TENTH ANNUAL LEADERSHIP EVENT

CYBER SECURITY SUMMIT

Security solutions through collaboration.™

THE RIPPLE EFFECT

The Cascading Impacts of Cyber Security

OCTOBER 26–28, 2020

cybersecuritysummit.org

10 YEAR ANNIVERSARY

Prof. S. Massoud Amin, D.Sc. (https://massoud-amin.umn.edu/)

- Fellow, IEEE and ASME
- Professor, Electrical & Computer Eng'g. & University Distinguished Teaching Professor
- Past Director and Honeywell/H.W. Sweatt Chair in Technological Leadership (2003-18)
- Founder, Security Technologies (MSST), & Medical Device Innovation (MDI) programs
- Director of Graduate Studies (DGS) MSST.umn.edu program (2009-13)
- MOT.umn.edu DGS (March 2003- June 2010, and July 2014- June 2016)
- Chairman, IEEE Smart Grid (2014-2018)
- Independent Director & Past Chairman, Texas Reliability Entity (TexasRE) (2010-2017)
- Independent Director, Midwest Reliability Organization (MRO) (2013-2017)
- Globally considered the "father***** **o**f smart grid" and a security pioneer ******

➢ ***** Father of the smart grid https://tli.umn.edu/tli-blog/inspiration-behind-smart-grid-series-defining-moments,

➢ ******Cyber-physical security leader, who directed all security-related R&D for all North American utilities after the 9/11 tragedies.

Areas of Expertise

- Dynamical Systems & Controls; Energy & Power; author of over 200 peer-reviewed publications
- Dr. Amin's professional contributions have primarily been in three areas:

1. Defense networks, combat & logistics systems – Command, Control, Communications, Computers, and Intelligence (C4I), and Intelligent Transportation Systems (1982-1997),
2. Modernization, efficiency, security & resilience of interdependent national critical infrastructures, including power, energy, communications, finance, and transportation (1997-present), and
3. Science & Technology assessment, valuation, law/business/policy foresight & strategy (1997-present)

Cyber Byte™ - Emerging Issues, Future Challenges, Trajectories, and Countermeasures

S. Massoud Amin, D.Sc.
Professor of Electrical & Computer Engineering, and University Distinguished Teaching Professor
Past Director and Honeywell H.W. Sweatt Chair, Technological Leadership Institute
University of Minnesota

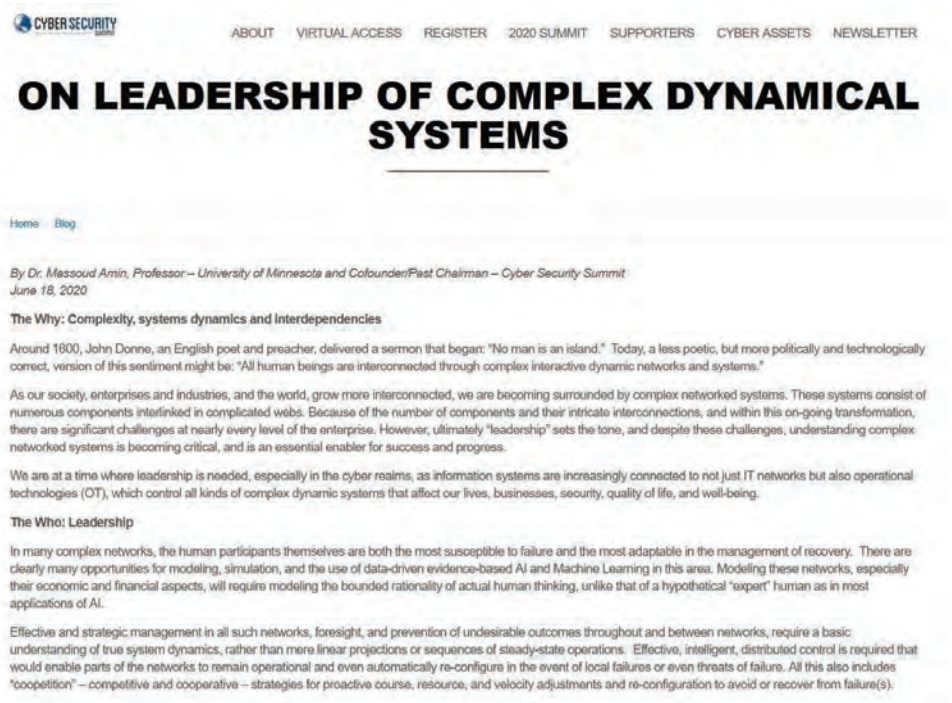
Fellow, IEEE and ASME
Chairman Emeritus, IEEE Smart Grid; TexasRE; MRO; and Sigma Xi/Minnesota

Oct. 28, 2020, 3:30 - 4:00 pm

Background* and Motivation:

The Why: Complexity, systems dynamics and interdependencies: We are at a time where leadership is needed, especially in the cyber realms, as information systems are increasingly connected to not just IT networks but also operational technologies (OT), which control all kinds of complex dynamic systems that affect our lives, businesses, security, quality of life, and well-being.

The Who: Leadership: Effective and strategic management in all such networks, foresight, and prevention of undesirable outcomes throughout and between networks, require a basic understanding of true system dynamics, rather than mere linear projections or sequences of steady-state operations… All this also includes "coopetition" – competitive and cooperative – strategies for proactive course, resource, and velocity adjustments and re-configuration to avoid or recover from failure(s).



CYBER SECURITY SUMMIT

ABOUT VIRTUAL ACCESS REGISTER 2020 SUMMIT SUPPORTERS CYBER ASSETS NEWSLETTER

ON LEADERSHIP OF COMPLEX DYNAMICAL SYSTEMS

Home Blog

By Dr. Massoud Amin, Professor – University of Minnesota and Cofounder/Past Chairman – Cyber Security Summit
June 18, 2020

The Why: Complexity, systems dynamics and interdependencies

Around 1600, John Donne, an English poet and preacher, delivered a sermon that began: "No man is an island." Today, a less poetic, but more politically and technologically correct, version of this sentiment might be: "All human beings are interconnected through complex interactive dynamic networks and systems."

As our society, enterprises and industries, and the world, grow more interconnected, we are becoming surrounded by complex networked systems. These systems consist of numerous components interlinked in complicated webs. Because of the number of components and their intricate interconnections, and within this on-going transformation, there are significant challenges at nearly every level of the enterprise. However, ultimately "leadership" sets the tone, and despite these challenges, understanding complex networked systems is becoming critical, and is an essential enabler for success and progress.

We are at a time where leadership is needed, especially in the cyber realms, as information systems are increasingly connected to not just IT networks but also operational technologies (OT), which control all kinds of complex dynamic systems that affect our lives, businesses, security, quality of life, and well-being.

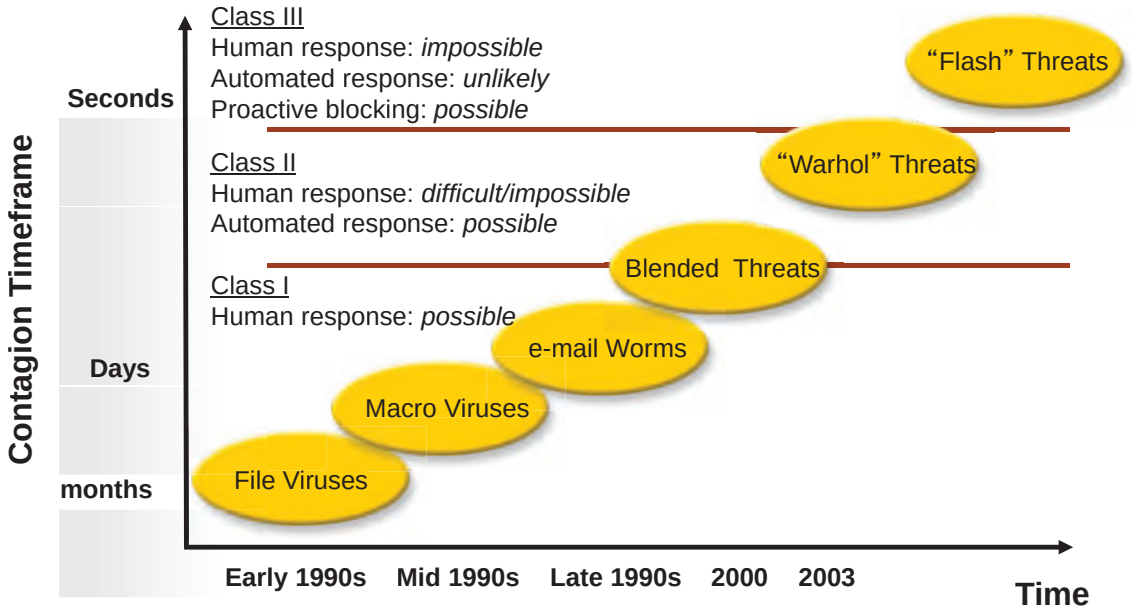
The Who: Leadership

In many complex networks, the human participants themselves are both the most susceptible to failure and the most adaptable in the management of recovery. There are clearly many opportunities for modeling, simulation, and the use of data-driven evidence-based AI and Machine Learning in this area. Modeling these networks, especially their economic and financial aspects, will require modeling the bounded rationality of actual human thinking, unlike that of a hypothetical "expert" human as in most applications of AI.

