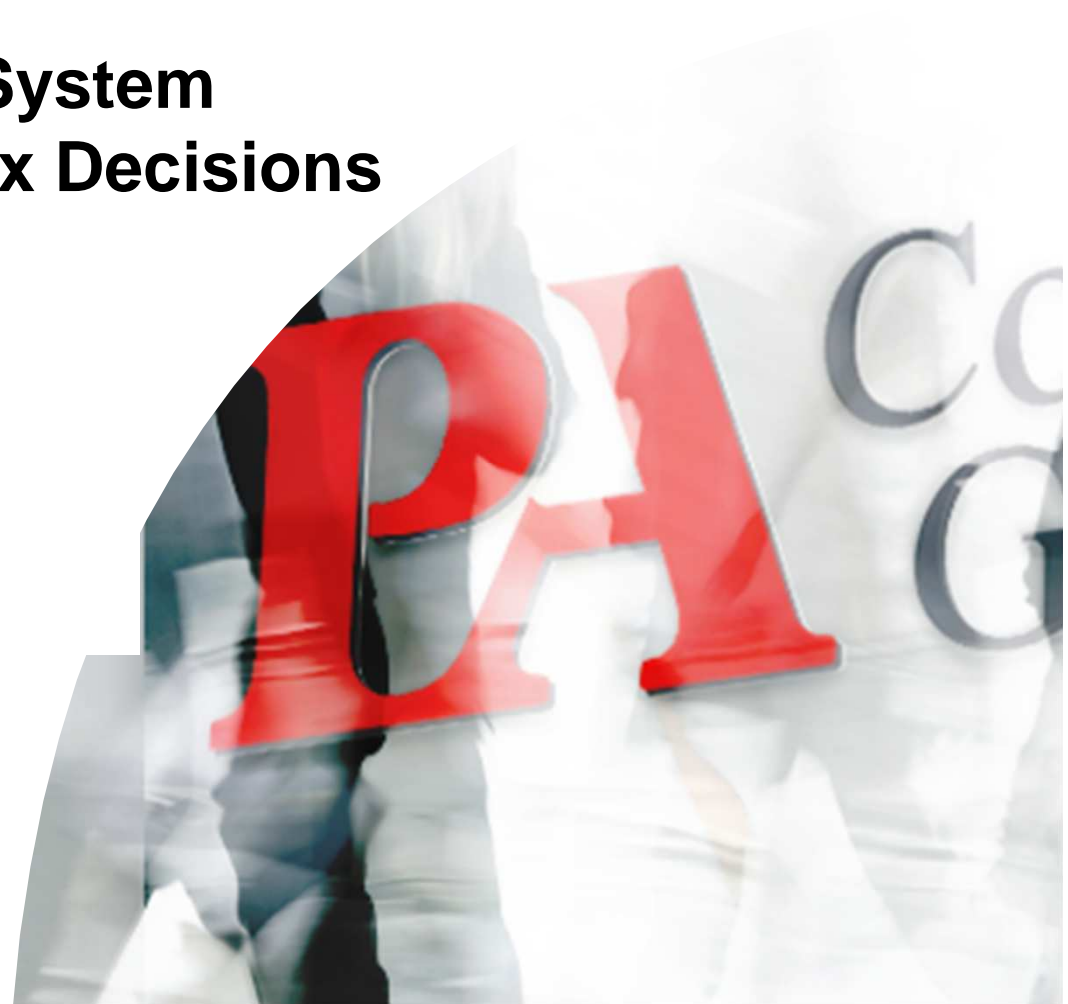


# Lessons From Using System Dynamics For Complex Decisions

Tom Mullen, PA Consulting Group  
Colonel Jim Baker, Joint Staff

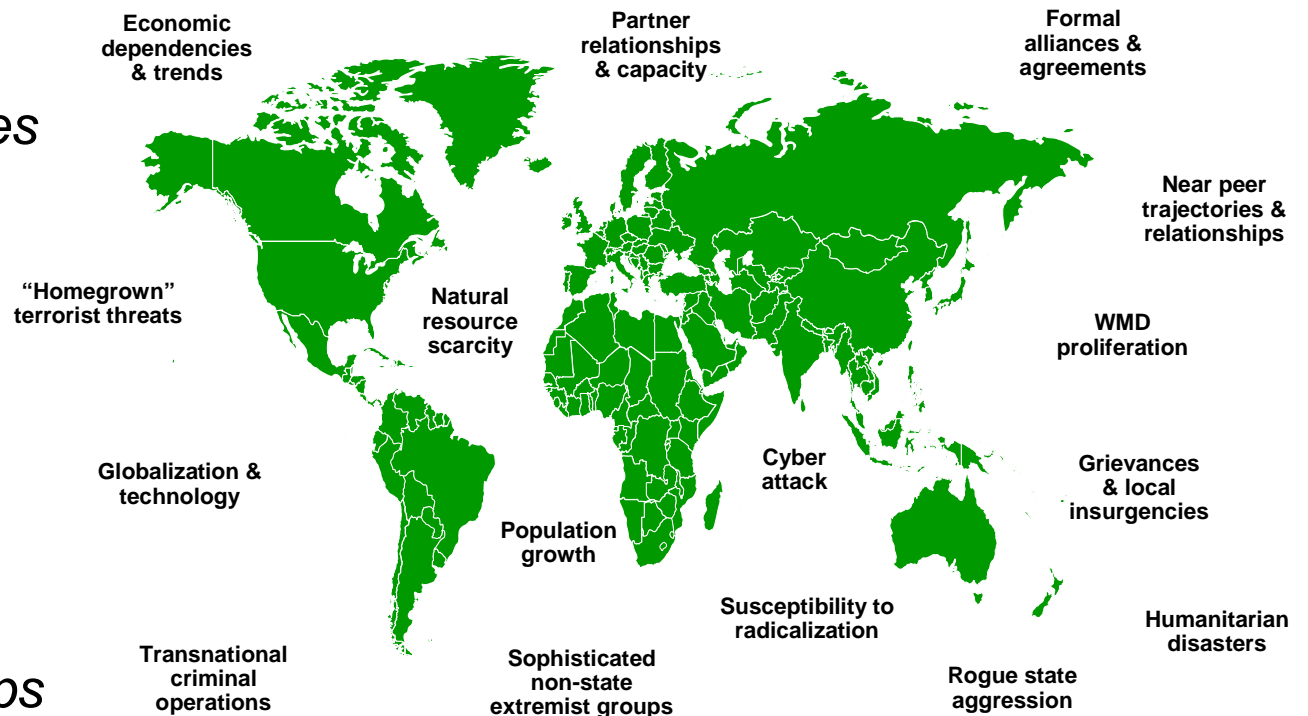
25 July 2011



## Context – lessons from work helping leaders on important challenges ...

### We face many big challenges with:

- *Overlapping objectives*
- *Complex histories and relationships*
- *Unintended consequences*
- *Long time delays*
- *Poor coordination across involved groups*
- *Difficulty understanding the full impacts of actions*



***These are hard problems with many dynamics!***

***Analysis is only part of the challenge ...***

There are many lessons from using System Dynamics to help address difficult problems in complex organizations

