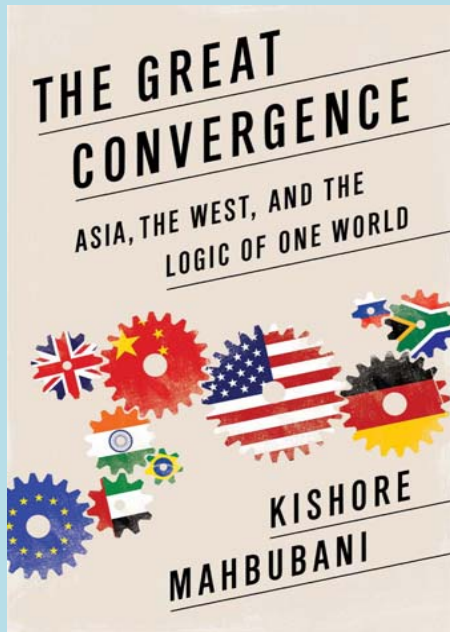
UNIVERSITY GRADUATES IN RECENT YEARS - ABOUT 6 MILLION

PERCENT URBAN POPULATION – MORE THAN 50%

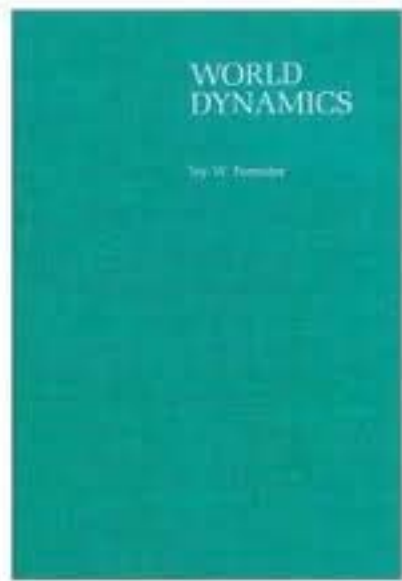
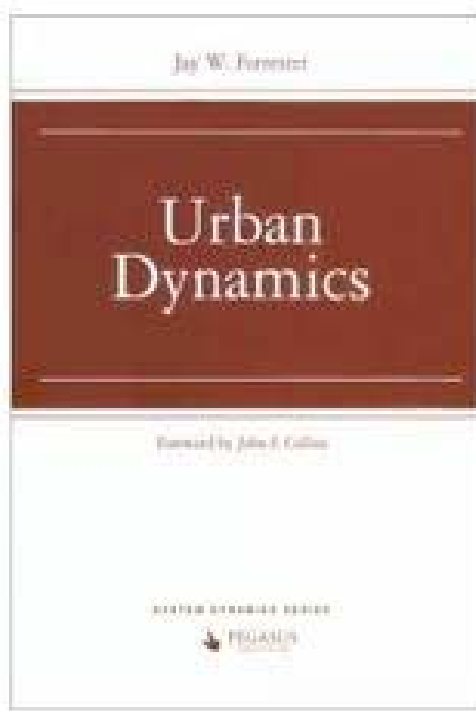
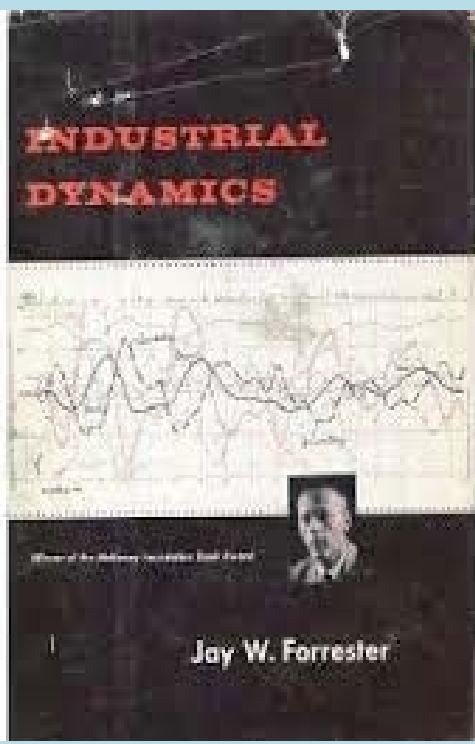
SOME ESTIMATES PROJECT THAT THE SIZE OF CHINA'S ECONOMY WILL SURPASS THAT OF THE US WITHIN THE NEXT DECADE

SYSTEM DYNAMICS SOCIETY MEMBERS: LESS THAN 25.

- Here are some compelling statistics on China's population, higher education enrollment, university graduates, urbanization and prospects of the size of its economy.



- I first become conscious of the opportunity that China offers System Dynamics Modeling from speeches and writings of the Lee Kuan Yew School's Dean, Kishore Mahbubani.
- I have found two of his insights to be particularly useful. First is that many Chinese (and Singaporeans too) make a distinction between democracy and good governance. This point is also a subtext in Jay Forrester's classics Urban Dynamics and World Dynamics. Further many Chinese leaders recognize that virtues claimed for the unfettered invisible hand must be balanced by virtues of community, stability and good governance.
- I believe than many China are open and eager for new visions of how regional, national and the global economies can function sustainably, with resilience and a concern for human well-being. Since Deng Xiaoping's iconic visit and first meeting with Lee Kuan Yew in 1978, Singapore has been place to which they look for inspiration.



- Can our system dynamics community make a contribution to this agenda? My experience teaching at the Lee Kuan Yew School tells me the answer is yes. I am convinced that foundational works in system dynamics modeling can capture the imagination of many Chinese because I have experienced the impact of these works on my students.

ECONOMIC DYNAMICS

Jay W. Forrester

Beyond Greed and Competition

*A New Economics for
the New Millennium*



Image from <http://sheepwaker.tripod.com/greed.jpg>

- But one more foundational work is needed. It is the fourth pillar of Professor Forrester's legacy, a transformational book on economic dynamics. Also needed is popularized book building on that work, playing the same role that Limits to Growth played for World Dynamics and The Dynamics of Growth in a finite world.
- Many years ago, it was my privilege to work for a year the National Model project and to gain an appreciation of this work's path breaking significance. That is one reason I have been such a nag about it.
- I ask God's blessing on Professor Forrester and on those who may be lead to support him in the completion of this landmark work.



- In March 2012, I celebrated my 74th birthday in Singapore. I had just finished reading Ezra Vogel's brilliant biography of Deng Xiaoping.
- I learned that the year Deng became paramount leader of China was also the year he celebrated his 74th birthday.
- I wrote a note to myself and pasted it below the keyboard on my MacBookPro. It remains there today.

**DENG XIAOPING WAS BORN IN 1904
HE BECAME PARAMOUNT LEADER IN 1978
HE LEAD CHINA THROUGH OCTOBER 1992
HIS LEADERSHIP TRANSFORMED THE COUNTRY**

**WHAT I HAVE DONE IS PREPARATION
FOR WHAT I WILL DO**

**MY MOST PRODUCTIVE YEARS
LIE AHEAD**