
Achieving Outcomes from Challenge-Driven Research Funding Programs

The Future of Challenge-
Driven Partnerships
UCI-CSTI-UIDP Workshop
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Grand Challenge Problems: Two Categories

Well Defined Goals

Sharp criteria for achievement of success

Technical research and innovation roadmaps

Structured relationships between industry, academic and government actors

Open Ended Missions

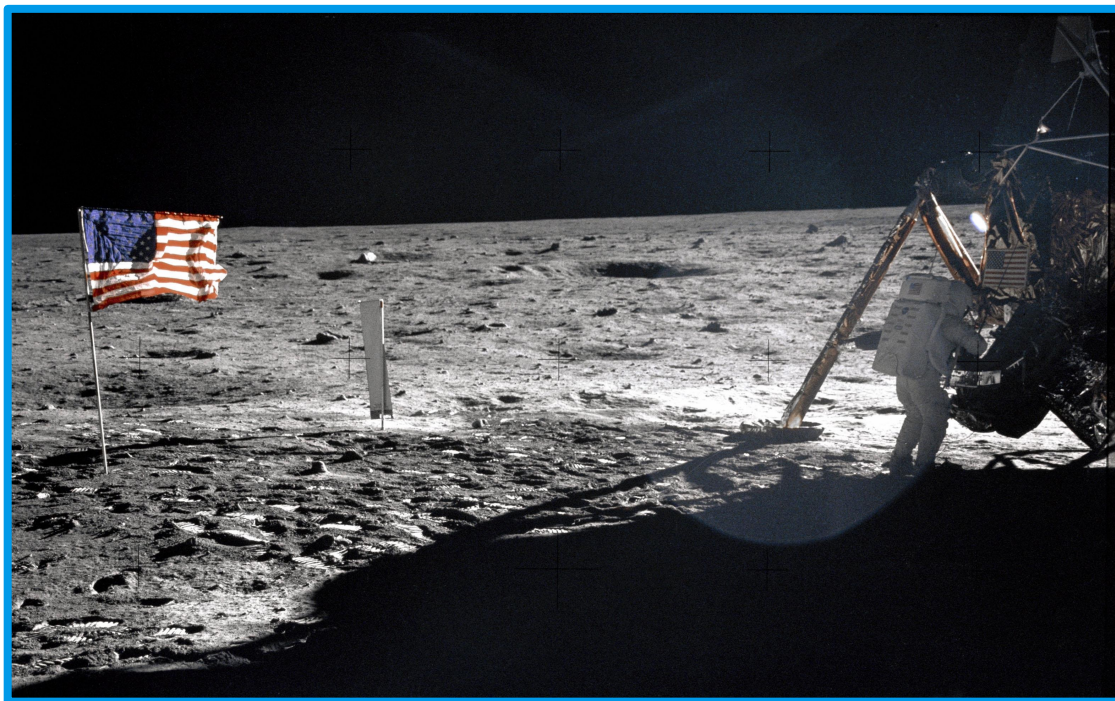
Require transformation of socio-economic-technological systems

Heterogeneous actors

Require social innovation in addition to technological innovation



President John F. Kennedy
speaks before a joint session
of Congress,
May 25, 1961



Apollo 11, July 20, 1969
Neil Armstrong: *One Giant Leap For Mankind*

“should commit itself to
achieving the goal, before this
decade is out, of landing a man
on the Moon and returning him
safely to the Earth”



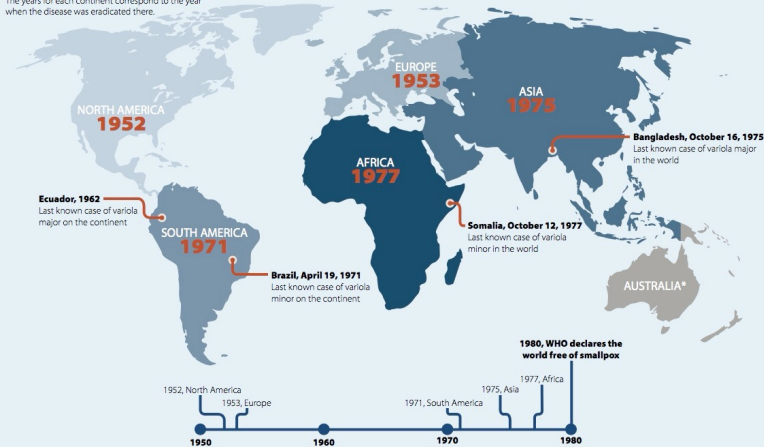
Edward Jenner

“On the Origin of the Vaccine Inoculator
1801

“the annihilation of the smallpox, the most dreadful scourge of the human species, must be the final result of this practice.”

GLOBAL SMALLPOX ERADICATION

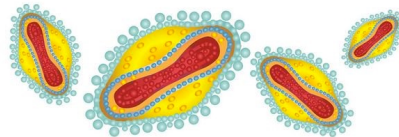
The historically important dates highlighted in the map show countries in which the last naturally acquired cases of smallpox occurred. The years for each continent correspond to the year when the disease was eradicated there.