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## **A few recurring challenges ...**

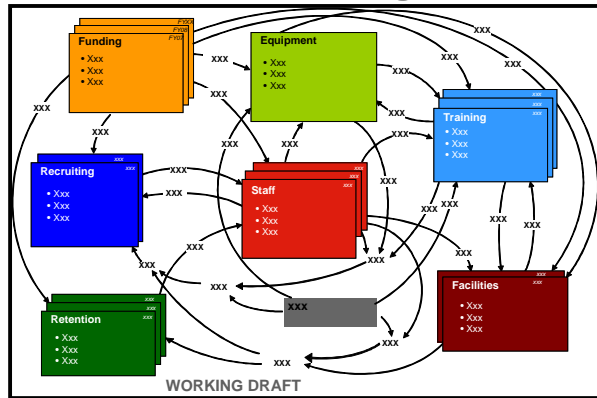
1. Match the method to the problem
2. Theories are different from reality
3. You will be a sound bite
4. Work in both the boardroom and the field
5. Use different formats to get your message out
6. Don't rely only on System Dynamics
7. Don't be discouraged by politics

***These may be familiar to many of you ...  
... we have some fresh examples to share!***

# Lesson 1: Match the method to the problem

*If you hear ... “We want to model this” ... consider what approach makes sense:*

