



Engineering Education

Learning to make a difference

Year Ahead: 2012-13 (edited version)

Reaching Our Full Potential
Community : Agility : Opportunity

Dr. David Radcliffe

Kamyar Haghighi Head, School of Engineering Education

ENE Research Seminar

August 23, 2012

Some Local Factors Shaping the Year Ahead

Priorities of
President
Daniels

Engineering
Strategic Growth
Plan 2012-16
(a.k.a. "Rightsizing")

*Curriculum
Challenge*

Roll Out
of *Core
Curriculum*

MDE
Accreditation
& Dr. Wankat's
retirement

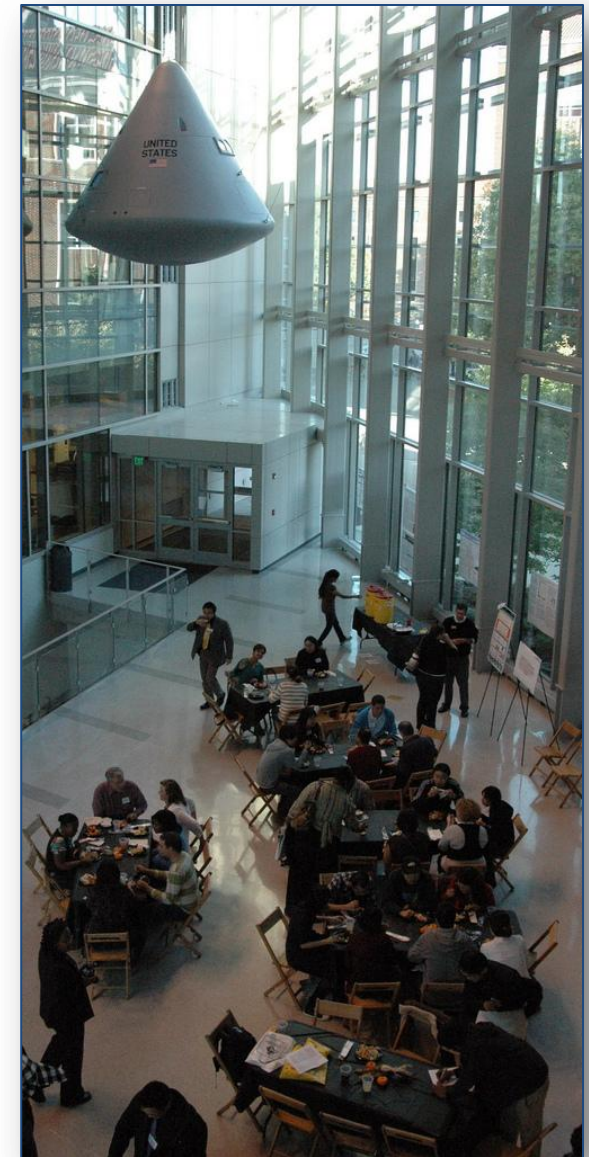
Roll out of
*Foundations
of Excellence*

Indiana's New
30hr General
Education law

Laboratory
and Office
Space

Major ENE Events 2012-13

Fall	Date
ENE Research Advance	Aug 15
Big Ten Grad Expo	Sept 23/4
1st ENE First-Year Friday (FYF)	Sept 28
Alumni Weekend & Family Day	Sept 28/29
Homecoming Weekend	Oct 13
Graduate Open House	Oct 25
2nd ENE Interdisciplinary Colloquium	Nov 1
ENE Industry Advisory Council (Research)	Nov 2
Spring	
5th ENE Outstanding Alumni Awards	Feb 20
ENE Industry Advisory Council (Beyond 2014)	April 8/9
ENE Strategic Advance (Beyond 2014)	May 8



ENE Open Hse. Picture by Alice Pawley

ENE Strategic Priorities for 2012-13

Empower Our People

- Expand Senior Leadership capacity
- Grow faculty and staff (numbers and capability)
- Create rolling plan for course development and teaching assignments

Set the Pace (in Academic Programs)