Effective and strategic management in all such networks, foresight, and prevention of undesirable outcomes throughout and between networks, require a basic understanding of true system dynamics, rather than mere linear projections or sequences of steady-state operations. Effective, intelligent, distributed control is required that would enable parts of the networks to remain operational and even automatically re-configure in the event of local failures or even threats of failure. All this also includes "coopetition" – competitive and cooperative – strategies for proactive course, resource, and velocity adjustments and re-configuration to avoid or recover from failure(s).

*Reference: https://www.cybersecuritysummit.org/2020/06/17/on-leadership-of-complex-dynamical-systems/

Threat Evolution: Malicious Code (March 1998)



Globally Interlocked Dynamics:
Understanding the Full Impacts of Decision Pathways

- To unfold the full potential of social progress requires an integrated understanding of the many dimensions of social development, their underpinnings, and the role of science and technology.
- Goal: To target our constrained development resources to maximize benefit and minimize unintended consequences

"Global Transition Dynamics Unfolding the Full Social Implications of National Decision Pathways,"
Chauncey Starr and Massoud Amin, 2003

Context: Metrics?

- Current cutting edge in AI, ML, Security, Resilience, ROI, and more →
- AI & Politics
- AI building blocks
- Internal and External (US, EU, China, …) -- AI focus
- Decoupling
- Post Covid-19 world order
- Possible Roads Ahead, Options, Costs, Threats, and Risks

What Lies Ahead?

IEEE SMARTGRID

intellect

22 TO 24 JANUARY 2015

The conference featured four parallel tracks:

1. **H3O – Smart Home, Hospital, Hotel & Office**
2. **Microgrids, Rural Electrification & Renewables**
3. **Smart Cities**
4. **Humanitarian Impact of Smart Electricity**

As a practical matter, all digitization depend on energy and power systems as well as communication networks, all of which must be structured to withstand temporary loss of physical components, just as they must operate through spontaneous local outages; but that depends on defending against attacks and systemic risks/threats, be they natural/environmental, pandemics, terroristic, military, or criminal.

Mega Cities with 10 Million People (May 1998):

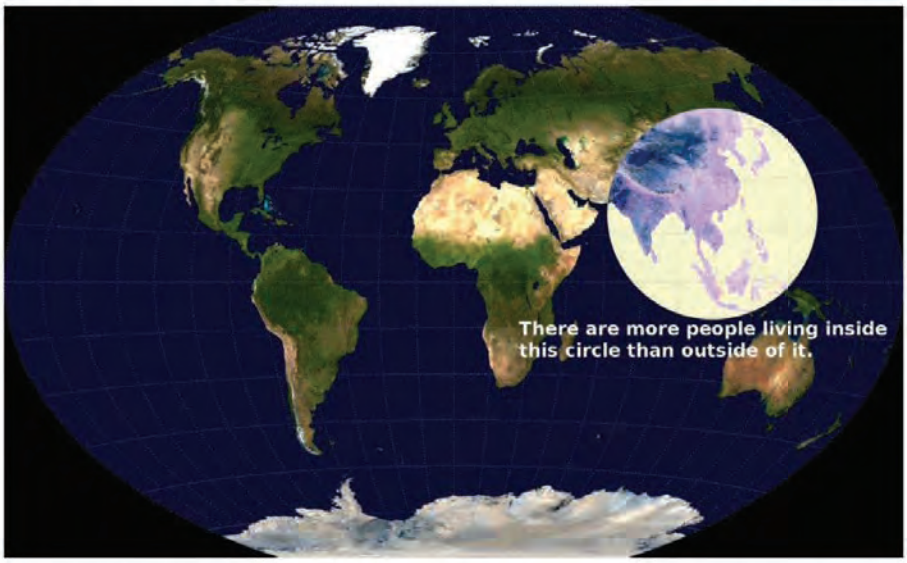
Increasing demands/stress on lifeline Critical Infrastructures

- By 2020, more than 30 mega cities* in the now less-developed world
- By 2050, nearly 60 such cities
- World's electricity supply will need to triple by 2050 to keep up with demand, necessitating nearly 10,000 GW of new generating capacity

Note: * Mega city 10 million population or greater

Actual numbers in 2020: "The total number of **megacities in the world** varies between different sources: The **world had 33 according to the UN (in 2018), 37** according to CityPopulation.de (in **2020**), and **35** according to Demographia (in **2020**)."

4th industrial revolution + shifting power balances = hardening US-China trade-tech-data conflict

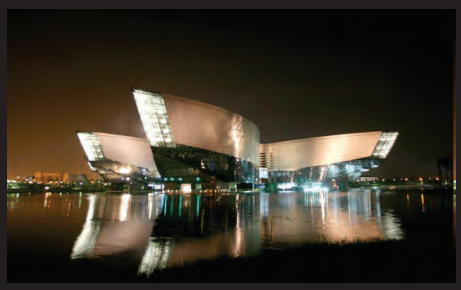


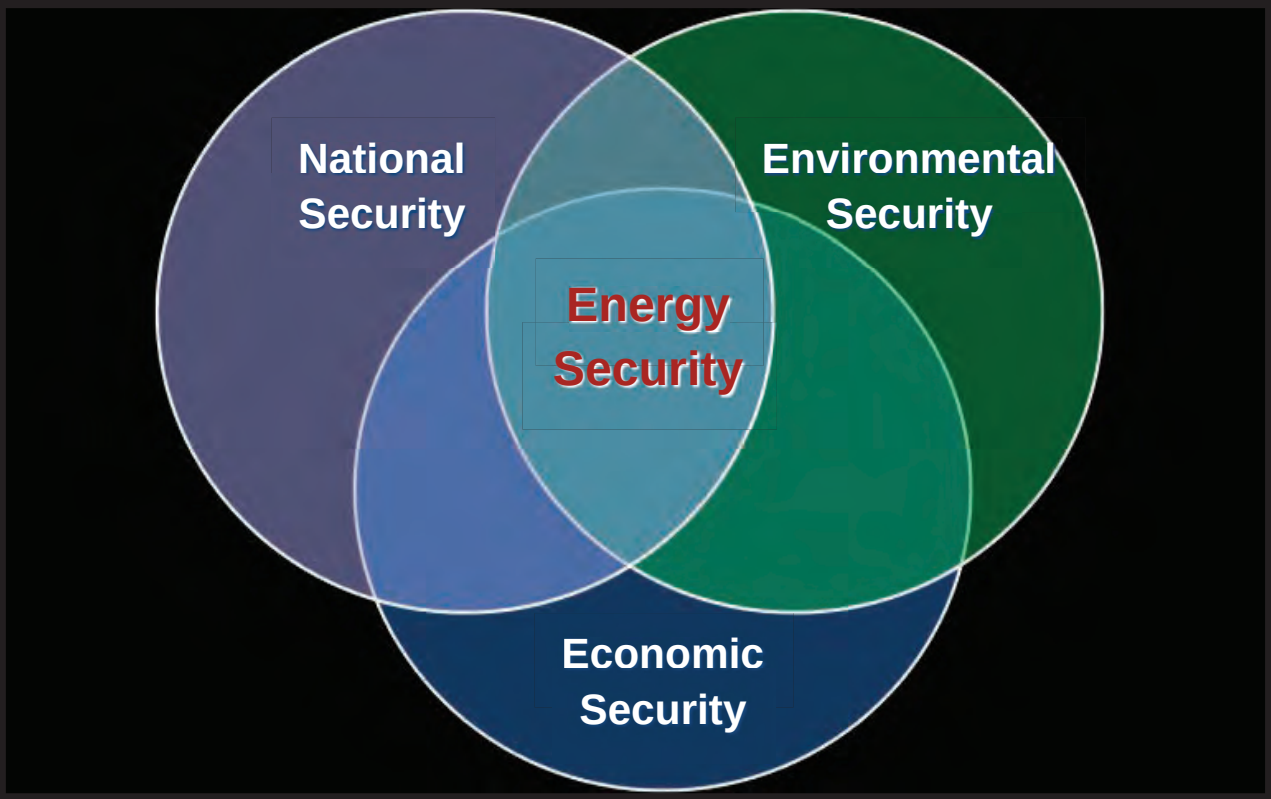
...and by ~~2050~~ 2040 more than half of global GDP will come from Asia!