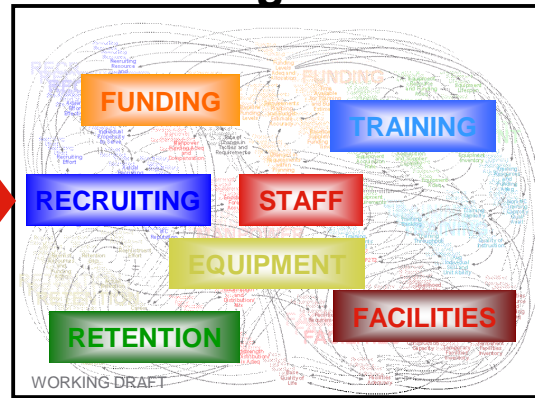
## Enterprise-Level Block Diagram



### Benefit:

- Create integrated view of organization to elevate discussions
- Fill a gap – had no rigorous way to assess enterprise-wide impacts of key actions and decisions

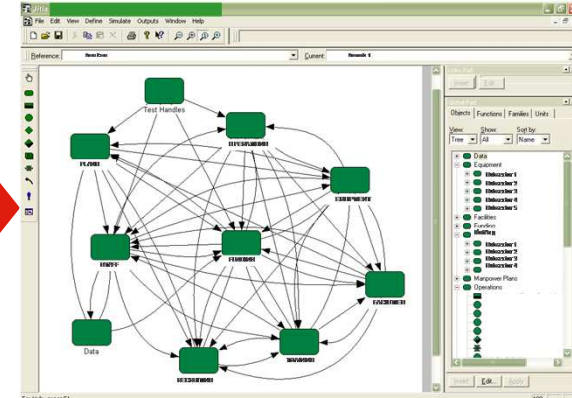
## Causal Dynamics Diagram



### Benefit:

- Help identify challenges and examine mitigation options qualitatively
- Identify potential unintended consequences to manage

## System Dynamics Model



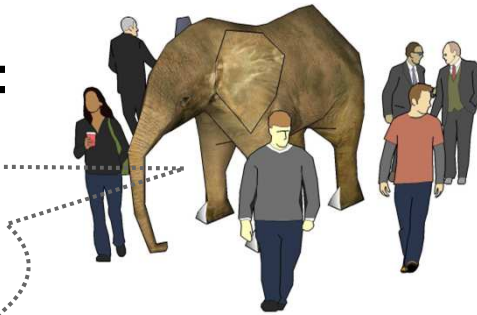
### Benefit:

- Quantify impacts over time of different options to manage growth
- Quantify factors ignored by more linear / narrower analyses
- Help those who want hard numbers

## Lesson 2: Theories are different from reality

### One expert's theory for solving the challenges of getting disaster relief to victims of the 2005 tsunami:

*"People in [this country] are very musically oriented so to make a quick impact after a disaster it is important to use the popular music favored by the different classes...."*



Reality has many complications ...

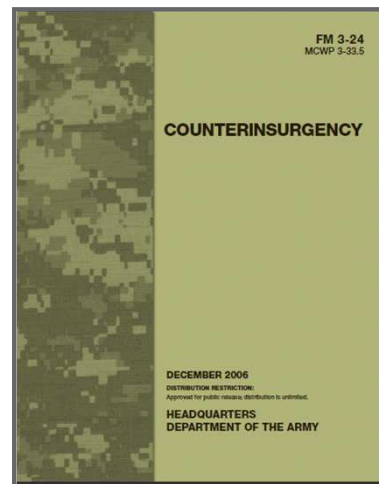
#### HOA Complexities:

- Low literacy
- High poverty
- Poor border controls
- Low government 'legitimacy', with military abuses against citizens
- Limited/no public services
- Ethnic, clan and regional conflicts and many insurgencies
- ...

#### Theory...

Field Manual 3-24 summarizes DoD approach to counterinsurgency

We developed a model to illustrate the dynamics of this theory



Field Manual 3-24

#### ... Reality



Horn of Africa (HOA)

