Public Written Comments

Submitted to PCAST

November 27, 2012 to January 2, 2013

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November 30, 2012 President's Council of Advisors on Science and Technology (PCAST) Webcast Question

From: "Chris Campbell" [redacted]
Date: Fri, November 30, 2012 9:07 am
To: info[redacted]
Priority: Normal
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Can you comment on the impact of Agenda 21 on local communities and how this would help our country/world as a whole?

Thank you,

Chris Campbell
Ruston, LA
[redacted]

November 30, 2012 President's Council of Advisors on Science and Technology (PCAST) Webcast Question

From: "Chris Campbell" [redacted]

Date: Fri, November 30, 2012 10:27 am

To: info[redacted]

Great discussions on MOOC's. How is and could the K-12 educational system be more involved in evaluation systems? What impact will this have on technology expenses, bandwith, etc. in areas trying to implement MOOCs.

Chris Campbell
Simsboro High School
[redacted]

From: Oriana Sanchez [redacted]
Sent: Friday, November 30, 2012 11:00 AM
To: info@tvworldwide.com; pcast@ostp.gov
Subject: November 30, 2012 President's Council of Advisors on Science and Technology (PCAST) Webcast Question

I enjoyed the webcast and the accessibility of listening to it. Would there be an opportunity where those being impacted by the discussion like the students would have an input or be participatory in the discussion at some point?

Lic. Oriana Izquierdo Sanchez
Coordinadora de Intercambios Universitarios/
University Exchange Coordinator US Embassy
Instituto Cultural Dominico-Americano
[redacted]
"La Fuerza de cien mil en las Americas" / " 100K Strong in the Americas"

November 30, 2012 President's Council of Advisors on Science and Technology (PCAST) Webcast Question

From: "Schmidt, Steffen W [redacted]>

Date: Sat, December 1, 2012 11:35 am

To: "info@tvworldwide.com"
[redacted](more)

Priority: Normal

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Excellent- BUT we need to rapidly train administrators such as department or division chairs who are mostly TOTALLY ignoring MOOC's and the new concepts of learning. They effectively block progress and, sine they have tenure, are unmovable.

Steffen

Innovation Ecosystem
From: "Tim Gieseke" [redacted]
Date: Fri, December 7, 2012 11:45 pm
To: pcast@ostp.gov
Priority: Normal
Options: View Full Header | View Printable Version | Download this as a file | Add to Address Book | View Message details | View as HTML

The challenge before us is to add an ecological dimension to the economy. This can be accomplished via EcoCommerce, www.ecocommerce101.com . It is by this avenue that a new economic concept emerged, symbiotic demand; as elegant as it sounds yet still meeting the self-interests of people. A browser search of symbiotic demand prezi will provide a visualization.

Tim Gieseke

Ag Resource Strategies, LLC

www.agresourcestrategies.com [redacted]

From: Kenneth Mecham [redacted]
Sent: Friday, December 14, 2012 10:05 PM
To: Scholz, Amber Hartman; [redacted]
Subject: Fwd: Exciting new idea,

We here at K.E.M Constructors, Inc. in Gresham, Oregon are trying our hardest to open an avenue of employment for women, veterans and disabled Americans. Our company is licensed and currently working with the SBA, DOT, CRC, DOV, DHS, the White House, Kenworth trucks, CAT trucks, Fountain Trailer Co and our own 15 employees.

We are all ready to work together to open a previously closed business and start new opportunities for the State of Oregon, the Columbia River, our economy and Veterans along with our disadvantaged women and disabled Americans.

We also have a product that we have developed over the past 8 years and will make an enormous difference in our coastal areas. This product will create clean waters, harvest and provide food for aquatic species and recreational scientific exploration. The blueprints for this product are drawn up and ready to be produced. The production and placement of this product to the upkeep and maintenance will provide hundreds of jobs for our unemployed. We can make jobs that actually help our environment and make our oceans cleaner at the same time.

We qualify for a number of grants, including the Federal Disadvantaged Business Enterprise. We are finding that the red tape involved in acquiring these grants is overwhelming. We are hoping with your assistance we could cut through some of the red tape and help us succeed in our ultimate goal to start a long lasting company that will begin putting all of these people back to work.

We appreciate you taking the time to read this letter and hope that you can help us make a real difference.

Sincerely,

Debra Mecham

Owner

K.E.M Constructors

Keeping Earth Maintained

Specializing in water reclamation and purification. We can act on emergencies such as fuel spills and other contaminates that are introduced into our waters, in any situation. This can also be done on dumpsites and State and Federal lands. Our supreme goal is to reclaim and refurbish our wetlands

and forests, including inlets to all major waterways, stagnate ponds, estuaries etc. Our company will work with all Federal, State and Local entities including testing labs for water purification and soil samples. We use aggrate of different specification and filter fabric. A mobile gas furnace with a conveyor belt to sterilize all filter material on site allows us to reuse all aggragate over and over. Our company saves on truck time and fuel that would normally be used in the removal of the contaminated materials off site avoiding disposing of the materials in the ground, therefore protecting the environment from further contamination of the earth.

Columbia River Portage & Transfer

This proposal is intended to help our local economy, create jobs and give hope to our Veterans and Disabled Americans.

Reasons to use Columbia River to create jobs,

Creating jobs for Oregonians- Utilizing local companies and renewing unused abandoned companies and traffic- Congestion will be reduced substantially by transporting fabricated parts right here on our side of the river by water and train.

On the Washington side of the river in and around the Port are limited storage areas. REMEMBER-Washington has the cranes the docks, open bays and the rail access soon they will have OUR opportunity! We will have missed THE BARGE so to speak. Our failure to foresee this new horizon of future employment possibilities for Oregon would be inept. Think of the possibilities? As you know, there will be an incredible amount of “puzzle” pieces and abstract shapes and sizes making up what will become our new bridge over the Columbia River. This will take an enormous amount of Port Space for storage. With our company we have thought in advance of the new bridge project and have determined that the ideal site and hub for Oregon's Columbia River access to the new bridge construction, the Northwest and points beyond. How about right here in our own back yard!