- Establish FYE Operations Center
- Expand TULIP (Teaching UGs for Learning Investment Program)
- Prepare for MDE Accreditation
- Create Masters (and Certificate) programs

Answer the BIG research questions

- Establish research labs for all major areas
- Foster a collaborative research ecosystem
- Take Industry-based research initiative to next level

Grow the Community

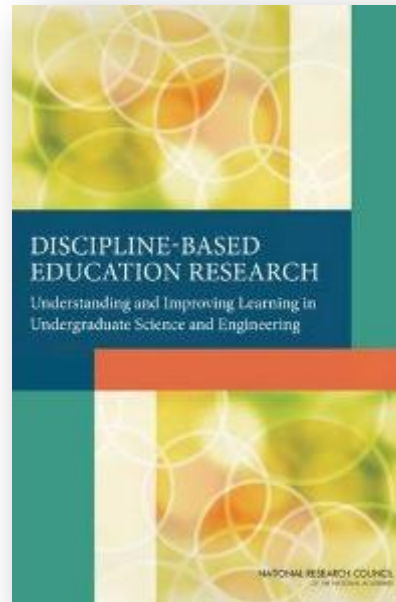
- Lead/host National events and plan for ENE tenth anniversary in 2014
- Consolidate Global Partnerships and academic exchanges

<https://engineering.purdue.edu/ENE/AboutUs/StratPlan.pdf>

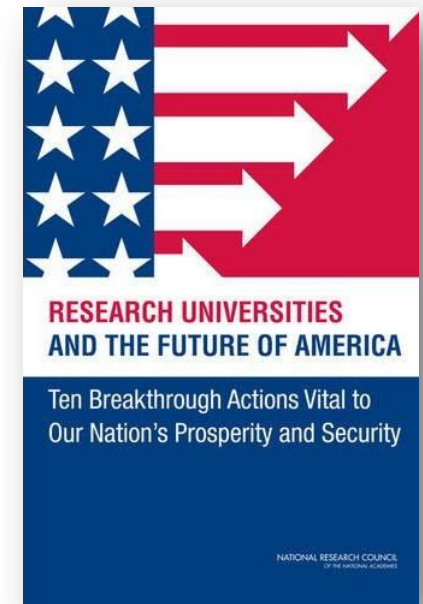
Our Strategic Environment: Recent Reports