# Lesson 3: You will be a sound bite



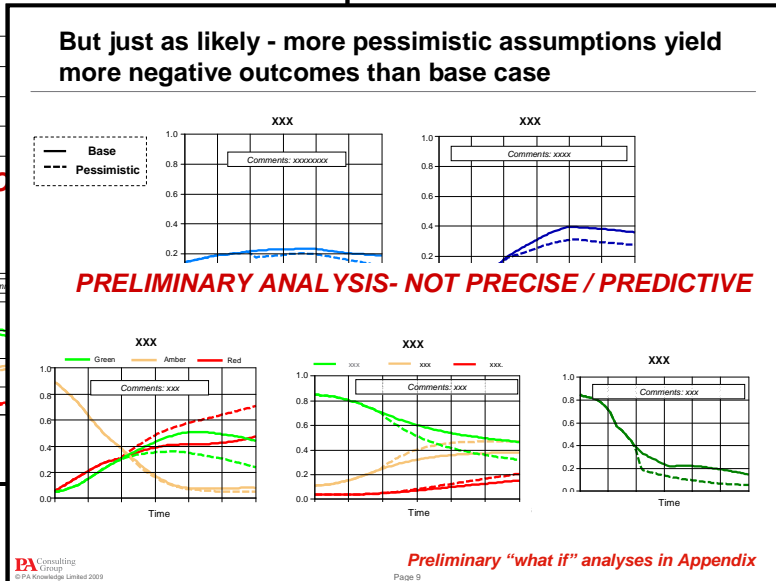
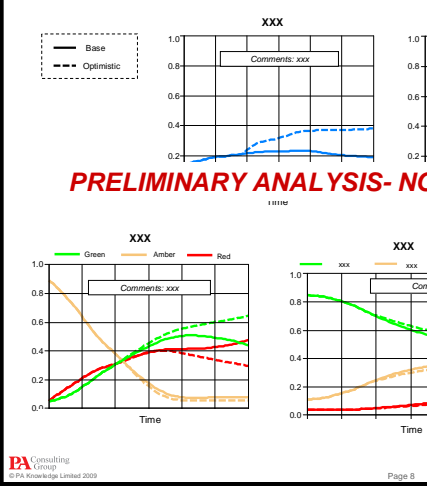
What you say:

**Strong forward progress on model development, refinement & preliminary 'what if' tests, but *critical to recognize '90-day' status & view outputs without false precision***

- The "base case" represents likely behavior given best current model structure
- We can run many types and compare outcomes case to assess impacts
- Given the many sources and recognition of "90-d" structure maturity, we find:
  - Base Case behavior
  - "Optimistic" variation
  - "Pessimistic" variation

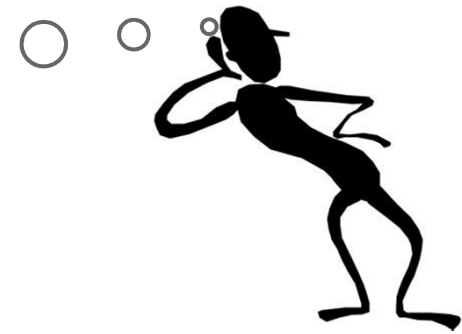
- Base case variations are based on:
- Utility of xxx
  - Number of xxx doing xxx
  - Xxx impact on xxx
  - Time to distribute xxx
  - Normal time to develop xxx
  - Sensitivity to xxx and xxx
  - Impact of xx and xxx on xxx

**Must recognize sources and range of uncertainty – under more optimistic assumptions the same inputs yield a more positive outlook vs base case**



... is not what they'll remember:

"Our new policy won't work."





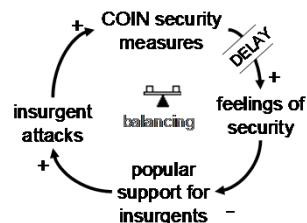
# Lesson 4: Work in both the boardroom and the field



Fort Wainwright, Alaska

*We got the full experience when modeling insurgency ...*

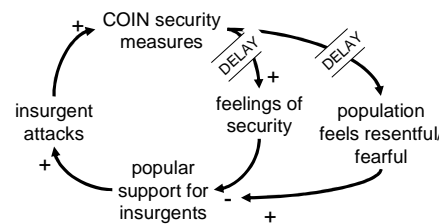
## Fixes that fail #1: Delays in feelings of security



*"Sadr officials kept using the word 'disarm'. When I asked them if they would give their guns back, they said 'Well, actually we're going to hide them until we see if the government can give us security. And if not, we'll have to take them back out again.'"*  
 - NY Times, 13 Feb 07

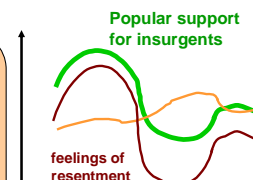


## Fixes that fail #2: Resentment or fear grows faster than security

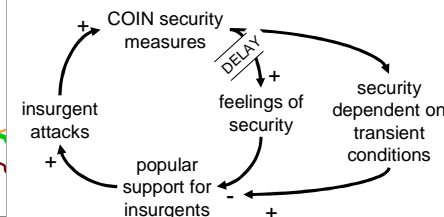


Ineffective or excessive security measures lead to resentment — leading to an oscillating dynamic with no clear progress in the field