Global Technology Diffusion

June 2006

Guangdong Science Center -- China
Opened 2008

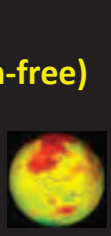




What Lies Ahead?

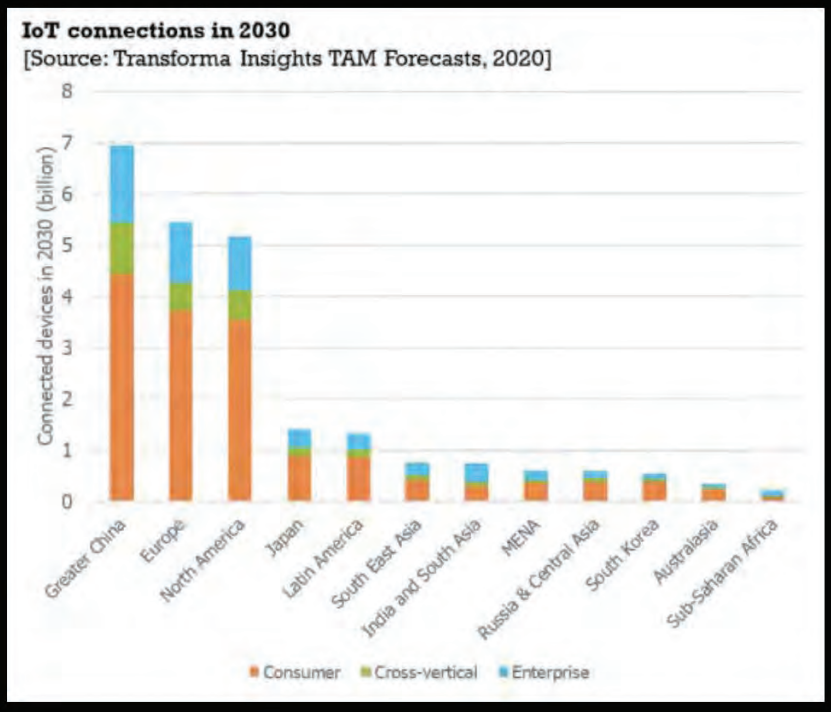
The world faces enormous problems
– here is one person's list of the top 10

1. **ENERGY (carbon-free)**
2. WATER
3. FOOD
4. **ENVIRONMENT**
5. POVERTY
6. TERRORISM & WAR
7. DISEASE
8. EDUCATION
9. DEMOCRACY
10. POPULATION



Rick Smalley, Rice U.
(1943-2005)
Nobel Prize 1996
"CIVIC SCIENTIST"

From Expertise to **Data**



AI BUILDING BLOCKS Semiconductors

Table 4: Leading U.S. and Chinese AI chips

Type	Firm HQ	Design firm	AI chip	Node (nm)	Fab
GPU	United States	AMD[116]	Radeon Instinct	7	TSMC
		Nvidia[119]	Tesla V100	12	TSMC
	China	Jingjia Micro[120]	JM7200	28	Unknown
FPGA	United States	Intel[121]	Agilex	10	Intel
		Xilinx[122]	Virtex	16	TSMC
	China	Efinix[123]	Trion	40	SMIC
		Gowin Semiconductor[124]	LittleBee	55	TSMC
		Shenzhen Pango[125]	Titan	40	Unknown
ASIC	United States	Cerebras[126]	Wafer Scale Engine	16	TSMC
		Google[127]	TPU v3	16/12 (est.)	TSMC
		Intel[128]	Habana	16	TSMC
		Tesla[129]	FSD computer	10	Samsung
	China	Cambricon[130]	MLU100	7	TSMC
		Huawei[131]	Ascend 910	7	TSMC
		Horizon Robotics[132]	Journey 2	28	TSMC
		Intellifusion[133]	NNP200	22	Unknown

Source: AI Chips: What They Are and Why They Matter. CSET. Apr 2020

AI BUILDING BLOCKS Semiconductors

Semiconductors + Add to myFT

TSMC falls into line with US export controls on Huawei

Chipmaker says it could replace any lost orders 'in a very short time'

TSMC chairman Mark Liu told shareholders that the company will not exploit any loopholes and will respect Washington's intentions © Bloomberg

Kathrin Hille in Hsinchu and **Kiran Stacey** in Washington JUNE 9 2020

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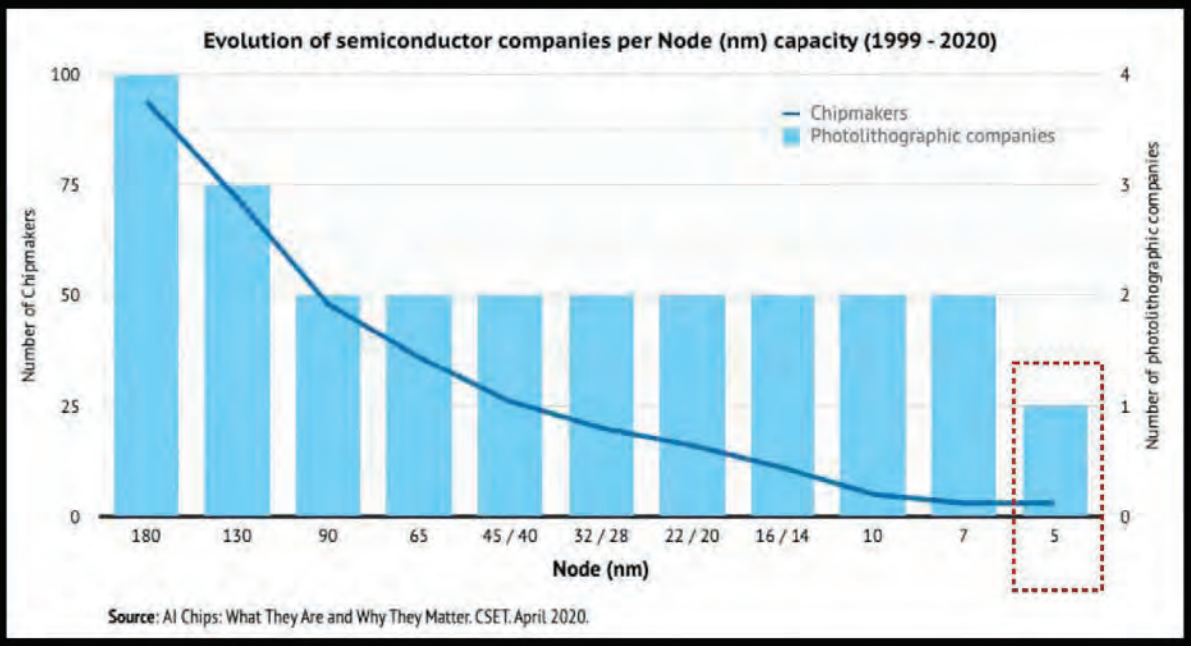
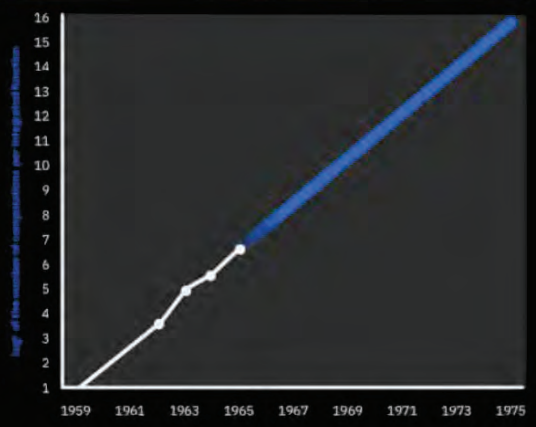
AI BUILDING BLOCKS Semiconductors