This dock can be used and should be used. Below you will hear how we can accomplish this: Covered secured metal buildings for storage of ores, I-beams, sheet metal, and ready made parts for the brand new bridge from Portland, OR to Vancouver, WA. This is why we need a big yard close to Oregon Steel Mill and the Port of Portland.
We would be able to offer state wide over length, over width and over weight heavy hauling in a close and central location so traffic and permits will be a minimum concern. We would utilize I-84 and marine drive. Also a Rail Road access will make vast use of our rail system and allow for extreme width and length shipments to be handled in our yard. It seems like I'm making some of

this up but as a Federally funded Incorporation, You-The government will actually own my company. This, in lue of “funded grants” and “state funds” and “loans” makes anything we do for Uncle Sam a pleasure and our sacred duty. We will be working in tandem thus saving the taxpayer money, time, confusion and you ”Our Government” have a clear and accountable trail of our US Treasury money and where it is spent. Most important we would be able to get our Veterans and Disabled back to a new and prosperous future.

Having the Columbia River at our back door would allow us barge access to the site for moving the bridge support systems right into place and our yard can serve as a supply center and manufacturing hub. Many types of steel are smelted in a variety of strengths. When specifications call for different ores to be added into the smelter we could have those stored in our covered warehouses for rapid direct shipment to Oregon Steel Mills. We of course cannot forget that if we were linked to the Rail Road we could take direct shipments to and from Oregon Steel Mills to our yard and transfer onto trucks and barges for the new bridge and any other projects that may arise. The ore can come from the suppliers directly to our warehouses via the Rail Road docks.

Another wonderful attraction to this area is the access to our NW Industrial area across the Fremont Bridge. In this area we find docks along N.W. Front Street and Oregon's own Gunderson Inc., makers of many giant projects such as Rail Road cars. Another proud company is Oregon Metal Slitters who deal in 20,000-40,000 pound rolls of sheet steel down to a millimeter thick. Lampros Steel Co deals with International I-Beams up to 110 feet in length and also steel plates of all sizes.

In our City of Portland in the SE area we have Custom Stamping, a metal stamping company making everything from Warn Winch parts to Wiggets. By adding a secure, solid and dependable dock that we can enhance between Boardman & Pier #6 on the Oregon side we can begin to incise more freight and materials along Oregon's proud Columbia River. These are all fine companies in Oregon providing excellent products and employment in these uncertain economic times. I have personally hauled some incredible loads for each of these companies.

In my younger years I was lucky enough to have been involved with redistributing the beams and steel that was to be the “Whops Nuclear Plant.” There before me was a field of beams not to be mistaken for that movie Field Of Dreams! I had never seen anything like it before! There were 110-120 foot long beams, short ones, fat ones....some were an unimaginable thickness....like 4 ½ inches thick and 56 inches wide! Some weighed in at over 60,000 pounds-now that’s support!

Now for the 60,000 pound question.....

Without a paved lot-compacted and level, or an indoor facility-both of which could sustain an overhead crane....How do you remove these mammoth sized “puzzle” pieces from a truck in a field, place them in specified holding areas in an efficient order allowing for iron workers to call for an item in the order in which it will be used, pick them back up, or place them back on trucks or train cars?

Well, I will tell you. To make short work of that problem we need our friends at Caterpillar. They have an incredible machine with a computerized weighing system that tells the operator exactly how much he has balancing on the forks of the machine-this is an invaluable tool. It's purpose is for special heavy duty jobs. Then what? Well, if you own this very elite piece of equipment they will come. We could possibly become a very important part of constructing our bridge across the mighty Columbia River with our ability to haul the materials and the barge access. We would be a very proud company that would own such a fork lift and the professional operators to go along with it. I want to remind you that this piece of equipment cannot be owned by just any company. The initial cost is staggering to a novice contractor and you can't own a machine like this and not have it working all the time to make it an investment that would pay for itself. There will be another use for our new lift truck-by having the yard to store things we could also load and store railway containers for our government along with supplies and storage of unknown items.
Our way of manipulating these and/or any other mammoth pieces of fabrication, container, heavy equipment etc will be faster, safer and won't involve using overhead cranes and rigging continuously-which slows down the time it takes to maneuver these objects

K.E.M Constructors could use it to move and stage containers for filling with our new products-Gator Screens for shipment world wide. I could name some more but together we will be able to utilize it to it's fullest ability in keeping with our goal of self sufficiency. We have a “bridge to build together” and we can haul the new lift truck around ourselves, saving a ton on transport ion costs. Who else would you trust for all your government projects? K.E.M Constructors, Inc, we would also be located between two major airports,Troutdale and Portland international. Another wonderful accommodation for any out of town personnel in conjunction with the new bridge project or persons doing business with our little port.

Now, my final thoughts to completely round out this tiny empire of industrial self-sufficiency.....

It is very important for us here at K.E.M. Constructors, Inc to try and incorporate green energy in every part of our company. This will include recycling products, water reduction, bio products, wind power and solar panels. We must make a difference every day for our children and our fish and wildlife.

We would also install an American made scale house that would be able to keep absolutely everything legal and every axle on every truck would have NO reason to ever leave the yard in violation of State or Federal weight limits on our public roads and highways. This is also another invaluable product that can be rented out to anyone in need of meeting weight specifications in compliance with all shipping safety regulations. K.E.M. Constructors, Inc. would like to utilize any and all tools available to enhance all of our lives now and beyond for our children. “We are only borrowing this earth, Lets give back”.

In the end, everyone wins. From the truck driver who gets tickets, to the company-K.E.M Constructors Inc, who at any time can tell you exactly how many pounds have passed thru our security gates being a shipping and receiving company. If a load is over weight we can charge them to balance the load making it safe again and a profit is made for K.E.M. Constructors inc., everyone wins. We can save millions of dollars cutting out the shipping, handling and overhead of an outsourced private company with strictly profit margin playing an incredible role in their

pricing. K.E.M Constructors, Inc cannot single handedly save the economy but together we can make a substantial difference.

Kenneth Mecham
K.E.M Constructors, Inc

Middle Class Tax Relief and Job Creation Act of 2012/PCAST
From: "JC McDowell" <[redacted]>
Date: Mon, December 17, 2012 5:22 am
To: ascholz[redacted]
Cc: kford[redacted]

SPECTRUM (TESTBED) BUSINESS

I've partnered with the US EPA - Green Team / Regulations.gov

I have Critical Infrastructure Prioritization protected under a Sensitive Security Information Policy. I am planning to call the US Justice to implement IT under mediation. My concentration acts are in Broadcasting, Public Safety and Job Creation. Please contact me for securitized intelligence community confidential science & technology innovations.