*"Insurgents will lead to sabotage, terror spreading insurrection. It will be a remarkable government that will not be driven to stern repressive measures — curfews, the suspension of civil liberties, a ban on assemble, illegal acts that can only deepen popular opposition, creating a vicious circle of rebellion and repression until the economy is undermined, the social fabric torn beyond question, and the regime tottering on the verge of collapse."*  
 - Taber, War of the Flea



## Fixes that fail #3: Security measures do not appear permanent



Occupying forces are perceived as temporary stop-gaps or occupying forces apply inconsistent ROE

*"If the Americans keep doing it, they can make a difference. But they have to stay."*

*Otherwise, it will never work."*  
 - Ali Muhamed  
 Ice Cream shop owner  
 16 Feb 07



## Insurgency study used many sources:

- Officers with field experience
- Retired officers with COIN experience in multiple places
- Review of publicly available sources
- What's missing – Iraqi perspective

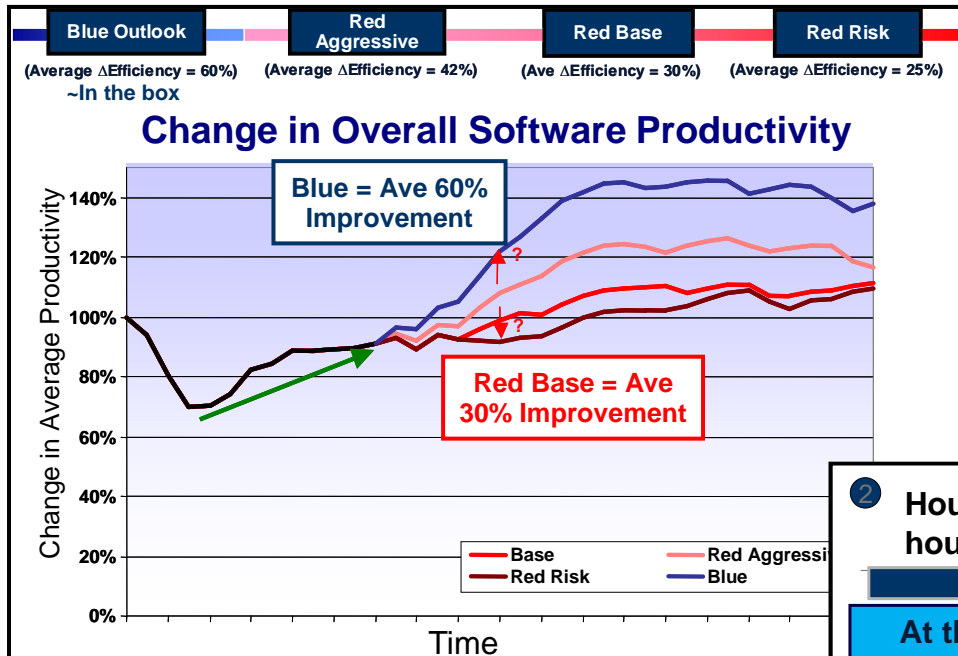
## Meeting those in field is important to:

- Test insights with those who will use it and ensure messages hold up
- Add real-world insight / experience





# Lesson 6: Don't rely only on System Dynamics...



SD analysis identified a big delay in this large development program

Managers of the troubled area rejected the analysis, claiming they were on track

They attacked the SD analysis

To help reach agreement, we led a conventional analysis of the areas in question -- using their data -- and highlighted the hugely optimistic assumptions that were implicit

2 Hours Expended & Progress Achieved - Spent ~34% of total hours and achieved ~27% complete

Hours Expended	Progress Achieved
<p>At the time of April Study:</p> <p>Total Hours Expended = 29%</p> <p><b>Latest Study:</b></p> <p>Total Hours Expended = 34%</p>	<p>At the time of April Study:</p> <p>~20% = Overall Progress Achieved</p> <p><b>Latest Study:</b></p> <p>~27% = Overall Progress Achieved</p>

Spent 5% budget and made 7% progress – progress in this block is catching up, but overall need to **average** 10% progress per 5% budget from here forward to meet plan ... with no scope growth or unexpected rework!