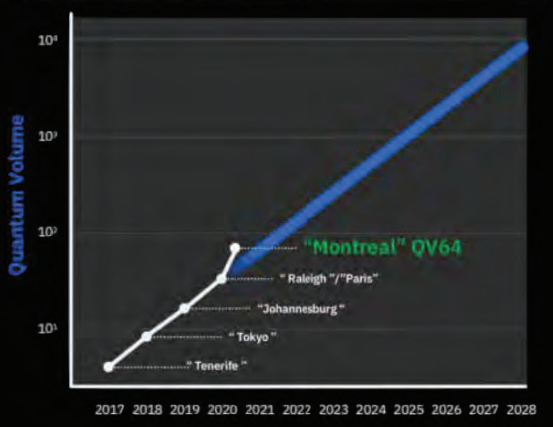
AI BUILDING BLOCKS Quantum Computing

We are in the early stages, and expect significant progress over the coming years

Moore's law

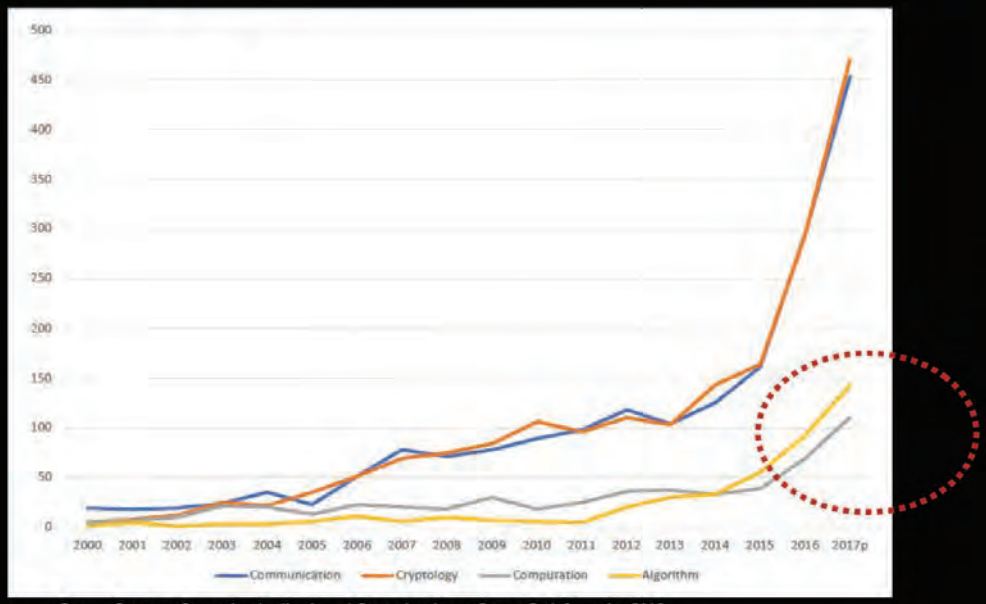


Quantum Volume: The New Moore's Law



3. AI BUILDING BLOCKS Quantum Computing

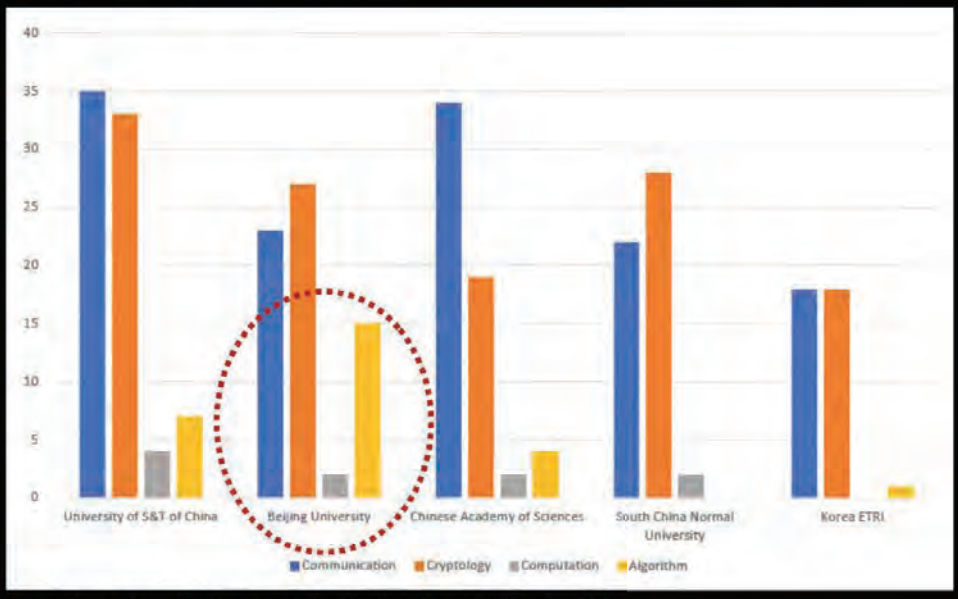
Quantum Communication, Cryptology, Algorithm and Computation Patent Families by **Category and Publication Year**



Source: Quantum Computing Applications: A Patent Landscape Report. Patinformatics. 2018

3. AI BUILDING BLOCKS Quantum Computing

Quantum Communication, Cryptology, Algorithm and Computation Patent Families by **Top Universities and Category**



Source: Quantum Computing Applications: A Patent Landscape Report. Patinformatics. 2018

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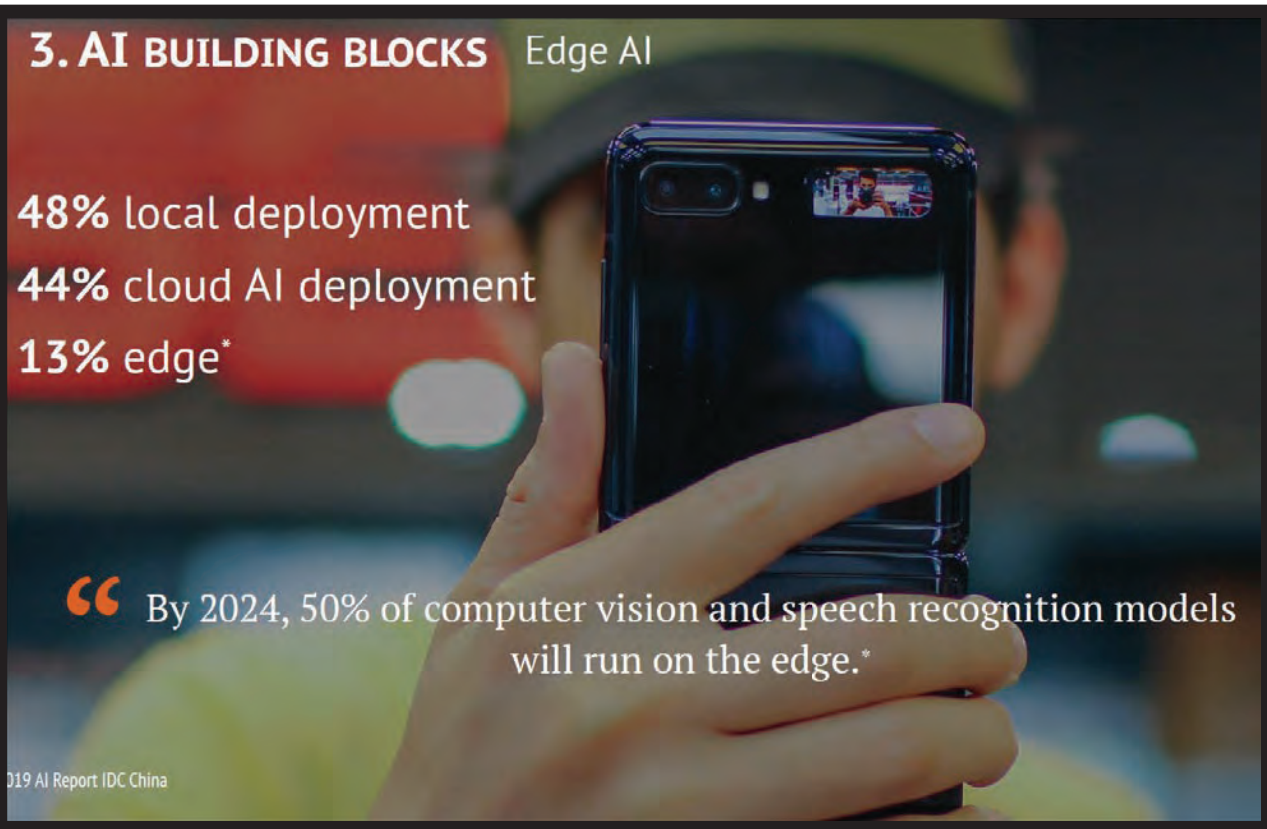
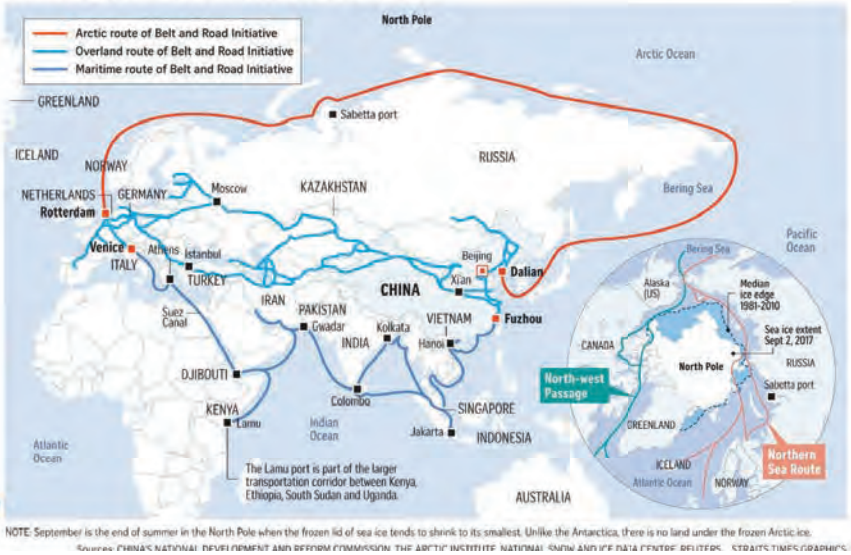