CIIPP PROGRAMS
JOHN D ROCKEFELLER - Debt Reduction
THOMAS EDISON - Watchdog Group
LAWRENCE ROBERTS - HSED-ARPA

Moving Forward,

JC McDowell Jr, (Conservation Research Scientist)
US Citizen Diplomat for Tribal Affairs
Head Office of Environmental Economics
THE GREEN GLOBAL DISTRIBUTION CENTRE FOR
MANUFACTURING EDUCATION PARTNERSHIPS
www.thejumetreatheragencygroup.webs.com
"Alternative Work 4 Online Leaders"
Chicago ~ Milwaukee ~ Gary ~ Egypt ~ Tokyo ~ Cuba

Engineering Publisher Multimedia Developer
c/o MARC Digital Laboratories
iART-CEO Mobility Holdings, The Republic of Panama
"Entertainment@The Speed of Sound"
[redacted]

From: williamson. [redacted]
On Behalf Of Tim Williamson
Sent: Wednesday, December 19, 2012 8:44 AM
To: Gen. Mike Hall; Dr. William Rouse
Subject: Fwd: Resilience

Recently, I posed the following scenario and questions concerning holistic complex adaptive system to a friend. Please let me know your thoughts on this topic. Thank you!

Tim Williamson

Ashwin,
Reading your posts and articles from a global perspective, and melding that with my experience and knowledge, it seems that resilience can be attributed to an interaction between several factors: openness to dynamic and evolutionary variety; systemic and network feedback; dynamic connectivity in all strata, across multiple agents, attractors, networks and systems; dynamic and unrestricted information flow and knowledge sharing; very clear yet simple statement of a system-wide vision, purpose and goals; encouragement of conflicting ideas within the system (ie. on the edge of chaos); and, finally, a recognition, acceptance and preparation for a sub-optimal outcome or course of action or movement toward the system-wide vision, purpose and goals will most likely be the result. Resilience then is more aptly defined as that point when a complex system becomes organic, longlasting, adaptive and self-perpetuating. Thus the system that reaches this level of growth requires a holistic approach to management and planning. Resilience complements emergence.

CAS systems are, by definition, emergent. Whereas complicated systems tend to be deterministic and thus Newtonian and not emergent. Building a fleet of rockets and space platforms to colonize Mars is a complicated endeavor. The interaction of the human crew and their families with the mechanical requirements in preparation for the mission, while on the flight and then while on Mars, is a complex and rapidly adaptive system, built of necessity, but this system may not be resilient nor emergent. Under normal routine conditions such a mission is complex and adaptive, but in crises or at specific mission points in time, rigid control is required. In these conditions, leadership and agents in the networks must be situationally adaptive. But is this a CAS? Does this system have resilience and emergence? Resilience and emergence would occur after landing on Mars and the structures were in place to ensure survival of the system. At that point, the complex system takes on a life of its own: becomes organic.

Emergence suggests that strict control cannot be optimised in a global sense in any CAS system, but suggestive guidance at influencial attractors, located within the global and local networks, can subtly move the overall system toward a common shared vision. The question for leadership is what minimal suggestion will influence attractors in the network(s) to suggest to those with whom they connect to discuss a path or to address a crisis from a certain perspective thus moving the system toward the system-wide vision. Psychology, history, science, cultural knowledge and diversity, technology, sociology and a very long range perspective then become tools of an emergent, resilient, complex adaptive system plan of action at the global level.
Designing a general map and model of these interacting elements, agents and attractors is my next task. Any ideas and suggestions?

--
Thanks!

Tim Williamson
Founder - Strategic Global Policy Forum
[redacted]

From: Fanny Mazella [redacted]
Sent: Thursday, December 20, 2012 11:26 AM
To: pcast [redacted]
Subject: PIAF consortium releases final report

PIAF consortium releases final report:
Privacy impact assessments should be mandatory and engage stakeholders

Press release
19 Dec 2012

Privacy impact assessments should be mandatory and must engage stakeholders in the process, says a consortium in its final report to the European Commission after a multi-country research project.

The 22-month PIAF project was co-funded by the European Union under its Fundamental Rights and Citizenship Programme and undertaken by a consortium comprising the Vrije Universiteit Brussel (VUB), Trilateral Research & Consulting and Privacy International. PIAF is the acronym for Privacy Impact Assessment Framework for data protection and privacy rights.

The consortium defines a privacy impact assessment (PIA) as "a process for assessing the impacts on privacy of a project, policy, programme, service, product or other initiative and, in consultation with stakeholders, for taking remedial actions as necessary in order to avoid or minimise the negative impacts".

Although privacy impact assessment has a history going back to the mid to early 1990s in countries such as Australia, Canada, New Zealand and the US, it is a relatively new concept in Europe. The UK Information Commissioner's Office produced the first PIA Handbook in Europe in 2007. Most recently, the European Commission made a provision for PIA (or data protection impact assessment, as it calls it) in Article 33 of the proposed Data Protection Regulation which it released officially in January 2012.

The PIAF consortium addresses recommendations to policy-makers as well as those undertaking PIAs. Among its key recommendations are these:

- The obligation to carry out a PIA when there is a likelihood of risk to the protection of privacy and personal data should have a firm legal basis. However, the legal obligation should not preclude other incentives for carrying out a PIA being identified and communicated to organisations, in particular, the benefits of PIA.

- A PIA should be carried out for projects sponsored by more than one organisation as well as for projects with a trans-border dimension, at least if they have significant privacy implications.

- A PIA should be regarded and carried out as a process and not only as a single task aimed at completing a report. A PIA process starts early and continues throughout the life cycle of the project.

- A PIA policy should allow organisations to carry out a PIA appropriate to their own circumstances. The policy should allow scalability of the PIA process.

- A PIA should address all types of privacy and not only the protection of personal data.