ASEE, 2012

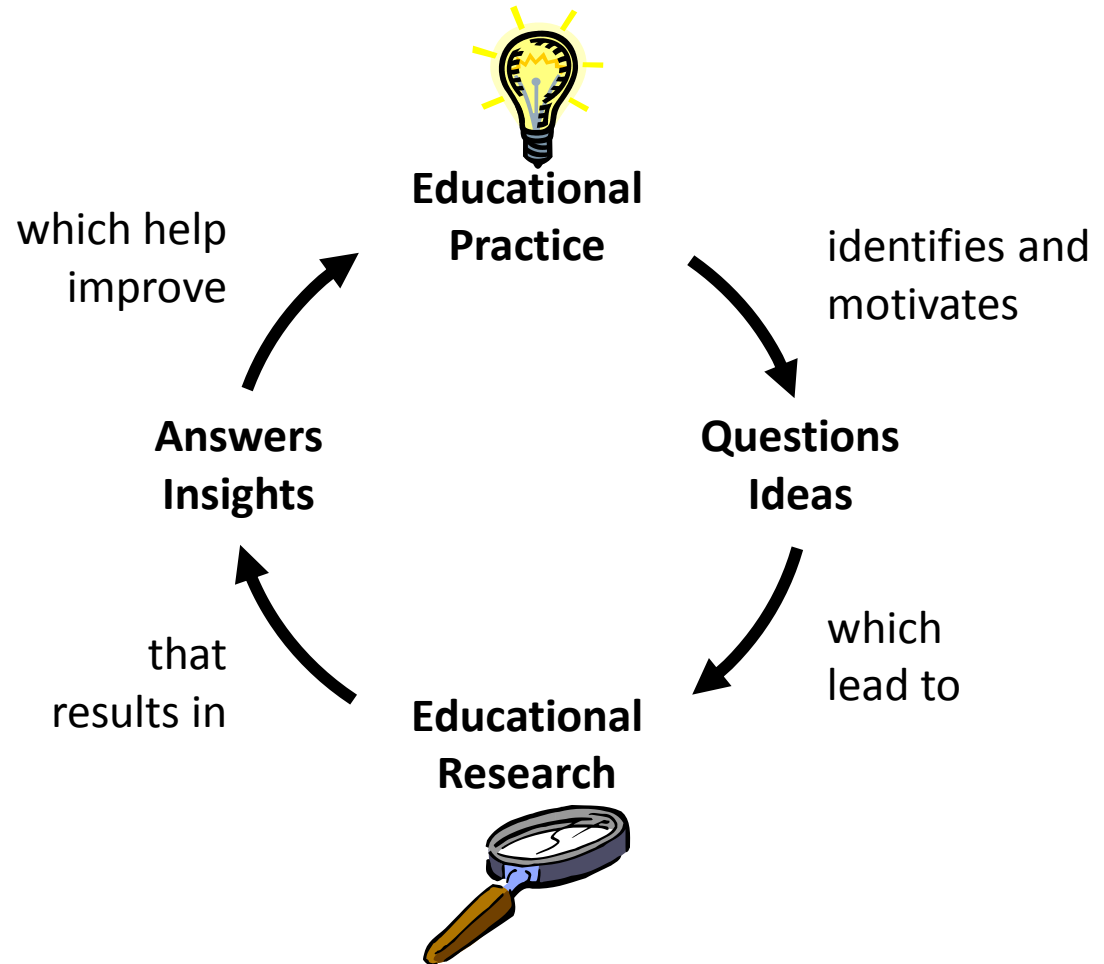


NRC, 2012



BHEW: NAP 2012

Transforming Engineering Education



*creating a culture for scholarly and systematic
innovation in engineering education*

Questions

Who?

While a quality higher education experience involves many stakeholders, the responsibility for the quality of the engineering educational experience rests with the engineering faculty and administration.

What?

A more efficient and effective educational enterprise could be achieved if the engineering curriculum and its instruction and assessment were deployed in programs perceived by students to be personally rewarding, socially relevant, and designed to help them succeed.

How?

Higher levels of performance in any field are achieved by continual innovation that is motivated by the desire to solve important problems and that is addressed systematically in tight interplay with research and proven practices. This time-tested model, widely practiced by engineering faculty in their disciplines but largely untapped in engineering education, lies at the heart of ***transforming the culture in engineering education***.



Recommendations 1-2

Recommendation 1—Value and expect career-long professional development programs in teaching, learning, and education innovation for engineering faculty and administrators, beginning with pre-career preparation for future faculty.

Recommendation 2—Expand collaborations and partnerships between engineering programs and (a) other disciplinary programs germane to the education of engineers as well as (b) other parts of the educational system that support the pre-professional, professional, and continuing education of engineers.



Recommendation 3-5



Recommendation 3—Continue current efforts to make engineering programs more engaging and relevant and especially expand efforts to make them more welcoming.

Recommendation 4—Increase, leverage, and diversify resources in support of engineering teaching, learning, and educational innovation.

Recommendation 5—Raise awareness of the proven principles and effective practices of teaching, learning, and educational innovation, and raise awareness of the scholarship of engineering education.

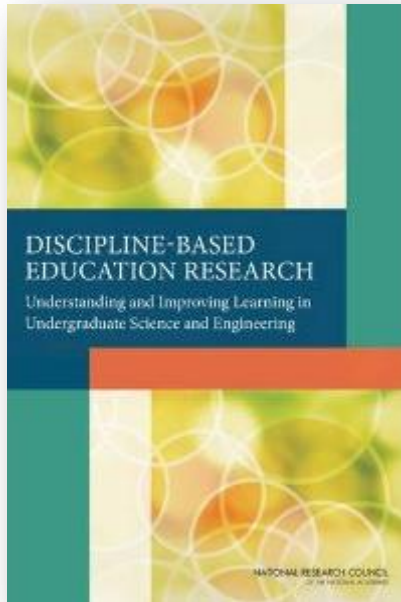
Recommendations 6-7



Recommendation 6—Conduct periodic self-assessments within our individual institutions to measure progress in implementing policies, practices, and infrastructure in support of scholarly and systematic innovation—innovation with impact—in engineering education.