China Standards 2035

- Artificial Intelligence
- Cloud computing
- Smart cities (IoT, 5G)
- Robotics
- Blockchain

China (re)emerging – simmering threat
Belt & Road Initiative (BRI): connectivity as a grand strategy

China's polar extension to Silk Road



NOTE: September is the end of summer in the North Pole when the frozen lid of sea ice tends to shrink to its smallest. Unlike the Antarctica, there is no land under the frozen Arctic ice.

Sources: CHINA'S NATIONAL DEVELOPMENT AND REFORM COMMISSION, THE ARCTIC INSTITUTE, NATIONAL SNOW AND ICE DATA CENTRE, REUTERS, STRAITS TIMES GRAPHICS

CONNECTING EUROPE & ASIA
THE EU STRATEGY

SUSTAINABLE, COMPREHENSIVE AND RULES-BASED CONNECTIVITY WILL CONTRIBUTE TO THE ENHANCED PROSPERITY, SAFETY AND RESILIENCE OF PEOPLE AND SOCIETIES IN EUROPE AND ASIA

WHAT IS CONNECTIVITY?

TRANSPORT
Diversified trade and travel routes linking existing and future transport networks, shorter transit times and simplified customs procedures.

ENERGY
More interconnected regional energy platforms, modern energy systems and environmentally friendly solutions.

DIGITAL
Increased access to digital services while maintaining a high level of protection of consumer and personal data.

HUMAN DIMENSION
Advanced cooperation in education, research, innovation, culture and tourism.

WHY DO WE NEED BETTER CONNECTIVITY FOR EUROPE & ASIA?

- **€1.5 TRILLION IN ANNUAL TRADE** BETWEEN EUROPE AND ASIA
- **EUROPE AND ASIA** ACCOUNT FOR OVER **60% OF THE WORLD'S GDP**
- SINCE 2015, **OVER 18,000 STUDENTS AND ACADEMIC STAFF** HAVE TRAVELLED BETWEEN OUR TWO REGIONS
- WE HAVE A **JOINT RESPONSIBILITY TO PROTECT OUR ENVIRONMENT**
- CROSS-BORDER **RULES AND REGULATIONS MEAN FAIR COMPETITION** FOR BUSINESSES
- **FISCAL AND FINANCIALLY STABILITY** REQUIRES LONG-TERM PLANNING

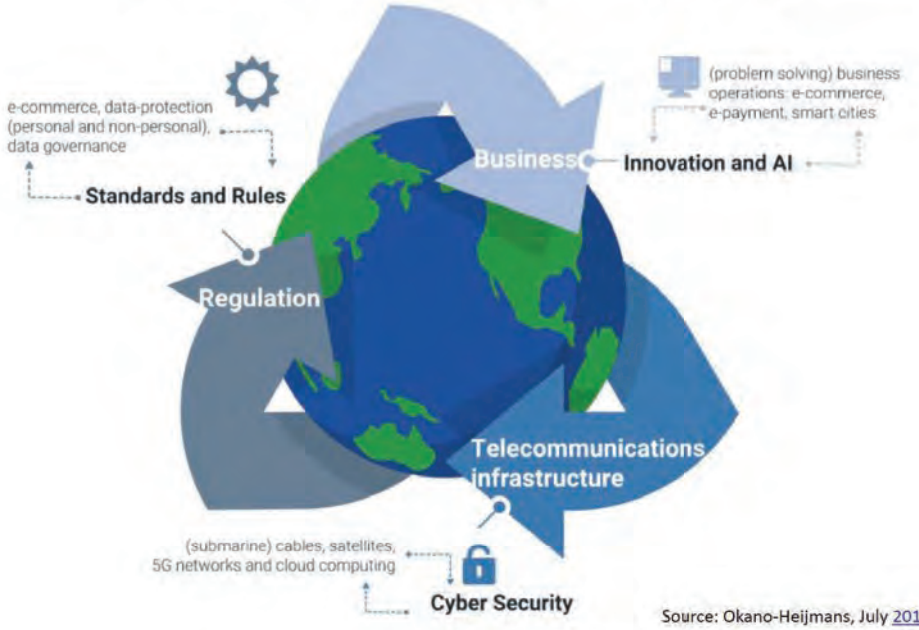
EU response to BRI

2.0 : Sustainable Connectivity

Formally adopted by the Council of the EU on 15 October 2018.

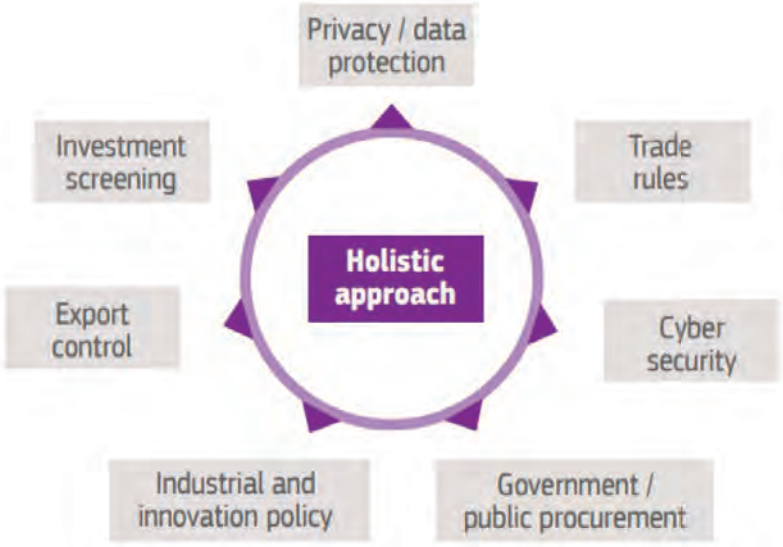
Source: EEAS website, 23 September 2018.

The next great game: digital connectivity



Source: Okano-Heijmans, July 2019.

Protecting strategic ~~autonomy~~ resilience in digital technologies: policy instruments



Source: European Political Strategy Centre, July 2019.

Changing tides

industrial policy 2.0 – towards 'trusted communities'?