- A PIA process should enjoy at least a minimum level of transparency. Both the assessor and stakeholders must have all relevant information to assess the privacy and data protection implications of a proposed project. Organisations should generally make PIAs publicly available, e.g., publish them on their websites. However, for PIAs genuinely involving national security or commercially sensitive information, the organisation could publish a summary or a redacted PIA.

- Organisations undertaking a PIA should identify and inform stakeholders, as representative as possible, including the public, if applicable, about the PIA process. Organisations should seek stakeholders' views and take them into consideration. A PIA policy should provide explicit mechanisms for stakeholder consultation.

- Risk management and checking legal compliance are core elements of PIA. To that end, effective procedures for risk management should be identified and/or developed. Residual risks should be justified.

- An organisation should be able to demonstrate that a PIA has been carried out adequately. A PIA process should be subjected to external review and/or audit. Independent third party review and/or audits are critical to ensure that a PIA was properly carried out and its recommendations implemented. Audits and reviews are a function of the principle of accountability and lead to improvements in PIA practice.

"The final deliverable of the PIAF project constitutes an important contribution to the research on PIAs in Europe," said Paul De Hert, project co-ordinator. The report builds upon the project's two previous deliverables, the first of which was a review of PIA policies and practices in seven countries and the second, on the factors affecting the adoption of a PIA policy in the EU Member States.

For more information, see the PIAF final deliverable (D3) on the project's website at [redacted]

Or contact:

Paul De Hert, VUB
[redacted]

David Wright, Trilateral Research & Consulting
[redacted]

Gus Hosein, Executive Director, Privacy International

[redacted]

Note: if you do not wish to receive further news from the PIAF project, please let us know and we will delete your name from our contact list. Apologies for any cross-postings.

Lexicon of Systems Science [redacted]
From: "Timothy Williamson (Google Drive)"
[redacted]
Date: Thu, December 20, 2012 5:51 pm
To: pcast@ostp.gov
Cc: ChinaMissionUN[redacted]

Lexicon of Systems Science

(complex, complicated, simple, theoretic)

Basic Rules:

1 Global and broadly inclusive, self-organizing.

2 Agent driven and open.

3 Multiple unrestricted collaborators.

4 Insert terms alphabetically.

5 Open, multi-disciplinary discussion and listing of terms and general definitions.

Notes:

1 Please properly document sources when appropriate. Give credit where and when such acknowledgement is due. Use the bibliography section for acknowledgements.

2 Collaborators are encouraged to review and combine similar terms periodically.

Content

Terms

A

ABM:

a agent-based models.

Accumulation:

a the activity that takes place in a stock; the net of inflows and outflows to and from a stock. [Sterman, JD. 2000.Business Dynamics: Systems Thinking and Modeling for a Complex World. Irwin McGraw-Hill, Boston.]

Adaptive:

a Displays Dynamic variety.

b Displays Generative change in a system which is typically found in complicated systems. An example would be fractals. A specific generated observed outcome may not be anticipated, but it is one of a set of likely possibilities that could have been generated from the initial set of rules.

c Evolutionary change in a system which is typically found in complex systems. Evolutionary change is generally sub-optimal, and not predictive from a set of simple rules.

d Ability to change.

Agent(s):

a an element of a network or system. Examples: individuals, other networks operating together in a larger system.

b Individuals within an interacting population, each may have only limited freedom to react to their neighbours yet the behaviour of the whole (emergent) may be much more complex.

Animated system:

a systems and models in which the whole is purposeful but the parts are not. [Ackoff, RL. 1999. *Ackoff's Best*. Wiley, New York.]

Archetypes:

a common system structures that produce characteristic patterns of behavior. (SEE ALSO: *system archetypes*) [Meadows, DH. 2008. *Thinking in systems : a primer*. Chelsea Green Publishing, Vermont.] See also: "system archetypes".

b the word comes from the Greek *archetypos* meaning "first of its kind". [Senge P, Kleiner A, Roberts C, Ross R, Smith B. 1994. The Language of Systems Thinking: "Links" and "Loops". *The Fifth Discipline Fieldbook*. Doubleday Currency, New York.]

Attractor:

a an influential agent, a hub in the network.

b A point to which a system tends to move, a goal, either deliberate or constrained by system parameters (laws). The three standard attractor types are fixed point, cyclic and strange (or chaotic).

Attractor, Standard types:

a fixed point,

b cyclic,

c strange (chaotic)

B

Balancing feedback loop: (See Biblio - Bellinger, Gene)

a a stabilizing, goal-seeking, regulating feedback loop, also known as a "negative feedback loop" because it opposes, or reverses, whatever direction of change is imposed on the system. [Meadows, DH. 2008. *Thinking in systems : a primer*. Chelsea Green Publishing, Vermont.]

Basin of Attraction:

a The set of initial states which are drawn to an attractor of the system.

Bounded rationality:

a the logic that leads to decisions or actions that make sense within one part of a system but are not reasonable within a broader context or when seen as a part of

the wider system. [Meadows, DH. 2008. *Thinking in systems : a primer*. Chelsea Green Publishing, Vermont.]

Butterfly Effect:

a The possibility that a large change can occur from a minor shift in initial conditions. A butterfly flapping its wings in the Amazon leading to changes in the location of a typhoon elsewhere in the world. Sensitivity to initial conditions, a chaotic system.

C

Causal link:

a indicates a causal relationship between variables. [Richardson GP, Pugh III, AL. 1981. Introduction to System Dynamics Modeling with DYNAMO. Productivity Press, Portland.]

Chaotic system:

a A system sensitive to initial conditions.

b A system whose long term behaviour is unpredictable, tiny changes in the accuracy of the starting value rapidly diverge to anywhere in its possible state space. There can however be a finite number of available states, so statistical prediction can still be useful.

Closed boundary:

a interactions within the system that produces growth, fluctuation, and change. Any specified behavior must be produced by a combination of interacting components. Those components lie within a boundary that defines and encloses the system. [Forrester, JW. 1971. *Principles of Systems*. Productivity Press, Portland. p4-1 to 4-2.]

b In concept a feedback system is a closed system. Its dynamic behavior arises within its internal structure. Any interaction which is essential to the behavior mode being investigated must be included inside the system boundary. [Forrester, JW. 1971. *Principles of Systems*. Productivity Press, Portland. p 4-2.]