VACCINATION

prevention is better than a cure!

smallpox ERADICATED



1796

Edward Jenner creates first smallpox vaccination

1967

World Health Organization pushes eradication efforts

1980

World Health Organization declares smallpox eradicated!

“In 1980 WHO declared smallpox eradicated - the only infectious disease to achieve this distinction. This remains among the most notable and profound public health successes in history.” WHO

Contemporary Grand Challenge Examples

- “Sun shot”: Dollar per watt PV solar
- Battery energy storage: \$100 per kWh
- COVID-19 Vaccine development

- UN Sustainable Development Goals
- Energy system decarbonization
- Aging society

- **US CHIPS Initiative**

Grand Challenges often are Wicked Problems

”Wicked problems are ones for which there is no clear stopping rule - you cannot say for sure that you are done with the problem. Working on it more might well bring forth a better solution. There is no single right answer and every attempt can matter because it affects the things people depend upon.”

Dilemmas in a General Theory of Planning*

HORST W. J. RITTEL

Professor of the Science of Design, University of California, Berkeley

MELVIN M. WEBBER

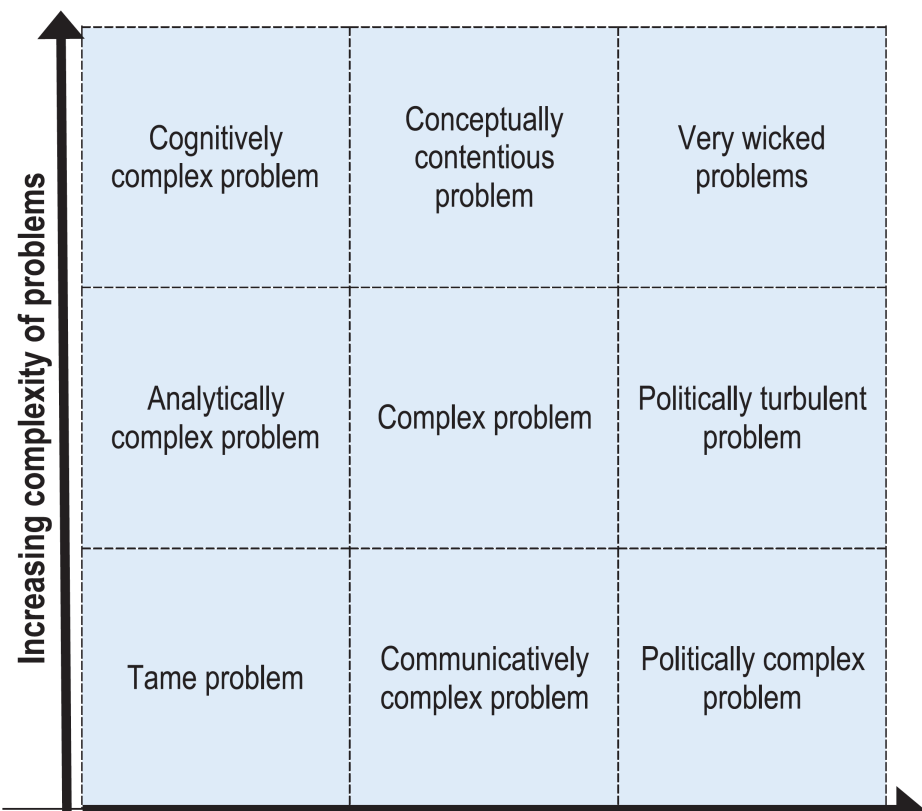
Professor of City Planning, University of California, Berkeley

[Policy Sciences, 1973](#)

Neither problem nor solution is clear

Problem clear, solution not clear

Both problem and solution clear



Increasing complexity of problems

Increasing difficulty re stakeholders/institutions

Co-operative or indifferent relationships

Multiple parties, each with only some of relevant knowledge

Multiple parties, conflicting in values/interests

UK Industrial Strategy: the Grand Challenges

- Growing the Artificial Intelligence and data driven economy
- Clean growth
- Future of mobility
- Ageing society

Implications for the Research Community

- Research funding agencies need to have clear understanding of the nature of the grand challenge
- Break “wicked” problems into tamer subproblems
- Program design should intentionally bring together complementary organizations and actors from academic, industry, government, and philanthropy
- Alignment of interests is difficult but necessary
- Industry roadmaps can be very effective. Example: semiconductor industry association roadmap for Moore’s Law

Report of NSF Workshop on a National Networks of Research Institutes (NNRI)

Workshop Co-organizers:

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Jim Kurose, University of Massachusetts Amherst

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June 29, 2021

Five Pillars

**Partnerships for Translation and
Innovation**

Regional and Place-Based Innovation

Management of Institutes and Networks

**Cultivation and Development of Human
Talent**

Institute and Network Success Metrics

Research and Innovation Experiments

Convergence paradigm for multi-disciplinary research

[NSF Gen-4 Convergent ERC program](#)

[NSF Convergence Accelerators](#)

Team science best practices

[UC Irvine TSAL](#)

Place based innovation eco-systems

[NSF Regional Innovation Engines program](#)

[EDA Tech Hubs](#)

US CHIPS program implementation

And many others ... e.g., ARIA

**Daunting realities of the 21st century require
us to get much better at grand challenge
endeavors**

Comments

Ideas

Questions?

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