Source: Politico.EU, 3 March 2020.

The overall aim of EU(MS):
Strategic ~~autonomy~~ resilience – in the digital age

STRATEGIC AUTONOMY
Ability of the EU and its Member States to independently set objectives and act upon them according to European interests

Political
- Susceptibility to blackmailing / coercion
- Integrity of democratic procedures
- Ability to shape global norms, rules and standards

Operational
- Exposure to cyber threats
- Integrity of critical information infrastructure

Industrial
- Import dependencies, supply chain disruptions
- Supply chain security, compromised equipment entering the EU
- Foreign control of critical infrastructure and essential service providers
- Ability to develop future capabilities

Reality: Many opportunities/challenges:

- Aging assets … ROI …. Reliability … Security … Resilience
- Confluence of multiple disruptive forces
- Severe weather events
- Physical and cyber attacks
- Dependencies and inter-relationships (say electricity/power, with energy, water, telecommunications, environment, markets etc.)
- Market and policy including recovery of investments

Source: IEEE report to the U.S. DOE for the White House's Quadrennial Energy Review (QER) to guide U.S. energy policy. See Chapter 4, on implications and importance of aging infrastructure and the options for addressing them: http://www.ieee-pes.org/final-ieee-report-to-doe-qer-on-priority-issues

Smarter about education, safety, energy, water, food, transp., e-gov… Innovative Cities:

- **Smarter transportation**
  Stockholm, Dublin, Singapore and Brisbane are working with IBM to develop smart systems ranging from predictive tools to smart cards to congestion charging in order to reduce traffic and pollution.
- **Smarter policing and emergency response**
  New York, Syracuse, Santa Barbara and St. Louis are using data analytics, wireless and video surveillance capabilities to strengthen crime fighting and the coordination of emergency response units.
- **Smarter power and water management**
  Local government agencies, farmers and ranchers in the Paraguay-Parana River basin to understand the factors that can help to safeguard the quality and availability of the water system. Malta is building a smart grid that links the power and water systems, and will detect leakages, allow for variable pricing and provide more control to consumers. Ultimately, it will enable this island country to replace fossil fuels with sustainable energy sources.
- **Smarter governance**
  Albuquerque is using a business intelligence solution to automate data sharing among its 7,000 employees in more than 20 departments, so every employee gets a single version of the truth. It has realized cost savings of almost 2,000%.

'Cities are perfect for promoting change and renewable energies. Cities can serve as innovation platforms, creating clusters of business around green energy."

Top 10 cities

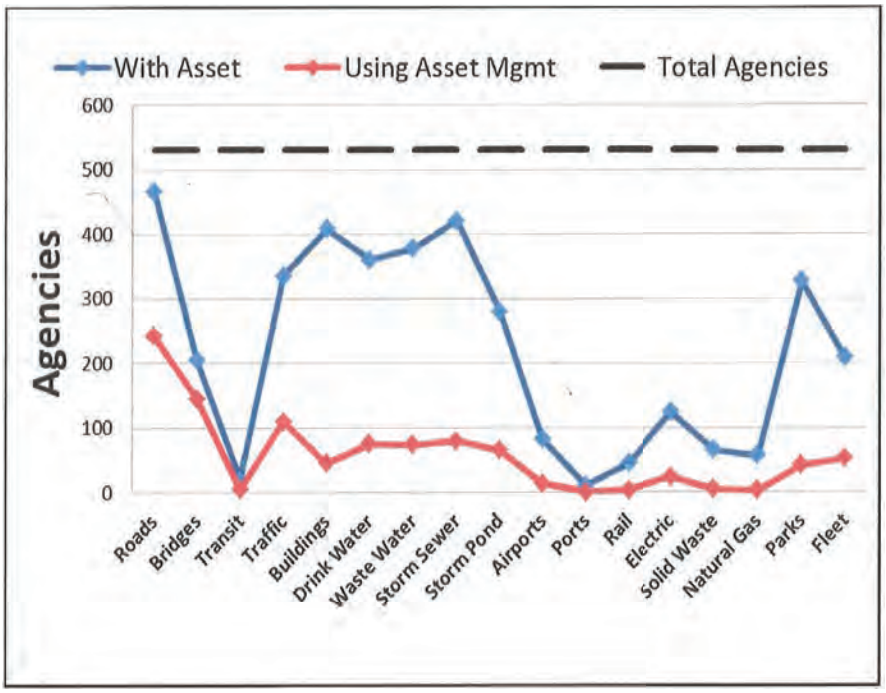
Rank	Country	City	Rating
1	Canada	Vancouver	98.0
2	Austria	Vienna	97.9
3	Australia	Melbourne	97.5
4	Canada	Toronto	97.2
5	Canada	Calgary	96.6
6	Finland	Helsinki	96.2
7	Australia	Sydney	96.1
8=	Australia	Perth	95.9
8=	Australia	Adelaide	95.9
10	New Zealand	Auckland	95.7

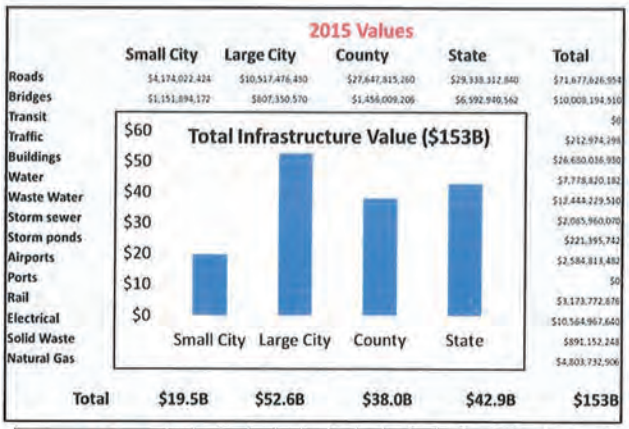
Not Just Utilities … Our Role in Minnesota: 2015 MN2050 Survey

MN 2050 Infrastructure planning, long term success

	2015 Values				
	Small City	Large City	County	State	Total
Roads	$4,174,022,424	$10,517,476,430	$27,647,815,260	$29,338,312,840	$71,677,626,954
Bridges	$1,151,894,172	$807,350,570	$1,456,009,206	$6,592,940,562	$10,008,194,510
Transit	$0	$0	$0	$0	$0
Traffic	$14,168,440	$138,820,460	$59,985,398	$0	$212,974,298
Buildings	$7,583,657,510	$13,724,959,690	$4,869,723,674	$501,696,056	$26,680,036,930
Water	$1,499,020,952	$6,279,799,230	$0	$0	$7,778,820,182
Waste Water	$1,704,463,332	$4,244,983,540	$0	$6,494,782,638	$12,444,229,510
Storm sewer	$0	$2,085,960,070	$0	$0	$2,085,960,070
Storm ponds	$150,185,464	$65,757,060	$5,453,218	$0	$221,395,742
Airports	$1,240,446,922	$1,344,366,560	$0	$0	$2,584,813,482
Ports	$0	$0	$0	$0	$0
Rail	$0	$0	$3,173,772,876	$0	$3,173,772,876
Electrical	$0	$10,564,967,640	$0	$0	$10,564,967,640
Solid Waste	$0	$94,982,420	$796,169,828	$0	$891,152,248
Natural Gas	$2,056,549,066	$2,747,183,840	$0	$0	$4,803,732,906
Total	**$19.5B**	**$52.6B**	**$38.0B**	**$42.9B**	**$153B**

Not Just Utilities … Our Role in Minnesota: 2015 MN2050 Survey





Assets Managed by Cities, Counties and State Agencies

	Assets Managed	Road	Bridge	Transit	Traffic	Buildings	Drink Water	Waste Water	Storm Sewer	Storm Pond	Airports	Ports	Railways	Electrical	Solid Waste	Natural Gas	Total
Small Cities	14	97	11	1	55	71	92	92	89	54	15	0	7	18	5	9	616
Large Cities	15	187	88	4	112	109	128	139	137	133	19	2	9	54	9	7	1137
Counties	14	132	99	4	64	45	7	5	36	18	8	0	4	4	18	3	447
State Agencies	7	9	3	0	3	7	0	4	2	2	0	0	0	0	0	0	30
Totals =		425	201	9	234	232	227	240	264	207	42	2	20	76	32	19	2230

Macro Forces

- Increased dependence on electricity/power & energy
- **Aging workforce**
- Energy/Power Systems Transition: Undergoing rapid change
- Renewal generation and storage operations
- **New technologies**
- Growing threats: Cyber and Physical (including Climate Change)
- Increased use of automation - IT and Operational Technologies (OTs)
  - But need to have security-by-design (built in) and train when automation fails

… pathways forward?