Recommendation 7—Conduct periodic engineering community-wide self-assessments to measure progress in implementing policies, practices, and infrastructure in support of scholarly and systematic innovation—innovation with impact—in engineering education.

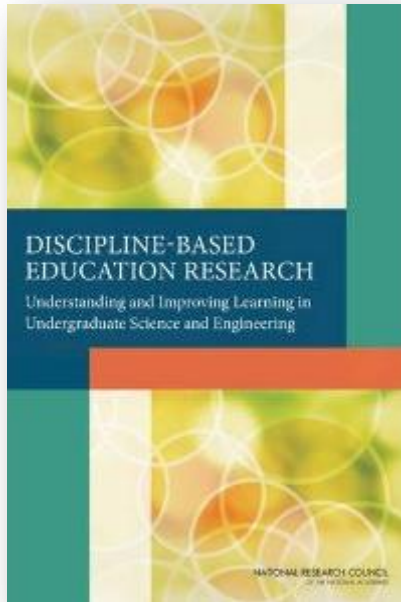
Discipline-Based Education Research (DBER)



Discipline-based education researchers study important aspects of teaching and learning.... for many of these topics, the research base in DBER is not yet robust these topics that are vital to learning science and engineering and warrant further study:

- ***the role of science and engineering practices in undergraduate education, including in undergraduate research experiences;***
- ***students' ability to apply knowledge in different settings (transfer);***
- ***students' ability to monitor their own learning processes (metacognition); and***
- ***students' dispositions and motivations to study science and engineering (affective domain).***

Practice-to-Research & Research-to-Practice



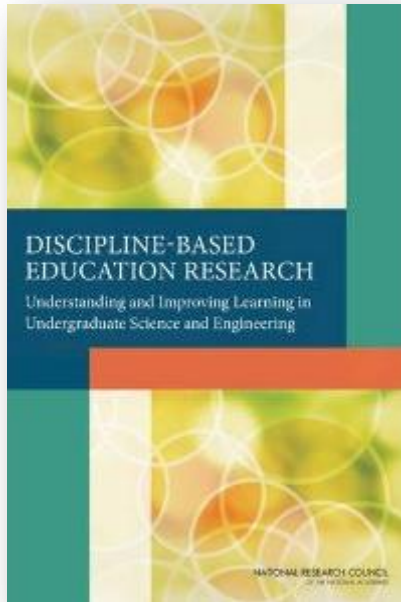
One of the long term goals of DBER is to contribute to the knowledge base in a way that can guide the translation of DBER findings to classroom practice.

The committee was charged with two related questions:

To what extent and how has DBER informed teaching and learning in the various disciplines?

What factors are influencing differences in the state of research and its impact in the various disciplines?

Future Directions for DBER



- understand how people learn the concepts, practices, and ways of thinking of science and engineering;
- understand the nature and development of expertise in a discipline;
- help to identify and measure the efficacy of appropriate learning objectives and instructional approaches that advance students toward those objectives;
- contribute to the knowledge base in a way that can guide the translation of DBER findings to classroom practice; and
- identify approaches to make science and engineering education broad and inclusive.