Complexity:

a The interaction of many parts, giving rise to difficulties in linear or reductionist analysis due to the nonlinearity of the inherent circular causation and feedback effects.

Complex Adaptive System:

a A form of system containing many autonomous agents who self-organize in a coevolutionary way to optimise their separate values in an emergent manner.

b Is a system that has the following properties:

- Lacks homogeneity.The system encourages variety.
- Systemic and network feedback;
- Dynamic connectivity in all strata, across multiple agents, attractors, networks and systems;
- Dynamic and unrestricted information flow and knowledge sharing;
- Very clear yet simple statement of a system-wide vision, purpose and goals;
- Encouragement of conflicting ideas within the system;
- A recognition, acceptance and preparation for a suboptimal outcome or course of action or movement toward the system-wide vision, purpose and goals will most likely be the result.
- The system is resilience on the grand scale, but not at the agent or attractor strata.
- The system displays systemic emergence.
- Operates just at the edge of chaos without becoming chaotic.
- Self-organizing.

Complexity Philosophy:

a A set of organic axioms or assumptions more appropriate to nonlinear and interacting complex systems.

Complexity Science:

- a The study of the rules governing emergence, the constraints affecting self-organisation and general system dynamics in nonlinear adaptive interacting systems. The study of the collective behaviour of macroscopic collections of interacting units that are endowed with the potential to evolve in time.

Complex System:

- a One not describable by a single rule. Structure exists on many scales whose characteristics are not reducible to only one level of description. Systems that exhibit unexpected features not contained within their specification. Systems with multiple objectives.

Complexity Theory:

- a The study of how critically interacting components self-organize to form potentially evolving structures exhibiting a hierarchy of emergent system properties.

Connectivity:

- a The relation of an agent to its neighbours, it can be sparsely connected (only affected by a few neighbours), fully connected (interfacing with every other agent in the system) or some intermediate arrangement. This parameter critically affects the dynamics of the system.

D

delays:

- a a process whose output lags behind its input in some fashion. [Sterman, JD. 2000.Business Dynamics: Systems Thinking and Modeling for a Complex World. Irwin McGraw-Hill, Boston.]

Deterministic system:

- a systems and models in which neither the parts nor the whole are purposeful. [Ackoff, RL. 1999. *Ackoff's Best*. Wiley, New York.]

Dynamics:

- a The behaviour of a system in time. Changes with time are the essence of complexity.

b The behavior over time of a system or any of its components. [Meadows, DH. 2008. *Thinking in systems : a primer*. Chelsea Green Publishing, Vermont.]

Dynamic equilibrium:

a the condition in which the state of a stock (its level or its size) is steady and unchanging, despite inflows and outflows. This is possible only when all inflows equal all outflows. [Meadows, DH. 2008. *Thinking in systems : a primer*. Chelsea Green Publishing, Vermont.]

b a stock is in equilibrium when it is unchanging (a *system* is in equilibrium when *all* its stocks are unchanging). For a stock to be in equilibrium the net rate of change must be zero, implying the total flow is just balanced by the total outflow. If water drains out of your tub at exactly the rate it flows in, the quantity of water in the tub will remain constant and the tub is in equilibrium. Such a state is termed *dynamic equilibrium* since the water in the tub is always changing. [Sterman, JD. 2000. *Business Dynamics*. Irwin McGraw-Hill, Boston.]

E

Ecological system:

a systems and models in which the parts are purposeful but the whole is not; ecological systems contain interacting mechanistic, organismic, and social systems, but unlike social systems have no purpose of their own. [Ackoff, RL. 1999. *Ackoff's Best*. Wiley, New York.]

Edge of Chaos (EOC):

a The tendency of dynamic systems to self-organise to a state roughly midway between globally static (unchanging) and chaotic (random) states.

Emergence:

a A property of Complex Adaptive Systems where an observed outcome from a system cannot be directly attributed to a linear combination of the agents in the system.

b An observed outcome from a Complex Adaptive System that is synergistic ie. greater than the sum of the contribution of the agents in the system.

c System properties that are not evident from those of the parts. A higher level phenomena, that cannot be reduced to that of the simpler constituents and needs new concepts to be introduced.

Entropy:

a The tendency of systems to lose energy and to settle to more homogenous (similar) states.

F

Feedback loop:

a the mechanism (rule or information flow or signal) that allows a change in a stock to affect a flow into or out of that same stock. A closed chain of causal connections from a stock, through a set of decisions and actions dependent on the level of the stock, and back again through a flow to change the stock. [Meadows, DH. 2008. *Thinking in systems : a primer*. Chelsea Green Publishing, Vermont.]

b The feedback loop is the basic structural element in systems. Dynamic behavior is generated by feedback. The more complex systems are assemblies of interacting feedback loops. [Forrester, JW. 1971.*Principles of Systems*. Productivity Press, Portland. p 4-5.]

Feedback loop substructure:

a A feedback loop consists of two distinctly different types of variables - the levels (states) and the rates (actions). Except for constants, these two are sufficient to represent a feedback loop. Both are necessary. [Forrester, JW. 1971. *Principles of Systems*. Productivity Press, Portland. p 4-6.]

first-order negative feedback loop:

a Where a single decision variable (the flow) controls the input to one system level (the state variable). Where there is no delay or distortion in the information channel going from the level (the state variable) to the decision (the flow) the apparent system level is assumed identical to the actual system level. [Forrester, JW. 1971. *Principles of Systems*. Productivity Press, Portland. p2-3.]

first-order system:

a a system in which there is only one level variable. [Forrester, JW. 1971. *Principles of Systems*. Productivity Press, Portland. p2-3.]

flows:

a material or information that enters or leaves a stock over a period of time. (SEE ALSO: *rates*) [Meadows, DH. 2008. *Thinking in systems : a primer*. Chelsea Green Publishing, Vermont.]

b The movement of resources from a place of high concentration to a low (e.g. energy goes from hot to cold). By utilising such flows systems can perform work (including self-organization). When flows in opposite directions balance, the system can arrive at the steady state (dynamic equilibrium) that characterises dissipative systems.

c terminology used in different disciplines (SEE ALSO: *stocks*). [Sterman, JD. 2000.Business Dynamics: Systems Thinking and Modeling for a Complex World. Irwin McGraw-Hill, Boston.]