… SECURITY by design

… Self healing, resilient, & adaptive (AI, ML, and more)

… Local "power quality": locally self adjusting

… Evolvable architecture, open, predictive

… Quantum, Q-bits … Innovation (control, quality, locality…)

… Modularity/flexibility & Predictive Precursors Management

Enabling secure, reliable and resilient systems requires people and organizations that can

- **Anticipate**
- **Plan**
- **Implement**
- **Adapt and improvise**

Risk-managed Architectures and Layered Defense

⌘ resilience: ability to recover quickly

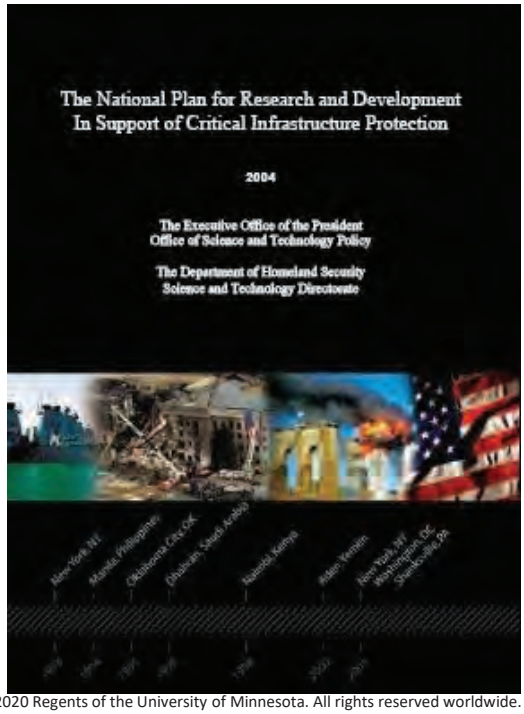
⌘robustness: failure-resistant through design and/or construction

⌘redundancy:duplicative capacity for service delivery

The National Plan for Research and Development In Support of Critical Infrastructure Protection

The area of **self-healing infrastructure** was recommended in 2005 by the White House Office of Science and Technology Policy (OSTP) and the U.S. Department of Homeland Security (DHS) as one of three thrust areas for the National Plan for research and development in support of Critical Infrastructure Protection (CIP)

… in 2004…



There is nothing in this world as common as an idea, and nothing as hard to carry out as an idea.

Will Rogers

Leaders Have Both Breadth and Depth

demographics

economics

environment

Society

politics

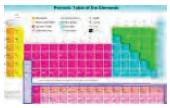
military

society

Business

Technology

...creating a human-built world.
(vision/values)



Science and Discovery

...discovering & understanding our natural world.

Human Capital: "Soft" Skills and Foresight are Critical

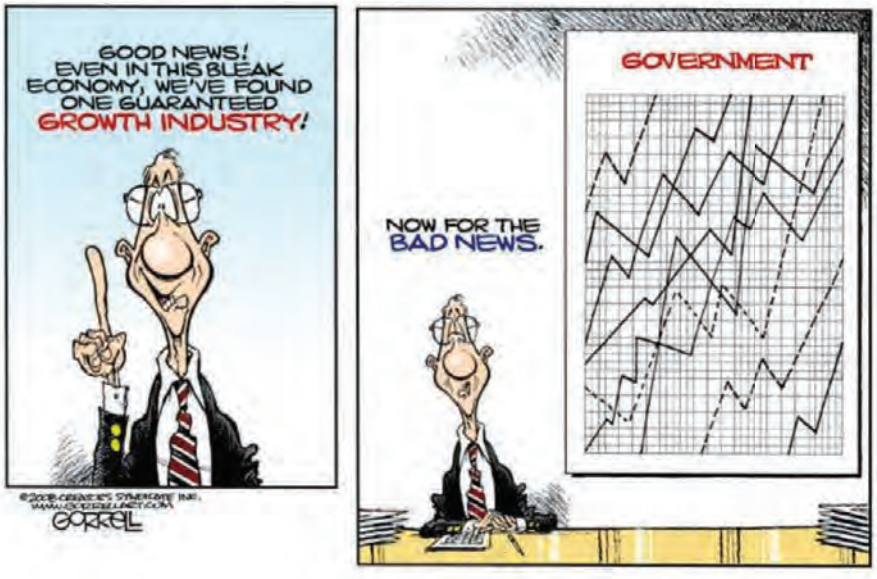
- Agile Reasoning
- Ability to Plan
- Attention to Detail
- Grasps Big Picture Overview
- Excellent Communicator
- Team Player
- Capability to Lead
- Flexible
- Has Emotional Control under Stress
- Adapts to changing environment

Unlocking Smart Grid Benefits Requires

- Intelligent Technology
- Intelligent Policy
- Empowered Consumers & Communities

INTELLIGENCE = the ability to understand and deal successfully with new situations

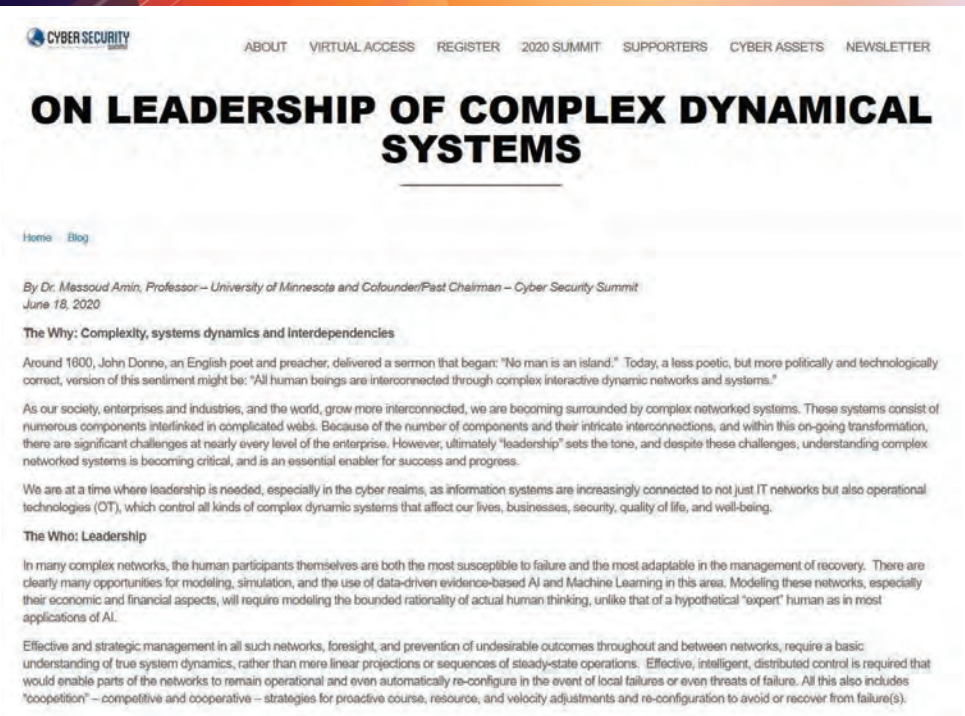
With the intensifying 'clash of capitalisms'...
...the state is growing in importance again!



Recall Background* and Motivation:

The Why: Complexity, systems dynamics and interdependencies: We are at a time where leadership is needed, especially in the cyber realms, as information systems are increasingly connected to not just IT networks but also operational technologies (OT), which control all kinds of complex dynamic systems that affect our lives, businesses, security, quality of life, and well-being.

The Who: Leadership: Effective and strategic management in all such networks, foresight, and prevention of undesirable outcomes throughout and between networks, require a basic understanding of true system dynamics, rather than mere linear projections or sequences of steady-state operations… All this also includes "coopetition" – competitive and cooperative – strategies for proactive course, resource, and velocity adjustments and re-configuration to avoid or recover from failure(s).