Research Universities and the Future of the US

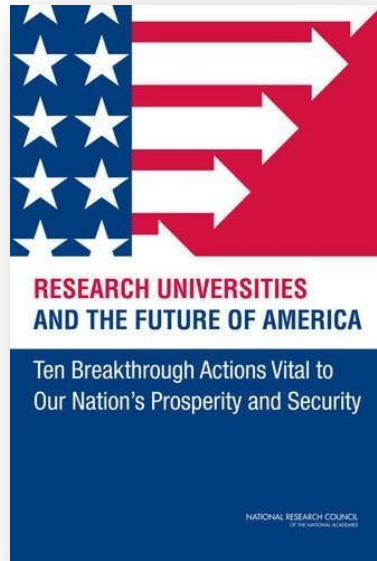


This report examines the health and competitiveness of our nation's research universities and their strong partnership with government and industry that is critical to the nation's prosperity and national goals.

It responds to a request from Congress for

"the top ten actions that Congress, the federal government, state governments, research universities, and others could take to assure the ability of the American research university to maintain the excellence in research and doctoral education needed to help the United States compete, prosper, and achieve national goals for health, energy, the environment, and security in the global community of the 21st century."

Recommendations 1-2



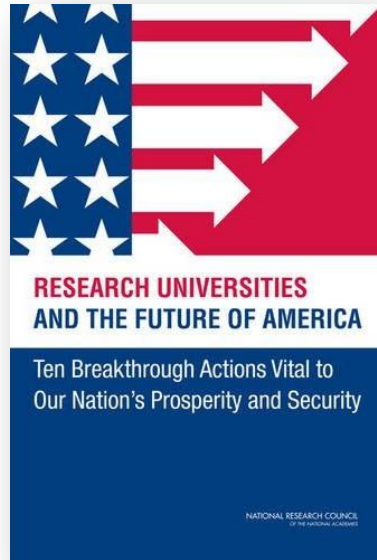
1. Federal Action

Within the broader framework of U.S. innovation and R&D strategies, the federal government should adopt stable and effective policies, practices, and funding for university-performed R&D and graduate education so that the nation will have a stream of new knowledge and educated people to power our future, helping us meet national goals and ensure prosperity and security.

2. State Action

Provide greater autonomy for public research universities so that these institutions may leverage local and regional strengths to compete strategically and respond with agility to new opportunities. At the same time, restore state appropriations for higher education, including graduate education and research, to levels that allow public research universities to operate at world-class levels.

Recommendations 3-4



3. Strengthening Partnerships with Business

Strengthen the business role in the research partnership, facilitating the transfer of knowledge, ideas, and technology to society, and accelerate “time-to-innovation” in order to achieve our national goals.

4. Improving University Productivity

Increase university cost-effectiveness and productivity in order to provide a greater return on investment for taxpayers, philanthropists, corporations, foundations, and other research sponsors.

Improving University Productivity



Governments are starting
to reward “productivity”



Winners, losers seen in funding process

By Eric Weddle
eweddle@jconline.com

The winners and losers for state higher education funding in the next two-year budget cycle are becoming clear.

Two colleges stand to lose a combined \$17.7 million in appropriations. Ivy Tech Community College may get boosted by nearly \$15 million.

The performance-based funding model, created by a state commission, rewards campuses for areas such as on-time graduation rates and degrees earned by low-income students. A draft version of the competitive formula released this month is the first step in the debate for 2013-15 budget appropriations.

Lawmakers will use these recommendations to decide next year what each college will receive in taxpayer support. These recommendations are not final.

Teresa Lubbers, Indiana Commission for Higher Education commissioner, called the formula finely tuned and balanced after working with school leaders, some of whom challenged the initial metrics in the past.

“Some institutions will benefit from one metric and one will benefit from the other,” Lubbers said last week, adding: “This is performance funding. There is a pool of money, and

Recommendations 5-7



5. A Strategic Investment Program

Create a Strategic Investment Program that funds initiatives at research universities critical to advancing education and research in areas of key national priority.