- mathematics, physics and engineering - derivatives, rates of change, flows
- chemistry - reaction rates
- manufacturing - throughput
- economics - rates
- accounting - flows, cash flow or income statement items
- biology, physiology - diffusion, rates, flows
- medicine, epidemiology - incidence, infection, morbidity and mortality rates.

Fuzzy Logic:

a A way of dealing with uncertain information and variables that do not permit simple yes/no categorisations (e.g. colour). Can also be used to make decisions where uncertainty occurs (fuzzy control). This is a form of non-Aristotelian logic (see general semantics).

G

Game Theory:

a The study of interactions between intelligent agents, concentrating on whether outcomes are zero, positive or negative sum.

Global Optimum:

a The very best possible fitness over the entirety of state space.

H

Hierarchy:

a systems organized in such a way as to create a larger system. Subsystems within systems. [Meadows, DH. 2008. *Thinking in systems : a primer*. Chelsea Green Publishing, Vermont.]

Hub:

I

J

K

L

Levels:

a the integration (or accumulation) of the results of actions in a system; level variables can not change instantaneously; levels create system continuity between points in time. (SEE ALSO: *stocks*) [Forrester, JW. 1971. *Principles of Systems*. Productivity Press, Portland.]
b levels represent the condition or state of the system. [Forrester, JW. 1971. *Principles of Systems*. Productivity Press, Portland. p2-10.]

Limiting factor:

a a necessary system input that is the one limiting the activity of the system at a particular moment. [Meadows, DH. 2008. *Thinking in systems : a primer*. Chelsea Green Publishing, Vermont.]

Linear relationship:

a a relationship between two elements in a system that has constant proportion between cause and effect and so can be drawn with a straight line on a graph. The effect is additive. [Meadows, DH. 2008. *Thinking in systems : a primer*. Chelsea Green Publishing, Vermont.]

M

Mapping:

a Transforming a input to an output by following a rule or look-up table. Also the selective study of 'reality'.

Modeling:

a a main purpose of modeling is to design and test policies for improvement.[Sterman, JD. 2000.Business Dynamics: Systems Thinking and Modeling for a Complex World. Irwin McGraw-Hill, Boston.]

N

Negative feedback loop

a a loop in which the control decision attempts to adjust some system level to a given value by a goal introduced from outside the loop. [Forrester, JW. 1971. *Principles of Systems*. Productivity Press, Portland. p2-9.]

b negative loops are self-correcting; they counteract change. [Sterman, JD. 2000.Business Dynamics: Systems Thinking and Modeling for a Complex World. Irwin McGraw-Hill, Boston.]

Network:

a Connected systems, the properties of which do not entirely depend on the actual units involved but on the dynamics of the interconnections.

Noise:

a apparently random and/or meaningless variation in a stream of data; what is considered noise and what is considered signal is a matter of perspective an purpose; as a matter of model scope noise might be filtered out or included as legitimate system feedback; one person's noise is another person's signal. [Sterman, JD. 2000.Business Dynamics: Systems Thinking and Modeling for a Complex World. Irwin McGraw-Hill, Boston.]

Nonlinear relationship:

a a relationship between two elements in a system where the cause does not produce a proportional (straight-line) effect. [Meadows, DH. 2008. *Thinking in systems : a primer*. Chelsea Green Publishing, Vermont.]

b Systems that behave in an unexpected way, not changing proportionally to a change in input.

O

Organic System:

a A form of system that is autonomous and adaptive, based upon biological ideas rather than mechanical ones.

Organization:

a A non-random arrangement of parts, generally serving a purpose or function. The restriction of the system to a small area of its state space.

P

Path dependence:

a a pattern of behavior in which the ultimate equilibrium depends on the initial conditions and random shocks as the system evolves; path dependence arises in systems with locally unstable equilibria. [Sterman, JD. 2000.Business Dynamics: Systems Thinking and Modeling for a Complex World. Irwin McGraw-Hill, Boston.]

Path dependence governed by negative feedback:

a the greater the displacement from the equilibrium the greater the force pushing it back toward equilibrium; e.g., displace a steel ball in a bowl to the edge of the bowl and release it - it will eventually come to rest at the bottom of the bowl; disturbances do not affect the equilibrium reached. [Sterman, JD. 2000.Business Dynamics: Systems Thinking and Modeling for a Complex World. Irwin McGraw-Hill, Boston.]

Path dependence governed by positive feedback:

a the greater the displacement from the equilibrium the greater the force pushing it away from equilibrium; e.g., a steel ball disturbed from its resting place at the very top of an up-side-down bowl will pick up speed as it moves out of

equilibrium; the initial disturbance determines the path taken by the ball and perhaps the ultimate destination - the system is path dependent. [Sterman, JD. 2000.Business Dynamics: Systems Thinking and Modeling for a Complex World. Irwin McGraw-Hill, Boston.]

Policy resistance:

a the tendency for interventions to be delayed, diluted, or defeated by the response of the system to the intervention itself. [Sterman, JD. 2000.Business Dynamics: Systems Thinking and Modeling for a Complex World. Irwin McGraw-Hill, Boston.]

Positive feedback loop:

a a positive loop diverges or moves away from a goal (unlike a negative feedback loop that seeks an externally determined goal). Action within the positive loop increases the discrepancy between the system level and a "goal" or reference point. [Forrester, JW. 1971. *Principles of Systems*. Productivity Press, Portland. p2-16.]

b positive loops are self-reinforcing; they tend to reinforce or amplify. [Sterman, JD. 2000.Business Dynamics: Systems Thinking and Modeling for a Complex World. Irwin McGraw-Hill, Boston.]

Q

R

Rate equations:

a capture the decision-making processes of the agents of the physical and biological laws that cause change in system states. [Sterman, JD. 2000.Business Dynamics: Systems Thinking and Modeling for a Complex World. Irwin McGraw-Hill, Boston.]

Reinforcing feedback loop:

a an amplifying or enhancing feedback loop, also known as a "positive feedback loop" because it reinforces the direction of change. These are vicious cycles and virtuous circles. [Meadows, DH. 2008. *Thinking in systems : a primer*. Chelsea Green Publishing, Vermont.]