CYBER SECURITY

ABOUT VIRTUAL ACCESS REGISTER 2020 SUMMIT SUPPORTERS CYBER ASSETS NEWSLETTER

ON LEADERSHIP OF COMPLEX DYNAMICAL SYSTEMS

Home Blog

By Dr. Massoud Amin, Professor – University of Minnesota and Cofounder/Past Chairman – Cyber Security Summit
June 18, 2020

The Why: Complexity, systems dynamics and interdependencies

Around 1600, John Donne, an English poet and preacher, delivered a sermon that began: "No man is an island." Today, a less poetic, but more politically and technologically correct, version of this sentiment might be: "All human beings are interconnected through complex interactive dynamic networks and systems."

As our society, enterprises and industries, and the world, grow more interconnected, we are becoming surrounded by complex networked systems. These systems consist of numerous components interlinked in complicated webs. Because of the number of components and their intricate interconnections, and within this on-going transformation, there are significant challenges at nearly every level of the enterprise. However, ultimately "leadership" sets the tone, and despite these challenges, understanding complex networked systems is becoming critical, and is an essential enabler for success and progress.

We are at a time where leadership is needed, especially in the cyber realms, as information systems are increasingly connected to not just IT networks but also operational technologies (OT), which control all kinds of complex dynamic systems that affect our lives, businesses, security, quality of life, and well-being.

The Who: Leadership

In many complex networks, the human participants themselves are both the most susceptible to failure and the most adaptable in the management of recovery. There are clearly many opportunities for modeling, simulation, and the use of data-driven evidence-based AI and Machine Learning in this area. Modeling these networks, especially their economic and financial aspects, will require modeling the bounded rationality of actual human thinking, unlike that of a hypothetical "expert" human as in most applications of AI.

Effective and strategic management in all such networks, foresight, and prevention of undesirable outcomes throughout and between networks, require a basic understanding of true system dynamics, rather than mere linear projections or sequences of steady-state operations. Effective, intelligent, distributed control is required that would enable parts of the networks to remain operational and even automatically re-configure in the event of local failures or even threats of failure. All this also includes "coopetition" – competitive and cooperative – strategies for proactive course, resource, and velocity adjustments and re-configuration to avoid or recover from failure(s).

*Reference: https://www.cybersecuritysummit.org/2020/06/17/on-leadership-of-complex-dynamical-systems/

Recall … Background* and Motivation:

Considerations include:

- In short, what are we trying to do/solve?
- Internal and external analyses, best practices (beyond lists and audits), and a lot more.
- What are the assets, performance metrics, gaps/issues, challenges/opportunities, associated risks/benefits, costs/ROI, and over what time horizon?
- The issues of distributed versus centralized control, especially the information available, required, and desired at each node in each case.
- Consider how to achieve robust and secure systems, even at the expense of optimization. The problem is how to design the trade-off between security, resilience and optimality so that the system will slide smoothly among these goals when failures or other unexpected events occur.
- In the case of human-operated systems (which most are), there is the problem of how to make systems "human error tolerant" without killing human creativity, especially creativity in responding to the unexpected.
- Early/precursor detection and proactive security: How can we tell when a situation is getting out of hand? We need an "expert system" that is capable of analyzing the effect of the particular combination of parameters that is currently out of normal range.
- It is necessary to plan and re-plan, i.e.: restart the planning process repeatedly, beginning from the present state of the system. While this is going on, how should non-critical information be handled? Another issue is how to deal with a situation where we are trying to recover from a fault, but a planned change is also occurring.
- How much can we expect of pre-attentive processing on the part of the key units/personnel? [Reference: "Development and Leadership of Research Consortia: Lessons learned and possible road ahead for continued innovation"]

In conclusion, our reliance on total interconnections comes with so many benefits, however there are downsides that must be addressed by leaders. This IS ultimately a key part of a leader's very own core responsibilities, even if he/she has delegated it to others. John Donne recognized this long ago when he ended that same sermon on an ominous note: "Never send to know for whom the bell tolls; it tolls for thee."

For more information, please see:

*Reference: https://www.cybersecuritysummit.org/2020/06/17/on-leadership-of-complex-dynamical-systems/

Considerations include:

- ✓ 1. In short, what are we trying to do/solve?
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- ✓ 3. What are the assets, performance metrics, gaps/issues, challenges/opportunities, associated risks/benefits, costs/ROI, and over what time horizon?
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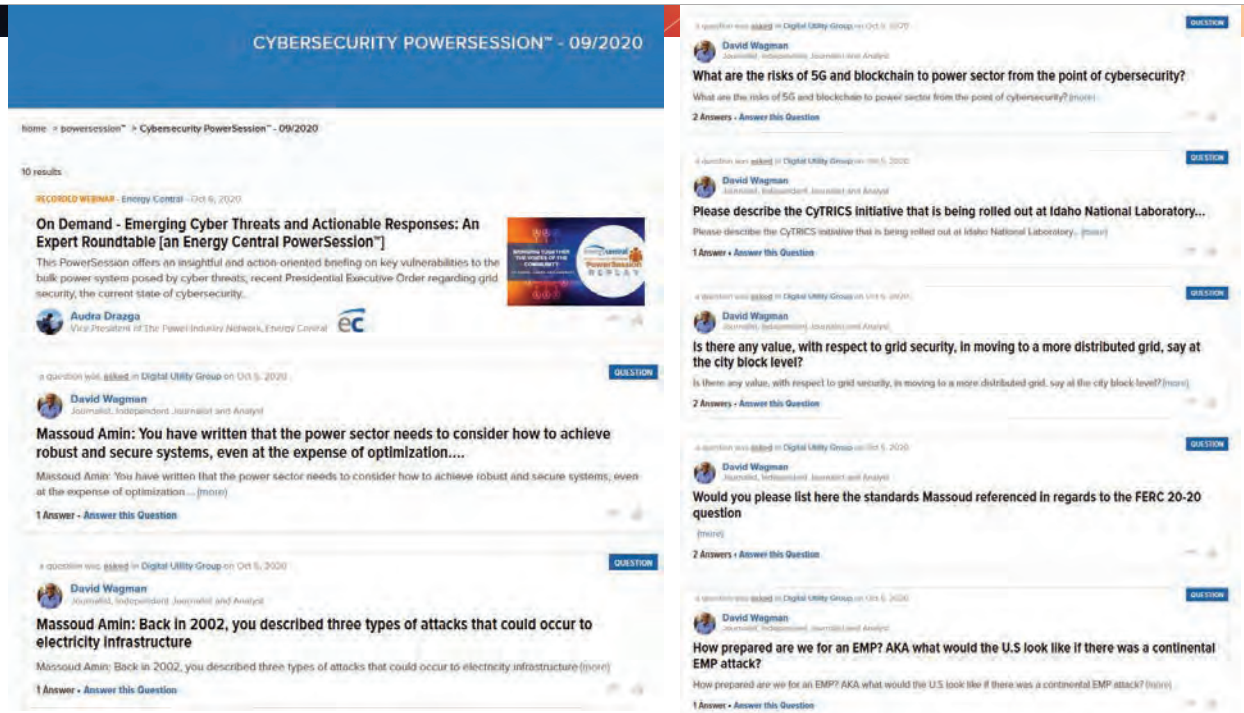
For more information, please see publications and presentations at:

- https://smartgrid.ieee.org/newsletters/may-2020/on-countering-multi-pronged-evolving-systemic-threats-covid-19-and-beyond
- https://smartgrid.ieee.org/newsletters/november-2019/continuity-change-assuring-proactive-security-defense-and-resilience-among-automation-digitization
- https://massoud-amin.umn.edu/sites/massoud-amin.umn.edu/files/2020-03/mro_newsletter_9-2011_p1-4.pdf
- https://massoud-amin.umn.edu/sites/massoud-amin.umn.edu/files/2020-03/global_transition.pdf
- https://www.cybersecuritysummit.org/2020/06/17/on-leadership-of-complex-dynamical-systems



Please see: https://energycentral.com/o/energy-central/demand-emerging-cyber-threats-and-actionable-responses-expert-roundtable-energy-0 and Q@A at https://energycentral.com/topics/tags/cybersecurity-powersession-09-2020

Discussion and the Road Ahead:

- What are the innovation opportunities?

  What is your vision for the future– what will it look like or how will it perform in 2021-2025?

  - **Pinch points:** What are the difficult challenges to overcome to achieve your vision?
  - **Pathways:** What enabling technologies and policies are needed to address these?
  - **Foresight:** What critical issues should we consider in beginning plans for 2021 and beyond?