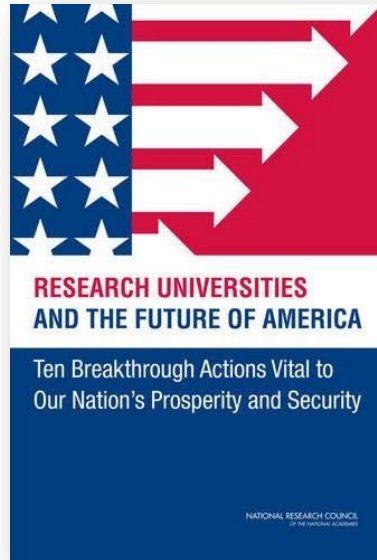
6. Full Federal Funding of Research

The federal government and other research sponsors should strive to cover the full costs of research projects and other activities they procure from research universities in a consistent and transparent manner.

7. Reducing Regulatory Burdens

Reduce or eliminate regulations that increase administrative costs, impede research productivity, and deflect creative energy without substantially improving the research environment.

Recommendations 8-10



8. Reforming Graduate Education

Improve the capacity of graduate programs to attract talented students by addressing issues such as attrition rates, time-to-degree, funding, and alignment with both student career opportunities and national interests.

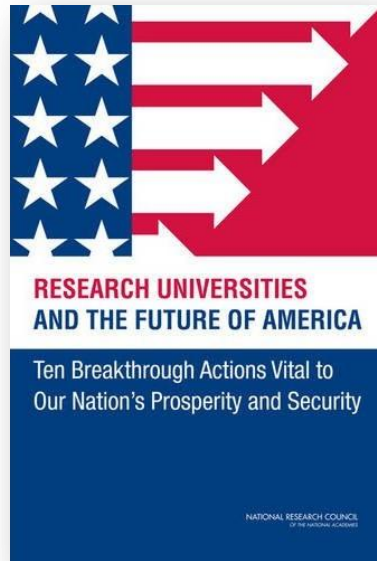
9. STEM Pathways and Diversity

Secure for the United States the full benefits of education for all Americans, including women and underrepresented minorities, in science, mathematics, engineering, and technology.

10. International Students and Scholars

Ensure that the United States will continue to benefit strongly from the participation of international students and scholars in our research enterprise.

Transformational Opportunities for ENE



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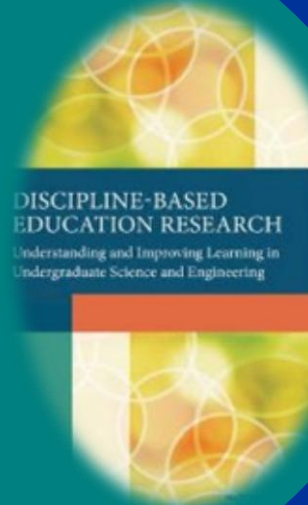
The BIG picture



**INNOVATION WITH
IMPACT**

Creating a Culture for Scholarly
and Systematic Innovation
in Engineering Education

JUNE 1, 2012



**DISCIPLINE-BASED
EDUCATION RESEARCH**
Understanding and Improving Learning in
Undergraduate Science and Engineering



**RESEARCH UNIVERSITIES
AND THE FUTURE OF AMERICA**

Ten Breakthrough Actions Vital to
Our Nation's Prosperity and Security

NATIONAL

Strategic Growth Opportunity: Dream BIG

The College of Engineering is entering a period of significant strategic growth

Imagine

a transformed and transformative educational experience for all engineering students at Purdue - undergraduate, graduate and professionals - one informed by sophisticated knowledge about how people learn to engineer. *Imagine* Purdue engineers and researchers who, in collaboration with others, help communities globally to achieve their aspirations in creative yet responsible and sustainable ways.

Imagine programs in engineering at Purdue that attract and develop a more diverse range of people and are suited to addressing complex sociotechnical issues. *Imagine* broader, more inclusive boundaries for engineering and the purpose of engineering education.