Resilience:

a the ability of a system to recover from perturbation; the ability to restore or repair or bounce back after a change due to an outside force. [Meadows, DH. 2008. *Thinking in systems : a primer*. Chelsea Green Publishing, Vermont.]

S

Second-order negative feedback loop:

a a system with two level variables, both of which are seeking a goal. A second order negative feedback loop system is required to produce oscillation in the system (when the delay parameters are disturbed, otherwise the system may be in equilibrium). [Forrester, JW. 1971. *Principles of Systems*. Productivity Press, Portland. p2-10.]

Second-order system:

a a system that has two level variables. [Forrester, JW. 1971. *Principles of Systems*. Productivity Press, Portland. p2-10.]

Self-organization:

a the ability of a system to structure itself, to create new structure, to learn, or diversify. [Meadows, DH. 2008. *Thinking in systems : a primer*. Chelsea Green Publishing, Vermont.]

b Ability to create structure without any external pressures, an emergent property of the system.

Shifting dominance:

a the change over time of the relative strengths of competing feedback loops. [Meadows, DH. 2008. *Thinking in systems : a primer*. Chelsea Green Publishing, Vermont.]

Social system:

a systems and models in which both the parts and the whole are purposeful. [Ackoff, RL. 1999. *Ackoff's Best*. Wiley, New York.]

Static:

Stocks:

a an accumulation of material or information that has built up in a system over time. (SEE ALSO: *levels*) [Meadows, DH. 2008. *Thinking in systems : a primer*. Chelsea Green Publishing, Vermont.]

b characterize the state of a system and provide the basis for actions. [Sterman, JD. 2000.Business Dynamics: Systems Thinking and Modeling for a Complex World. Irwin McGraw-Hill, Boston.]

c provide systems with inertia and memory. [Sterman, JD. 2000.Business Dynamics: Systems Thinking and Modeling for a Complex World. Irwin McGraw-Hill, Boston.]

d are the sources of delays. [Sterman, JD. 2000.Business Dynamics: Systems Thinking and Modeling for a Complex World. Irwin McGraw-Hill, Boston.]

e decouple rates of flow and create disequilibrium dynamics. [Sterman, JD. 2000.Business Dynamics: Systems Thinking and Modeling for a Complex World. Irwin McGraw-Hill, Boston.]

f terminology used in different disciplines (SEE ALSO: *flows*). [Sterman, JD. 2000.Business Dynamics: Systems Thinking and Modeling for a Complex World. Irwin McGraw-Hill, Boston.]

- mathematics, physics and engineering - integrals, states. state variables, stocks
- chemistry - reactants and reaction products
- manufacturing - buffers, inventories
- economics - levels
- accounting - stocks,balance sheet items
- biology, physiology - compartments
- medicine, epidemiology - prevalence, reservoirs

Suboptimization:

a the behavior resulting from a subsystem's goals dominating at the expense of the total system's goals. [Meadows, DH. 2008. *Thinking in systems : a primer*. Chelsea Green Publishing, Vermont.]

Swarm:

a Collection or group of agents.

Synergetics;

a The use of geometric ideas within a systems view to describe and understand reality. Closely associated with Buckminster Fuller who applied it also to human behaviour.

b An outcome of a system that is greater than the sum of the parts.

System:

a a set of elements or parts that is coherently organized and interconnected in a pattern or structure that produces a characteristic set of behaviors, often classified as its "function" or "purpose". [Meadows, DH. 2008. *Thinking in systems : a primer*. Chelsea Green Publishing, Vermont.]

System archetypes:

a a formal and freestanding way of classifying structures responsible for generic patterns of behavior over time, particularly counterintuitive behavior. (SEE ALSO: *archetypes*.) [Wolstenholme, EF. 2003. A core set of archetypal structures in system dynamics. *System Dynamics Review* 19(1): 7-26.]

System boundary:

a the delineation of system components that are necessary to generate the behavior of interest, excluding where possible, and aggregating where useful for simplicity. [Richardson GP, Pugh III, AL. 1981. Introduction to System Dynamics Modeling with DYNAMO. Productivity Press, Portland.]

System Dynamics:

a a highly analytical approach to understanding the behaviour of complex systems over time, by modelling them, increasingly with the use of purpose-built software. System Dynamics was developed by Jay Forrester at the Massachusetts Institute of Technology in the 1950's. It's focus is on modelling feedback loops using stocks and flows. [http://en.wikipedia.org/wiki/System_dynamics]

Systemic Thinking:

a thinking in terms of system-wide (or situation-wide) repeating patterns. [Bartlett, Gary. 2001. Systemic Thinking - a simple thinking technique for gaining systemic focus. The International Conference on Thinking – "Breakthroughs 2001".[http://www.prodsol.com/systemic_thinking/Systemic%20Thinking.pdf & http://systemicthinking.com]

b in common usage, the term is often used interchangeably with "Systems Thinking" and more generally to mean, "thinking about complex adaptive systems".

Systematic Thinking:

b thinking in a structured, step-by-step, methodical way.

Systems Thinking:

a making sense of complex adaptive systems by understanding the interactions between their elements. Systems Thinking was first popularised by Peter Senge in his book "The Fifth Dicipline" [Doubleday/Currency, 1990]. It is a simplified derivative of System Dynamics. The primary focus of Systems Thinking is on the reinforcing and balancing feedback loops established in complex systems. Senge identified eight common feedback loop configurations, which he called System Archetypes. Joseph O'Connor and Ian McDermott defined Systems Thinking more precisely in their book "The Art of Systems Thinking" [Thorsons, 1997].

T

Teleological system:

a systems that are goal seeking and purposeful; an output-oriented view of a system rather than a deterministic input-oriented view of the system. [Ackoff, RL. 1999. *Ackoff's Best*. Wiley, New York.]

b taking into account what is variously and rather loosely called adaptiveness, purposiveness, goal-seeking and the like. [von Bertalanffy, L. 1969. *General System Theory*. George Braziller, New York.]

Tipping point:

a the point in time when the dominance of one feedback loop gives way to the dominance of another feedback loop; the first loop starts strong then declines in strength until the system passes through the point where the second loop begins building strength; a simple SIR epidemic model is an example. [Sterman, JD. 2000.Business Dynamics: Systems Thinking and Modeling for a Complex World. Irwin McGraw-Hill, Boston.]