% of LAC Spent as of XXXX Roll-up of detailed data from other reports and plans



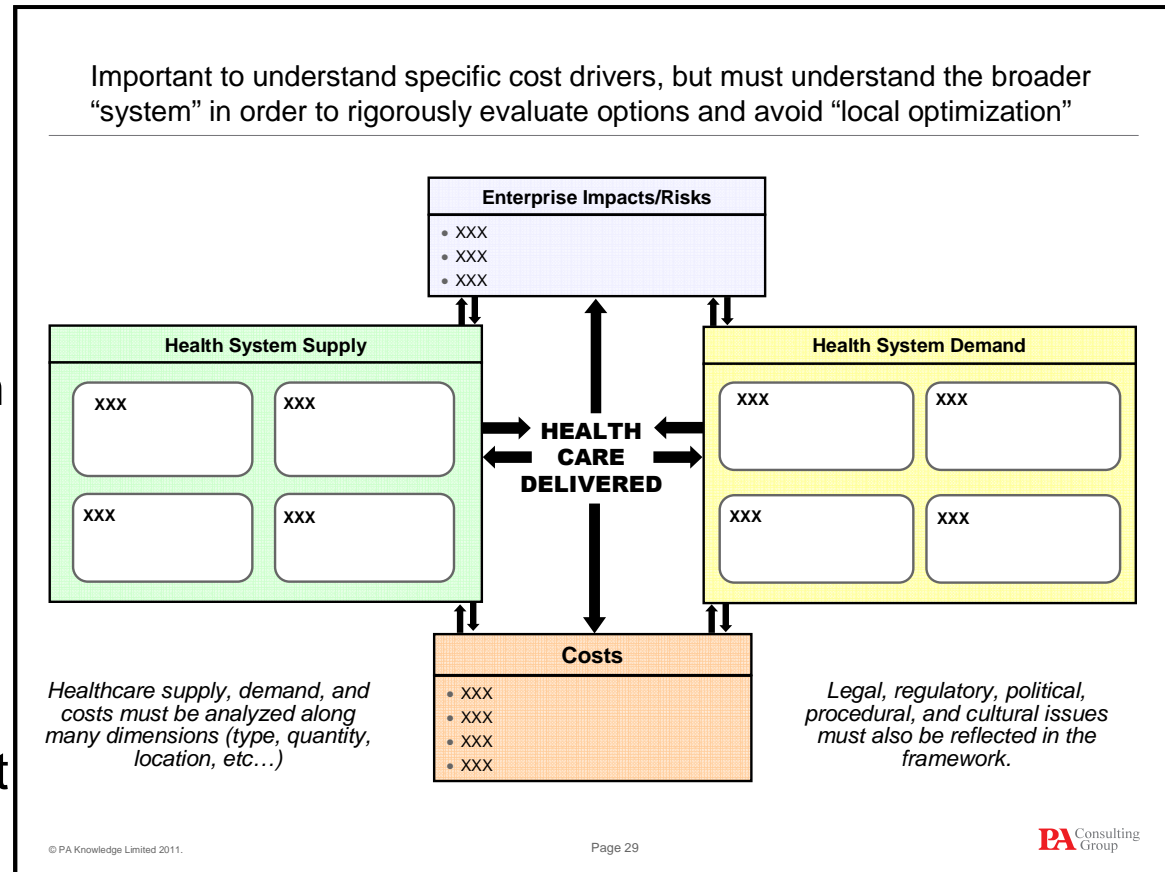
## Lesson 7: Don't be discouraged by politics ... find the art of the possible

**Health System** challenges are complex and high stakes with no easy answers

The highest-leverage actions are “non-starters” in this highly politicized arena

Having the “right” analysis is not enough to “fix the system”

Instead, find and implement improvements that *are* possible given the politics



**Persistence can also pay off ...  
many important changes begin as ‘non-starters’ ...**

## Moving Forward -- Our challenges are not getting any simpler!

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- Sustainable Budgets / Reducing Long-Term Debts
- Energy Options for the Mid and Long Term
- Understanding Economic Interdependence
- National / International Security
- Healthcare
- Demographic Changes
- Rising and Falling Powers
- ....

***System Dynamics can be a powerful approach to help analyze many of these issues – we hope these ‘lessons’ are of some help to those of you addressing these and similarly complex problems in the private sector!***