Transformational Research Growth & Impact

Sought out research partner in large Purdue grants

ENE led major multi-year grant ~ \$20m

More diversified research funding sources

Greater coherence in ENE research endeavors



INSPIRE 2020

Industry Research Institute

Expanded global research collaborations

New research labs & collaboration spaces

Research-to-Practice collaborations with other engineering schools in Purdue

New professional development opportunities for post-docs

Exciting new informal gatherings for exchange of ideas

Improved graduate student recruitment, retention & development

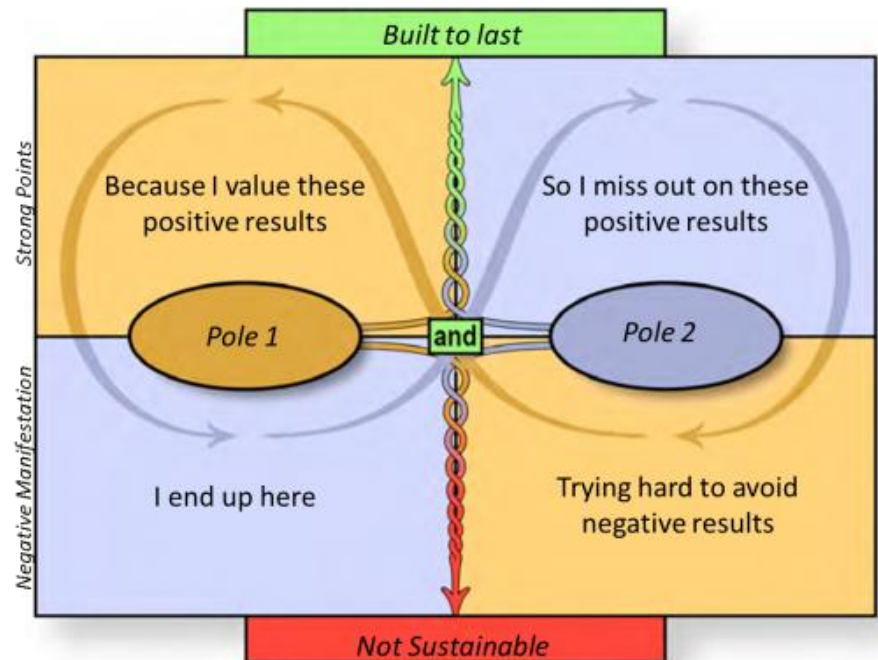
Two Frames for Grasping these Opportunities

Blue Ocean Strategy: Rather than compete based on existing ways of doing and being (Red Oceans), we create new ways of being and doing where there is no competition.

Polarity Management: Rather than being a choice between alternative futures, it is about the achieving the best of both while avoiding the down side of each.

Red Ocean Strategy	Blue Ocean Strategy
Compete in existing market space	Create uncontested market space
Beat the competition	Make the competition irrelevant
Exploit existing demand	Create and capture new demand
Make the value-cost trade-off	Break the value-cost trade-off
Align the whole system of a company's activities with its strategic choice of differentiation <i>or</i> low cost	Align the whole system of a company's activities in pursuit of differentiation <i>and</i> low cost

<http://www.blueoceanstrategy.com/>



Polarity Map™ © 1992, 2008 Polarity Management Associates LLC

<http://www.amazon.com/Polarity-Management-Identifying-Managing-Unsolvable/dp/0874251761>

Follow-up Reading

Innovation with Impact: Understanding and Improving Learning in Undergraduate Science and Engineering
Summary

<http://www.asee.org/about-us/the-organization/advisory-committees/Innovation-With-Impact/Innovation-With-Impact-Executive-Summary.pdf>

Full Report

<http://www.asee.org/about-us/the-organization/advisory-committees/Innovation-With-Impact/Innovation-With-Impact-Report.pdf>

Discipline-Based Education Research: Understanding and Improving Learning in Undergraduate Science and Engineering

Summary http://www.nap.edu/catalog.php?record_id=13362

Full Report http://www.nap.edu/openbook.php?record_id=13362&page=R1

Research Universities and the Future of America: Ten Breakthrough Actions Vital to Our Nation's Prosperity and Security

Summary <http://sites.nationalacademies.org/PGA/bhew/researchuniversities/index.htm>

Full Report http://www.nap.edu/catalog.php?record_id=13396

Video <http://www.youtube.com/watch?v=6bcrlQ1G5-M&feature=youtu.be>