U

V

Variables:

a objects in a model that represent quantities. [Richardson GP, Pugh III, AL. 1981. Introduction to System Dynamics Modeling with DYNAMO. Productivity Press, Portland.]

Variables, dependent:

a quantities whose value can be changed by another variable. [Richardson GP, Pugh III, AL. 1981. Introduction to System Dynamics Modeling with DYNAMO. Productivity Press, Portland.]

Variables, independent:

a quantities whose value cannot be changed by another variable. SEE ALSO: constant, parameter.[Richardson GP, Pugh III, AL. 1981. Introduction to System Dynamics Modeling with DYNAMO. Productivity Press, Portland.]

W

X

Y

Z

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2 Complex Systems Glossary, CalResCo, Chris Lucas, founder, http://www.calresco.org/glossary.htm

From: Lloyd Etheredge [redacted]
Sent: Friday, December 28, 2012 11:15 AM
To: Pitzer, Karrie S.; Dr. Eric Lander - Co-Chair, PCAS [redacted] Dr. Maxine Savitz - [redacted]
elect [redacted]
Cc: Dr. Rosina Bierbaum - PCAS [redacted] Christine Cassel - PCAST
[redacted] Christopher Chyba - Princet [redacted] Dr. S. James Gates - [redacted] Mark Gorenberg - PCAST [redacted] Dr. Shirley Ann Jackson - PCAST [redacted] Dr. Richard Levin - PC [redacted]; Dr. Chad Mirkin - PCAST [redacted]>; Dr. Mario Molina - P [redacted] Dr. Ernest Moniz [redacted] Dr. Ed Penhoet - PCA [redacted] Dr. Barbara Schaal - PCAST [redacted] Dr. Eric Schmidt - PCAST [redacted] Dr. Daniel Schrag - PCAST [redacted] t, Scott
Subject: PCAST: Fresh Thinking, Scientific Method, and Rapid Domestic Progress? Implications of http://www.youtube.com/watch?v=Eu2SKd8D2hg

Dear Co-Chairs Holdren, Lander, Savitz, Press and PCAST Members:

As a second term agenda for the Obama Administration, you might want to take a fresh look at the potential, bold use of scientific method to improve the national effectiveness and efficiency of government programs at community, city, county, and state levels.

An introduction to evidence concerning this potential is online in a presentation by Dr. Michael Perich (cited above, **http://www.youtube.com/watch?v=Eu2SKd8D2hg**). The award presentation reflects sustained research investments by Dr. Jack Grayson and his associates http://www.apqc.org: The applications of scientific method, including databases identifying variations and best practices for hundreds of institutional processes, have emerged from the development of the Baldrige Award movement in the public sector. Dr. Perich's presentation concerns national award results that are being obtained for K-12 (including STEM) education. The new high-performing systems also save money.

Two Premature Conclusions from the Great Society Years

During the Great Society years we experimented with many "magic bullet" programs. Scientific methods determined that many of these "magic bullet" ideas did not work (although they also identified public school performance in the K-12 years as a key investment for high-priority improvement). Two premature conclusions from these Great Society years were: 1.) That "we had run out of good ideas" and 2.) That applications of social science are an inherently "liberal" agenda coupled with top-down federal initiatives and spending more money. Informed by these premature conclusions, mistaken restrictions on NSF programs slowed the rate of further investigation.

Fortunately, research and thinking continued elsewhere: The new national databases and frameworks evolved with leadership by a former Nixon Administration official and business school Dean, Dr. Jack Grayson (via www.apqc.org and the Baldrige Awards) and others. It is impressive and exciting work, that also challenges the two premature, "write-off" conclusions about the rapid learning that is possible.

Raising the Mean

One of the discoveries, which merits a high priority for PCAST's attention, is the wide range of national variation across communities, counties, cities, and states. With PCAST's leadership we can build rapid learning, community-based systems that can raise the national mean of performance. And, when budget cuts are necessary, help governments at all levels to achieve them with minimal injury to essential investments.

Evolving Scientific, Evidence-Based Thinking

The "intellectual technology" that has been evolved to achieve these results is broadly consistent with earlier, pioneering scientific frameworks developed by Lasswell, Campbell, and many others: Outstanding results from any government program are not a matter of "magic bullets" technocratic improvements, or implementing top-down ideas from liberals in Washington: they require hard and sustained work, leadership skills and motivation, measuring results and a sustaining context and commitment to good outcomes for the public, a system-level perspective, attention to human relationships, building teams, etc. Local systems differ, and it can require a decade or more of hard work, with sustained top-level support from elected government officials, to build these system-level processes of collective thinking. Progress also benefits from national databases that decompose organizational and agency behavior into hundreds of distinct processes for which Best Practices can be identified. And from training to apply these evolving frameworks to think about transforming complex, adaptive systems. There also is a political dimension: the motivation that is required for high performance often is a key, missing ingredient. [It is easier, in the American system, to argue that more money will solve the problem. However, one of the exciting messages from scientific methods and evidence-based thinking is that this is unnecessary to achieve a much better future.] <1>

Sustained national progress - if we build rapid learning networks that support scientific, evidence-based thinking - need not wait for economic recovery or new money from Washington, nor winning partisan battles in Washington about the role of the federal government and the size of its budget.

A Second Term, Rapid Learning Agenda?

Could you address the implications of these discoveries? With your leadership a renewed, expanding support for scientific thinking and community-based rapid learning (in all areas of our national life) could be an exciting contribution during President Obama's second term.

with best wishes for the New Year,
Lloyd Etheredge

<1> Concerning the foundation that PCAST already has laid in its analysis of STEM education, you might be interested in the *sympatico* observations in Kwalwasser's **Renewal** (2012) study of 40 top performing school districts, a system-level perspective that has a broad convergence with the public sector evidence from the apqc and Baldrige databases
http://renewingourschools.com/harold-kwalwasser/

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[The Policy Sciences Center, Inc. is a public foundation that develops and integrates knowledge and practice to advance human dignity. It was founded by Harold Lasswell, Myres McDougal, and their associates in 1948 in New Haven, CT. Further information about the Policy Sciences Center and its projects, Society, and journal is available at www.policysciences.org.]